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Successful Managerial Control by Ratio-Analysis

BOOKS BY SPENCER A. TUCKER

Successful Managerial Control by Ratio-Analysis
Finding Product Costs with Machine-hour Rates
Cost-Finding and Control
Wage Incentive Systems (co-author)

Successful Managerial Control by Ratio-Analysis

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SUCCESSFUL MANAGERIAL CONTROL BY RATIO-ANALYSIS

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To my sons, Michael and Harry

Foreword

A study of the way the task of managing is developing as the years pass reveals that it is tending little by little to advance from an art to a science. Managing will probably always be something of an art, since it involves primarily directing the efforts of somewhat unpredictable human beings toward a common goal. Nevertheless, as we learn more about the nature of the task of managing and learn to apply the principles of measurement and control, we find that we can approach more and more elements of this task in a scientific manner.

Every business produces numbers of figures and statistics about its operations which, if properly manipulated and interpreted, have a valuable story to tell management about the way things are going. Unfortunately, the figures are most commonly used only to prepare the customary profit-and-loss statements and balance sheets and for the purpose of determining tax liabilities. Other over-all figures of volume, such as statements of sales by product lines and by salesmen and the like, are usually compiled and are studied from time to time by management.

But as the author shows in the pages which follow, these figures (and others which can easily be obtained), when properly manipulated and interpreted, can tell a great deal more about the state of affairs within the business than is commonly recognized. His methods of compiling and dealing with primary, secondary, and tertiary ratios are explained in painstaking detail and illustrated profusely with practical examples of their application. But more important, the author presents what may well be a breakthrough in the use of statistical information to aid managers—top managers and functional managers alike—in the better managing of the activities for which they are responsible.

Each manager will, of course, wish to tailor the application of the procedures suggested by the author to the requirements of his own business and function. He will need to study his own situation carefully and, with or without the help of others, develop the statistics and subsequent ratios which will be most meaningful and helpful to him in carrying out his day-to-day managing activities.

But the important thing to be learned from the author is that figures which will make it possible for the manager to manage with a little less art and a little more science are available or can be developed. In this way, the book offers a valuable contribution to the further development of truly scientific management.

H. B. Maynard

Preface

The purpose of the book is to introduce and acquaint the reader with the "MC" concept and to show him how to use this technique in his own situations. This book is intended for managers at any echelon in the manufacturing organization, for practicing industrial engineers in resident or professional activities, for students of industrial engineering, management, and business administration, for industrial cost accountants, and for industrial bankers.

MC is a concept and technique for managerial control of a business which reduces company data to significant ratios and interrelates their movements.

Appropriately enough, the letters MC stand for managerial controls and identify a new system of the control of manufacturing which the author has pioneered and applied to approximately two hundred business enterprises over the past twenty years. These companies ranged in sales size from $250,000 to $80 million per annum.

Simple arithmetic is used throughout. First, ratios are developed which *evaluate* facets of the economy vital to company life and growth. Then *control* is provided by acting on the interrelationship of the movements of the ratios.

Although this book deals with the application of MC to manufacturing, the technique is well suited to and has been installed in transportation and distribution, warehousing, and wholesaling. However, throughout the book, specific references are made to various types of *manufacturing.*

This book develops 429 specific ratios and explains their functions. In addition, 154 charts which typify and diagnose practical situations and conditions in manufacturing by use of the ratio movements are provided, and these are drawn from a diversity of industries. Introductory comments on the ratios and charts follow this preface.

The MC idea was born out of need—a need to advance the practice of management as a science, to give the manager an objective tool for acting, counseling, decision making, planning, evaluating, and controlling.

Many managers instinctively feel the need for a functional managerial tool because they know they cannot see their data in perspective. The

ideas behind this concept in themselves express the necessity for this technique and the urgency of a constant alertness to the complexities of managing.

The MC tool has always been needed in industry. The increasing refinements in areas of competitive activity require this advance in the objective aspects of managing, to obtain the highest *optimum* profit and the greatest profit-making opportunity out of each changing set of circumstances, consistent with a healthy financial state.

The MC concept is based on these premises:

1. Any event or happening in any area of a company is not autonomous, nor isolated from the company's over-all economy, nor is it absolute in value.
2. Any one event is always related to other events; it is affected by or affects other events.
3. Acting on isolated events is improper managing and can be harmful.
4. Business operation consists of infinite acts, events and circumstances, of different size, velocity of change, degree of impact, visibility, etc.
5. Maximizing in any one area can cause larger negations elsewhere in the company.

Against this backdrop of mobility, the managing situation is further complicated by:

1. The widening role of data *subtlety,* the elusive hidden areas, the creeping changes that are major determinants in the ability of companies to compete and survive
2. The streams of economically *unweighted* data from which management is expected to make balanced decisions
3. The deterioration of managerial judgment from submersion in this data and unconscious frustrations about the objectivity of actions and decisions
4. Gnawing doubts about the accuracy of the data, the real meanings, the dependence on the honesty of others
5. Lack of time in which to coordinate, plan, develop, create

The concept of proper management as exemplified in the MC technique states that:

1. Managing is a series of evaluations and decision making.
2. Decision making requires accurate and fast appraisals of the movements and interrelationships of data and events.
3. There is one best decision for a given set of circumstances to reach an objective.
4. All companies have a characteristic personality, cast from the composites of those who manage it, and will not respond to the same events or set of circumstances in the same way.

5. Managing must be done by specifics, not averages, while the events are in process, not after the facts.

6. Using financial statements as the sole managerial tool is abdication of the job, and managing occurs by postmortems.

7. Managing should prevent the development of hard-to-lose patterns by testing their decisions in advance.

8. Management should advertise widely throughout the organization that it is the possessor of this type of knowledge.

It is the object of MC to predigest and give importance priority to the events and data competing for attention so that the manager can act on "first things first," fully confident of their ultimate effect on the company. It is not the purpose of this book to make an engineer, accountant, or financial genius out of the manager. Nor is there an attempt to make a manager out of a nonexecutive type. Managing requires an ability to relate to people effectively; to elicit from them cooperation, respect, and work. It also requires organizing and coordinating ability. But it does not necessarily require proficiency in every technical skill subordinate to the manager: the manager need not be a multiprofessional. Proper managing means observing the changing events, understanding their meanings, and then acting swiftly when the company-wide effects of the impact of events are known.

The author assumes managerial competence. It must be assumed that if a manager saw his building on fire he would know what action to take: when, how, and in what amount. He assumes that the manager knows how to give orders, deal with labor, negotiate a bank loan, develop products. He believes that the manager knows about the tools for raising factory productivity, improving methods, resolving wage and job inequities, preparing promotional literature, floating a public stock issue. He presumes that the manager would take proper action if productivity fell, if excess costs rose, if rejects climbed too high, if machines broke down, if salesmen oversold, if there were insufficient cash flow, etc. These basic management tasks are not part of the book. For those who wish to go further into these subjects, a wealth of literature is readily available.

Three major areas of company activity are used to illustrate the MC technique: production, sales, and capital finance. Activities like purchasing, quality control, research and development, and the like, have not been made part of the data for fear of creating too much detail and thereby clouding the basic concept. These activities may either be made part of the three major areas or can be considered separately when setting up the MC system.

It is the author's desire to show that anything happening in a company doesn't stand alone, that it is part of an organic whole. MC is based on

the proposition that since events are always in motion, each causing effects elsewhere, managerial action must not be taken on the basis of detached facts, but rather on the weighted effect of those facts on the total economy. It is the aim throughout this book to show the fallacy of acting on unrelated events; to show the gains to be made from integrating the data by simple arithmetic.

The term "managerial control" means different things to different people; it surely means different things to those who have written on the subject. What it means to this author is action designed to be imposed during the useful life of the event rather than after it has ended. After-the-fact type of managerial effort by statistical analyses places its emphasis on forms which tabulate the same historical data in various ways. The MC technique promotes no specific forms in order to avoid clouding the concepts.

The book discusses the various areas for the purpose of establishing evaluation and control in the areas of production, sales, and capital. Evaluation is a two-way street: each echelon of management requires a check on itself and a check on its subordinate levels. The self-evaluating controls become the upper echelon's tools for appraising that next-lower managerial level. There is no holding any brief for specific production techniques, for marketing methods, for special financial arrangements. The book takes the condition and affairs of the company as they stand and shows how to evaluate and control its activities from the grass-roots level to the board-chairman managerial echelon. It shows how decisions can be tested in advance; how decisions make an impact-in-total. It shows how to determine where there is need for managerial action and what it is worth to the company; it suggests ways of remedying negative conditions, and ways of preserving positive surges.

Once the events and facts and their *total* effects are known, positive and negative trends can be seen in advance and planned for: the positive ones enhanced; the negative ones rapidly eliminated before they develop into patterns. MC does not view any one fact as positive or negative until its company-wide effect has been measured. This leads to the pretesting of decisions and the proper evaluations of all performances.

Simple ratios are developed for grass-roots evaluation and control of performances and conditions. More advanced ratios interrelate major areas. So while ratios are constructed to evaluate and control the separate areas of production performance and economy, sales efforts and financial management, the more advanced type of ratios interrelate: the impact of production on the capital structure, sales-effort support of the needs of the production economy, financial effect of sales targets, etc. Finally, ratios which integrate all three areas are given.

The fact is stressed that the quality of a decision, of an evaluation,

is the degree to which the data are integrated. However, many decisions and evaluations can be performed successfully at the one-area level provided the range of effect of that data is known. Many clients have started their MC system in just the production area; others in just the sales area. However, the limiting thresholds in the movement of the one-area data must be studied and determined beforehand.

The notion of *total integration* is introduced throughout the book. Examples and illustrations orient the reader to the needs for such data integration. While the last chapter contains the most diagnostic examples of conditions through total integration, other examples are interspersed throughout the earlier chapters.

This book and its ratios, examples, case histories, and illustrations act solely as a vehicle for presenting the MC technique. To best demonstrate the concept, examples typifying and diagnosing conditions are drawn from various industries, with the approach changing to suit the specific characteristics of the industry. While the method and rationale for constructing the ratios are given, the reader is cautioned against believing that there are general ratios which can be applied to all companies. The ratios must be specific; designed and "machined" to fit specific companies and situations. The reader is shown that decisions based on comparing identical ratios of different companies, even in the same industry, can be as harmful as swapping medical prescriptions.

All the material is taken from previous client assignments; consequently the data are practical. Of course, not all ratios were used at all companies.

The subjects or conditions chosen for analysis and diagnosis are but a tiny fraction of the areas which typically need investigation. Therefore only the most important conditions and those which often elude and mislead management are treated in the charts.

Trade associations find the MC technique a rewarding method of developing weighted economic comparisons among their members. The author has used special MC ratios in preparing annual survey data for trade associations and found that they elicited more response and interest from members than when traditional methods were used.

Even though more complicated mathematics can be used to arrive at somewhat more accurate conclusions, it is avoided in this book because a managerial tool which is within the reach of only a few is not a managerial tool at all, but rather a tool for the specialist. In the majority of the companies in which the author has installed MC, the down-to-earth application as given in this book obtained excellent results. In a few of the larger companies (above the $25 million sales level), the author used advanced mathematics in adapting the MC technique to computers for *automatic decision making*. While the answers obtained

were unquestionably more accurate, the elements of human performance, customer psychology, market caprice and national economics, frequency of machinery breakdown, buyer-seller compatibility, etc., partially negated some of the programmed assumptions and placed the quality of the decision making at about the same level as that obtained in this book. The gains from the computers lay in their use in *evaluation and control,* not decision making. However, before installing any computer for managerial evaluation and control, consideration must be given to the other functions which it can usefully perform for the company, and the decision to install it must be fully justified.

It is hoped that this book will be found of value to the following groups:

To the owner-manager of a smaller enterprise, who can use it to set up his own MC plan or oversee its installation. Invariably, the owner's insecurity as to areas he feels are vital to control must be integrated into an MC plan.

To resident managers of multiplant companies, who can use it for evaluation and control of the local efforts over which they have jurisdiction.

To the managers at all echelons of larger corporations, who can use it to coordinate evaluation and control throughout the organization; to set up balanced performance standards for divisions and for the major operating and financial heads; for weighted decision making at all managerial levels.

To industrial engineers, in resident or professional practice, to install as an effective managerial tool; to orient industrial engineers to the need for knowledge and effect outside of their usual area of interest. (Some industrial engineers think of manufacturing as being solely production, without considering sales and finance as part of the manufacturing effort. It is hoped that after this book is read, those who are responsible for assigning work to industrial engineers will do so on the basis of an overall weighted company need rather than an isolated requirement in one area.)

To students of graduate-level industrial engineering and business administration, to give them a practical orientation to the daily problems of managing manufacturing enterprises. (Some of these men are destined to become managers or owners; some will go into technical or professional life. In any case, they should not only have a balanced knowledge of all aspects of manufacturing, they must also understand and be aware of the interplay of the variables constantly in motion in any company. This is especially important to the man who enters smaller manufacturing companies. It is the author's earnest wish that academically trained men may enter industry with a better idea of what it takes for a company to stay in business, to prosper, and to grow.)

To industrial cost accountants and students of accounting, to acquaint them further with the limitations of formal accounting data.

To the industrial banking profession, particularly the loan officer, who can use the MC tool as an adjunct or substitute for a bank's representative in difficult situations where the bank has a vital interest in the life and continuance of a business.

The problems presented at the end of each chapter are designed to test the reader's grasp of the subject matter in a practical manner. He is asked to construct ratios for evaluation of certain specific areas; to discuss impact of certain events and conditions. In many cases, the questions do not necessarily require one correct answer since the reader is asked to supply his own data by specific reference to an industry, a company, a condition, or a group of events. It is the instructor's task to determine the correctness of the answer based on the practical material supplied by the student in qualifying his answer. The questions vary widely in length and complexity but represent the everyday problems in industry. Some of the problems are of the scope of semester papers or major reports. Since the emphasis is "practical" rather than theoretical, the manager-reader will find the problems useful in analyzing some of his own ratio and control needs.

ABOUT THE RATIOS AND CHARTS

Ratios

There are 429 MC ratios in this book. There are also case-history data from which the ratio values were computed. Ratios are developed and computed for production, sales, and capital finance; some ratios cross over from one area to another. Ratios were numbered in order to identify them in curves and as part of more advanced ratios. The case-history data were code-numbered so that formulas for each ratio could be developed by a substituted symbol.

In production, Roman numerals are used to identify elementary ratios ranging from I to XLVIII. The advanced production ratios are identified by capital letters from A to M′ and from AA to YY. The basic data are coded from 1 to 47 and by letters from a to l.

Elementary ratios in sales are also identified by Roman numerals, but with either the letters S or SP preceding them. They range from SI to SLX; from SI′ to SXLI′; from SPIV to SPLXXIII. The advanced sales ratios are identified by capital letters, but preceded by the letter S. These range from SA to SP; from SAA to SNN. The basic data are coded from 1 to 74 and by letters from a to zz.

In capital finance, the elementary ratios are identified by Roman numerals, but preceded by the letter F, ranging from FI to FXXVI. The

advanced capital-finance ratios are identified by capital letters, but preceded by the letter F, ranging from FA to FD′. The basic data are identified by letters from aa to ar; from ba to cf.

The total integration ratios are identified by the letters TI and range from TIA to TIN.

All the important ratios are described in the text and used on the diagnostic charts.

Charts

The curves appearing on the charts are derived from actual conditions at client plants. Multiple scales are used in some of the charts because of the range of values of some of the data. They serve to show the reader the changeableness of the data, the interrelationship of events, the results of typical gyrations, and how the diagnoses were made. The juxtaposition of the curves is designed to show relative interrelationships and would not necessarily appear the same way in all situations. Most importantly, the charts are used to show the reader that these and many other relationships do exist and how this approach can be used for prechecking or diagnosing other conditions.

It must be understood that the number of formulas or interrelationships needed for each specific diagnosis is as unlimited as the causes requiring diagnoses.

And, as Lord Kelvin put it, "Unless we can express in numbers what we are talking about, we have very little idea of what we are doing."

ACKNOWLEDGMENTS

Putting a practical tool that I have used empirically over the years into a formal book was not an easy task. It required that the material be placed in perspective and logically developed, so that readers might get as much of the technique as possible. What always loomed large was the question of emphasis and of the image to be formed in the mind of the reader.

Several people read different parts of the manuscript and were kind enough to offer suggestions freely. For this effort, thanks are due Thomas P. Johnson, Maurice Martin, and Martin Post. For generous advice on the financial sections I am indebted to Sidney Rennert. To Messrs. Johnson and Stocker of *American Machinist* magazine, thanks are due for suggesting that the MC technique be put in book form. Mention also must be made of Irene Frankenthaler for her editorial advice. Special thanks are due Sergio Gazitua for his painstaking assistance in making the manuscript more readable. Many thanks are due my secretary, Mrs. Elizabeth Prendergast, who miraculously transformed herself into a

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Spencer A. Tucker

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CHAPTER 1 *How to Get Effective Management*

Making a profit today in manufacturing enterprise is no easy task. Besides the obvious necessity for having the right product at the right time at the right price in the right market, profit making requires the right managing: informed, skillful, balanced, and able to act swiftly in the right situation for optimum good to the company, now and in the future.

Profits and Competition

Industrial competition has steadily moved into the subtler areas of manufacturing structures to where the little things are important. These items are the ones from which the present-day profit potential is drawn. Years back, one company could successfully compete against another by having lower hourly labor rates or because it paid less for materials, etc. Not so today. Now the competitive battlefield is in the tiny, elusive, and sometimes hidden areas of manufacturing concerns. *Profit making* now comes from constantly unmasking hidden costs or negative acts, from policing and guarding against insidious creeping change, from lighting up a hitherto unknown profit area. Today managerial inertia is a disease. Fact finding is vital.

Profit planning requires much more than these efforts. Profit planning for the longer term must include action for growth and survival. It must plan for continuous profits which are made consistent with the financial state of health of the company. The maximization of profits is no guarantee of financial health, and in fact, when profits are maximized to the exclusion of other considerations, the company can get into serious difficulty. The drive for high profits has forced many companies to the brink of bankruptcy because of the strain placed on the capital structure by the requirements of supporting those drives.

The goal of the manufacturing enterprise should be the *continuance* of an *optimum* profit *consistent* and *coexistent* with its *financial state of health* with due consideration for the firm's *growth* and *longevity*.

The one single function charged with accomplishing these objectives is *management.*

No matter how refined and sophisticated the competitive areas; no matter how complex the inner workings of the company; no matter how variable the market; no matter how changeable the technology; management must somehow be the modern alchemist. It must place all these variable ingredients in a pot and turn them into gold. And it must be able to do this consistently, regardless of the nature of the ingredients.

Doing this is no simple task.

To accomplish the fullest objectives of the enterprise, the manager must be in frequent and intimate contact with all activities and happenings in his company. He must receive data by which he can evaluate these activities, make decisions, make a choice of alternatives, and project a future plan. These data must be fresh and accurate. They must be weighted and objective so that they have economic meaning. They must not bog him down in minutiae and detail. He must feel secure with the data and free to spend time in other activity for the good of the company.

He must be able instantly to appraise a supervisor's performance and that of his department. He must be able to pinpoint quickly a loss area or a profitable one. He must be able to measure just what effect his decisions will have on other areas of the company and on the company as a whole. He must take action while the facts are alive, not after they have become ancient history.

He must consider action in any area *not separately,* but as part of an organic whole.

Without the proper tools, management is lost, frustrated. Managements sometimes think they have the right tools, but they find out later that acting with them did little good and often did more harm.

Generation of Events

Every second in industry, in every square inch of company property, data of some kind are being born out of events, facts, acts, circumstances, and costs.

In the life process, matter is always in motion, always changing. The same is true with any manufacturing concern. As long as a company is living and breathing, myriad events and acts are taking place. These events are of different sizes, move at different speeds, occur at different intervals.

Any event, no matter how small, no matter where it occurred, is felt to some degree in the company's economy, and it is management's job *to manage* with full regard for the impact of these events.

Some of these acts are transient; some occur regularly; some are reportable and accumulate into written data:

Indirect labor: up 6 per cent
84 out of 114 sales department quotations lost
New sales for new products: 2 per cent
Unusable waste: 11 per cent
Production center activity: off 15 per cent
Quotation mortality: 45 per cent
Current ratio: 3.1:1
Customer credits for poor quality: up 12 per cent
Period productivity: 112 per cent
Period billing: $6,250
Average collection period: 64 days
Customer potential obtained: 55 per cent
Fixed assets: 89 per cent of net worth
Average cost of salesmen's contact: $17.32

This is a tiny fraction of the events and data that *exist* and *happen* in any company constantly, regardless of its size. Of course, the above list shows what happened *after* it happened. The manager must know about the elements causing these data *while the events are happening* so that he may be able to influence the character of the reported data. His job is really twofold: not only must he see the *elements*, or *start* of a trend, before they develop into a full trend; he must also take the proper action to correct a negative circumstance after it has been reported to him.

What does he do about the above list of facts, then, assuming for the moment that it includes all the reportable events in the company? Which does he tackle first? Which are negative; which are positive? Since all events are related one to the other, isn't it fallacious for him to act on any of these unless he knows in advance the impact of his action on the other areas of the company?

The rise in indirect labor may be positive if it supported a higher direct labor load. The period productivity may be negative if it caused an amount of excess costs sufficient to wipe out the productivity gain. The economy of the customers' potential obtained depends on the expenses of obtaining it and effect of the resulting product mix on fixed expense recovery in production.

Reporting of the events, then, is the first and necessary step in proper managerial control. Acting on these unrelated events is fallacious and dangerous. Each event impacts differently on the company at different times.

Impact of Events

Not only does each event or act have an impact in its own area, it affects some other areas and the company as an organic whole.

An event in *sales* will have an *impact in the sales department.* While the record will show an increase in sales, it will *also have an impact in production,* based on what facilities will be used to produce the article. The same dollar sales can make widely different use of the equipment based purely on the type of product. The sales act will *also affect the financial areas* because of the material content of the product sold. This affects the inventory level and the current asset and borrowed capital structure. The same dollar sales can make widely different demands on inventory and capital.

Interrelationship of Events

Acts and events all happen at once, constantly. One fact or circumstance does not wait to put in an appearance; events do not occur in tandem, they occur simultaneously. Each event causes an effect; each makes something change within the company. There also are facts happening or being born which have effect even though not formally reported.

All events are related to other facts or events, and invariably they change with respect to each other. Repair parts are related to machinery running hours; materials handling labor to the productivity of the direct productive workers; sales expenses to the sales produced; units shipped to accounts receivable, etc. Repair parts are *also related* to the cash position; direct labor productivity is *also related* to the sales effort; sales produced to the utilization of equipment; the accounts receivables to the current liabilities, etc. To some degree, all events are related to other events in the company; all events affect all areas of a company no matter how distant the various functions appear to be by tradition.

One-fact Managing

An act or event can produce a seemingly positive effect at its home base but can cause a negative event to occur elsewhere. A reduction in the materials handlers' labor is positive in itself, but when compared with the impact it has elsewhere, the first event may not be so positive. Reducing the materials-handling payroll may cause a piling up of work-in-process, overcommitment in inventory, increase in rejects caused by crowding, etc. Reducing entertainment expense may be positive at the grass-roots level but may cause a drop in the new accounts opened. Increasing borrowed capital because of the higher earning rate on the total assets may increase the return on stockholder investments, which

in itself is positive, but it may make the creditors' stake in the business dangerously high.

The one-fact type of decision can occur in any place in the company. One manufacturer believed that if he held on to a certain inventory turnover figure, which was advertised as ideal for his industry, everything else would fall into place. What happened was that as sales increased, he increased inventory in proportion, to maintain the same inventory turnover rate. Soon the size of his inventory became too large for his net worth and working capital, to the point where his company's safety depended on the stability of the inventory value. A drop of 30 per cent in value at his high sales point would have placed him in bankruptcy.

Typical One-fact Decision

Here is an example of a typical decision beneficial to one area of a company and of the impacts it causes elsewhere. Management, wanting to increase production efficiency, decides to replace an antiquated hand-assembly setup with an automatic assembly line. Preliminary investigation shows that striking improvements will result. Production will have twice the capacity, and direct labor will be reduced 75 per cent. Savings from direct labor alone will pay for the new equipment in nine months.

Assuming that the company buys the new equipment *on the basis of the above two facts,* let's see what questions will at once arise not only in production but in other areas of the company.

Sales. Can new sales be added to absorb the increase in capacity? If not, then the new equipment will remain idle one-half the time and the cost of owning this equipment may rapidly offset the direct labor savings. If new sales are added, will this require additional sales effort and expenses? Where will the sales come from, and what will be the cost of penetrating new markets and territories to obtain them? How will the contact cost be affected? Will this increase the load of sales administration, estimators, quotations?

Capital. Can the company's financial structure stand the cost of the new equipment? How will the cost be affected by alternative methods of financing? Will the financing selected to minimize the cost weaken the stockholders' interests? How will their return on their investment be affected? Will this acquisition seriously limit expansional aims of the company; will it interfere with its ability to pay its current obligations promptly? At doubled production, how will this affect the company's liquid assets in terms of inventory? Will this seriously affect the working capital position or the level of the net worth? If sales do not double, how will the lack of fixed expense recovery affect the capital structure?

Maintenance. Will the new equipment have to be serviced by outside specialists? What are the estimated costs for this service, and how often is it expected to be used? If no outside service is needed, will the company have to train one of its own men? At what cost? If the equipment breaks down, how much will the down time cost the company per hour?

Tooling and Setup. What is the average cost of setting up the new equipment? Will the increased productivity of the equipment offset these costs? If a variable product mix is sold, what is the cost of the setup time for each product or run? How much will the special tooling cost the company, and how often will it have to be changed?

Material Inventory. How much additional raw material will have to be carried in inventory? Is there enough space in the plant to store the extra material? What is the cost of this space? Can better use be made of it, or is it limiting another vital production effort?

Indirect Labor. Will the indirect labor force have to be increased to support the higher output of the machine? How many materials handlers, shipping clerks, inspectors, billing clerks, estimators, etc., have to be added? Will this installation require additional supervision, or can the existing supervisory crew handle it properly?

Pricing Policies. If the double production is obtained, should savings be passed on to customers to encourage the flow of orders by means of marginal pricing? Should the company retain the added earnings to placate its stockholders? Should there be a middle point; where should it be? Should provision be made in pricing to compensate for the effects of inflation for future replacement? If there are no savings the first year, should the customers be charged higher prices to help the company pay its losses?

Profits. How much more sales will the company have to make to compensate for its increase in fixed costs while maintaining the same number of profit dollars? What will be the profits if no increase is obtained? How much more sales will be required to balance a specific unit-price reduction and still maintain the same profit? What will the profits be if sales rise only slightly after a price reduction? How much more vulnerable is the company to recessions? Will this acquisition place it in the position of not being able to readily adjust expenses to income?

These are but a few of the areas that are affected immediately by the decision to buy the new equipment, and the questions listed by no means give a complete picture of the other myriad events that will be born. If management carries out its investigations properly, giving economic weight to the areas affected and their interrelationships, and

finds a positive answer by appraising the total impact on the company now and in the future, then it has justified its decision.

But one-fact managing is superficial and dangerous. It's like building a house without a roof, on the assumption that it will never rain; the sun may be shining today, but it's only a matter of time before the clouds appear.

Traditional Managing

The varieties of management techniques are as numerous as the number of people using them. In some plants, managing may take the form of a daily tour through the plant and a chat with the plant manager, which the latter makes as revealing as he wishes. In other plants management relies heavily on traditional accounting and financial reports like the profit-and-loss statement and others.

The profit-and-loss statement is a report of an event after it has happened. For managerial control purposes it is ancient history. Even if profit-and-loss statements are issued frequently, these should not be used as a managerial tool. The figures represent an *averaging of the peaks and valleys* of the economy. They cover over the regular and transient events, the profit leaks and the profit-making opportunities, the variations in product mix, expense recovery, etc.

Proper management calls for the managing of people, in the areas they control, but most importantly, *at the time they are doing it or controlling it.* It is practically impossible to go back to find the profit leaks. Everyone's memory seems to fail under these circumstances. Usually when plant operating data are 24 hours old, they are old. In 48 hours, they turn rancid; in a week, they are ancient history. Even if people can remember, they usually will not make themselves vulnerable to criticism.

Managements' Dilemma

The major expenses in similar industries cost approximately the same. Differences in product costs within an industry depend on the differences in man, material, and machine utilization, in variations in the supporting expenses thereto and in the way these relate to the market and to the capital structure. Consistent profits depend on getting the maximum practical economy out of small areas for profit making. These economies come from the handling of the almost infinite number of events and actions which happen normally in every plant every second of the day.

These economies are not as easy to make as they were years ago. Then the arbitrary cut in an expense or in the labor force stood, was

accepted, and eventually was adjusted to. Now most of the economies lie in optimization of conditions: the proper product mix, the optimum maximum machine speed, the maximum economical radius of delivery.

With the advance in industrial activity, the areas of optimization are vast and unending. The events which need reporting, weighting, and interrelating are unlimited. On the other hand, the manager must be emancipated from endless detail in order to carry on the longer-range plans for the company, which become increasingly vital each year. He is faced with the dilemma of needing more and better data with which to manage his company so as to compete and survive in an economy which is more and more refined. But he doesn't have the tools with which to do it, doesn't have the time to develop them, and is required elsewhere in planning the future of the company.

The smaller company needs data which are reliable and believable, which are produced quickly and which depict various situations clearly enough to allow the manager to make his decision and/or take the remedial action indicated; then allow him to go securely about his other business.

The task of making decisions or taking action on the mass of detail is simply an exercise in mental gyrations. The task is tiring, inefficient, and misleading and blunts the manager's judgment, and it also distorts his perspective. Those managers who are aware of the infinite, interweaving events in manufacturing enterprise and know they do not have the tools to cope with them are indeed frustrated. What disturbs them is the feeling that perhaps they did not make the best possible decisions from the facts they had. After all, the decisions and actions that can be taken from one set of data are many. What mature manager doesn't doubt that he is being kept in an ivory tower by self-seeking subordinates—being spoon-fed only the information they want him to have?

The manager must feel secure if he is to function effectively. Managers who must spend time away from the details of the everyday operation in order to propagate the business must traditionally depend on others for information and answers without being able to make any intelligent *verification* of accuracy or honesty of the data. The problem of the busy owner-manager is security—security in the judgment and honesty of those who collect, present, and interpret the facts for him.

However, when there are proper managerial tools in effect—and this fact is advertised and widely known—information becomes purified, answers become accurate. With these tools, management can make fast and valid appraisals, can make decisions with the greatest objectivity, and can spend time in other vital areas fruitfully, without the usual gnawing doubts.

In large companies where the problem of the owner-manager's time

is not as critical, these managerial tools provide a source of constant evaluation and a method of decision making through total data integration.

Decisions, Decisions

Management is up against the seemingly impossible and unending task of trying to make objective and rational decisions from the myriad data which are generated throughout the company and which are in a constant state of flux. It is required to act on immediate matters like remedying a negative condition in the sales department or preserving a positive condition in production. For this, fast, accurate, and economically weighted data are needed. The manager is required to develop a subordinate staff and so must have available the same type of data with which to do it. Counseling or disciplining based on emotionality or on subjective or one-fact data will backfire.

The manager is also expected to establish policies in the various segments of the company's structure relating to optimum productivity levels, product mix, inventory burdens, types of customers, territorial economy, balancing of assets, etc. And he must be sure that these policies and directives, while positive in their local area, will not cause a serious negative condition elsewhere.

The manager must also be ready to face a choice of alternatives and for this needs information of the type mentioned above. He also needs to know the full characteristics of his company's data so that he can plan for the longer term.

The manager is a decision maker. Ideally, he should make the decision from interrelated data reflecting the activities in his company and then act to implement his decision. While managing as traditionally practiced may appear to be simple, proper management is *not* simple unless the proper tools are available.

Every piece of data, no matter how seemingly small or unimportant, no matter where it occurs in the company, is grist for decision making. Management has the enormous task of making enough sense out of these data so that it can make decisions and take action.

Economically Weighted Decisions

Anything that happens in a business, any act or event, whether transient or permanent, whether planned or accidental, becomes a part of the decision-making process. And what appears to be healthy for one area of a company might not be positive for another area or for the company as a whole. A manager may cut down on his indirect crew in production, which is a one-area decision. But this may lead to produc-

tion bottlenecks, a high level of work-in-process, increased rejects due to lack of space, higher borrowings because of slower billings, etc. He may decide to conserve on sales expense as a one-area decision. And this could lead to higher levels of finished goods, decrease in cash flow, reduced fixed-expense recovery, etc. He may use borrowed instead of earned capital to finance purchases, and while this boosts the percentage of return to the stockholders on their investment, it may make the company vulnerable to higher inventory risks and it may place pressure on the sales effort to the extent of incurring uneconomical sales expenses.

Successful management must interrelate the effect of a decision in one area with all the other areas of a company, and then act only when the total economic effect on the company becomes apparent. Sound management must be able to evaluate and control performances in each area as they are happening. This is the way it obtains local economies and performance precedence. It must then be able to measure the effect that a performance in one area has on the other areas of the company. Once it is able to do this, then, from knowing the cause-and-effect relationships in measurable terms throughout the company, it can pretest or pregauge the effect of any decision before making it, provided, of course, that the data concerning the decisions are reported and available.

The Tools Management Needs

Management needs fast and accurate economically weighted data. When it reads about an act in one of its reports, it must know what that act really means, what its real impact is on the company, what worth it has as a measure or appraiser of a condition. What does gross payroll of $12,000 mean? What does the sales-book entry of $6,000 mean? What does 162 hours of down time mean? What does 145 contacts for the sales department mean?

The first step in giving meaning to these seemingly unrelated events is by means of ratios. Thus payroll to sales begins to mean something; down time to direct labor gives some perspective; sales dollars to contacts is also more meaningful than the isolated events or facts.

To be effective, these ratios must be more detailed so that they evaluate the smallest areas: *administrative expense to direct labor hours* tells the administrative load that each direct hour must carry before a profit can be earned, which is the place to test one of the effects of adding more staff people; *contacts to sales of new product* evaluates the difficulty or ease of selling new products when compared with existing product sales; *inventory to current liabilities* will tell the extent to which (for one thing) the product mix is affecting the capital structure.

The value and computation of any one ratio at any instant is an evaluator of a condition existing up to that point. Thus *administrative expense to direct labor* may be high, but it may be less than it was in the previous period. When examined isolatedly, the value may look too high and therefore negative; this is the old way. However, considering the changing values from period to period tells whether the condition is improving or worsening. Management should not be concerned with the absolute value of the ratio, just the relative value, since everything is in a state of flux.

The first tool, then, that the manager needs is a set of ratios from all areas of the company by which he can observe the positive and negative movements of his company. He must have these data frequently at a level suitable to his managerial rank in the company. The higher the rank, the less refined the ratios, and vice versa. When peaks and valleys occur, he'll know why and what some of the causative elements were. The negatives stand out like a sore thumb, and he is not made to wait until they all pile up and show themselves on the profit and loss statement.

Regardless of the direction in which a ratio is heading, since it is composed of individual pieces of data, the movement of the ratio will affect other ratios and data. For example, the indirect labor to direct labor ratio may go down (positive), but this might create a bottleneck in production and a drop in shipments (negative); the worker productivity (earned hours to clock hours) might go up (positive), but this might be generating an excess in rework (negative); the sales dollars to sales contacts made might drop (negative), but the reason may be an increase in the number of new accounts opened (positive); the current ratio (current assets to current liabilities) might drop (negative), but this might be due to accelerated sales (positive), etc.

One positive movement can cause a whole flock of movements which are either positive, negative, or both. In the above example, the negative effect of the drop of the current ratio could be due to increased sales, which is positive. However, consideration must be given to degree. If the increase in sales is great enough to warrant the drop in the current ratio, provided the drop does not impair the company's ability to pay its current debts, then on just the basis of these stated facts, the condition would appear to be positive. But what if the drop in the current ratio was due to a poor collection policy to the point where bank loans to finance current operations had to be made? This would be a condition of a different color.

If an action is taken on the basis of one ratio without first measuring its effect on other critical areas, it is little improvement over one-fact managing. These ratios then are management's first control tool.

The second managerial tool needed is some form of picturization of the way the movement of ratios affects other ratios and other areas of the company. Each company has its own special characteristics because the company is a reflection of all its people. A change in an event will be more volatile in one company than it will in another, even though both are the same size, make the same product, and are located in about the same area. All companies have their special personalities, and for this reason observations should be made of the way in which the events and ratios move and behave. For this purpose, control charts should be developed which show interactions of movements. From these charts, management can draw inferences and make decisions with full advance knowledge of their effect.

In effect, the control tools should sit the manager behind the monitoring screens of a closed-circuit television system, allowing him to control and influence the events, the profits, the growth, while they are happening. He can see the action taking place on each stage and can see how the events on each affect the others. With some experience, then, he is soon able to cause an event to occur on one stage, knowing how this will affect the others. This is control and premeasured decision making.

The MC System

MC (managerial controls) is a system which accomplishes the above-stated needs of management. MC finds the optimum economic environment quickly and easily and maintains a continuous reading of the company's pulse. More than hindsight, it gives management a tool for pregauging cause and effect.

The meat of MC is its "living ratios" derived from heretofore unrelated data taken from the company records—from reports, etc. For purposes of illustration throughout this book, facts and data are drawn from the three major segments of the business: production, sales, and capital. The job of MC is to weight these facts and interrelate their effects by the use of ratios. The ratios themselves are then integrated to give company-wide economic effect to decisions made on the basis of ratio movements.

Once the manager knows the meaning of the movement and direction of the ratios or the composite indices, he is more secure in his actions and decisions. He can counsel or discipline intelligently and objectively, knowing the full economic weight of the subject under discussion. He can feel secure in his decisions because he has tested the effects of the decision before making it. With MC there is no room for guesses, memory, or excuses.

MC pinpoints loss spots or areas of profit germination instantly. The

manager is freed from details and ambivalent doubts and can sleep at night. There is no attempt to keep him in an ivory tower. Information is difficult to "doctor" because the data must "add up." The manager finds himself in the position of *managing* his staff and the real facts.

Using this technique, the manager knows when to tolerate an excess, when a reduction in the expense is not favorable and positive. He is able to counsel with his key people. He no longer has to wait for the periodic financial and operating statements to tell him what happened—he knows. Formerly, when he asked about the rise in maintenance expenses, he received a mumbled answer about "troubles" in the shop. This had put the manager in a poor spot since he was not able to relate the cost of those "troubles" to anything. Were they the result of poor materials that stuck in the die, lack of proper preventive maintenance, machines running at excess speeds? With MC, the manager might not have considered the rise in maintenance expenses out of line, if it was balanced by long running hours caused by an accelerated setup plan.

Formerly, the general manager might be disturbed about the rise in the expense level of the sales department since the sales level remained the same. MC might show that the higher sales expense was justified, because while the sales dollar level was the same, its composition was different: there were more new accounts opened, more sales of new products, greater geographic penetration, etc. MC gave it economic meaning.

The Control Areas

In this book, three major areas are considered: production, sales, and capital. Actually, there are other areas, but these three are common to most manufacturing.

Individual ratios are set up for each of these three areas so that each respective manager can evaluate properly the activities and efforts of his department. However, the broad picture for general management's evaluation, control, and decision making comes only when the data from these three areas are integrated. Thus action in one area can be measured in the others and any event, no matter where it occurs, will have its effect on the integrated data.

However, before any ratios or any other type of control data can be established, information must be assembled properly and records made available. This is explained in the following chapter on getting the basic tools with which to set up ratios and controls.

In the words of Lincoln, "If we could first know where we are and whither we are tending, we could better judge what to do and how to do it."

PROBLEMS

1. It is decided that additional space be built in manufacturing. The company owns the building. Show how this decision will affect the company's economy. Indicate the areas affected and the considerations.
2. A company proposes adding a new line of products. Indicate the areas which will feel the impact of this move and discuss thoroughly.
3. Discuss the difference between profits and profit-making opportunities.
4. Write 250 words on the following events; discuss how and where their effect is felt on other areas and events in the company:
   a. A lost quotation.
   b. A sale.
   c. A running machine-hour.
   d. A loan is arranged.
   e. A machine breaks down.
   f. A worker waits for work.
   g. Management decides to make, not buy.
   h. Management decides to buy, not make.
   i. Sales are made for products to be made on specific equipment.
5. List ten typical events that occur in manufacturing, in order of their speed of occurrence.
6. Name the negative aspects and areas of each of five normally positive events and explain.
7. Name the positive aspects and areas of each of five normally negative events and explain.
8. Show two positive aspects of each of the five normally positive events mentioned in Problem 6.
9. Show two negative aspects of each of the five normally negative events mentioned in Problem 7.
10. Discuss the interaction of circumstances which happen in a company's life.
11. Name events in manufacturing which are isolated from any other event.
12. What are the disadvantages of one-fact managing?
13. Discuss the subtle expense areas; competition.
14. What is a decision? What is an economically weighted decision?
15. Explain the impact of a given amount of down time. Include all areas.
16. Discuss the possible negative effects of reducing a typical "excess cost."

CHAPTER 2 *Tools for Ratios and Controls*

Events occur in every molecule of a company's geography and during each microsecond of its life. These events, regardless of their origins or characteristics, act with varying degree on the company's economy. Simultaneous with the entry of these events are management's constant attempts to generate income, operate profitably, keep financially healthy, and provide a growth path and formula. It is management's job to influence the events, to exploit them, and to support these aims.

First, however, it must know about them: where they are, when they happened, what their value is.

Events Must Be Reported

Many events in the average manufacturing firm are recorded; some are not; labor payment emanates with the clock cards and is then entered on the payroll journal; material purchases start with the requisition and finally find their way to the purchase journal; sales to customers first appear in the order-entry procedure, then through the factory work orders, to the shipping records, to the invoicing ledger, to the accounts receivable, to cash. These steps are basic and vital. They are usually reported as a matter of course.

However, many other events of a more subtle and less obvious nature are sometimes not recorded at all or with as much regularity: the amount paid for indirect labor of various types; the value of machinery repairs; the hours of down time; the value of waste and rejects; the number of contacts made by each salesman in various territories for various products; the selling expenses per product; the present customers' potential; the potential per territory by product; the turnover of working capital; the productivity of the total assets employed in the company; etc.

Where there are no formal record and reporting made of the values and changes in this type of data, management is guessing when it

makes decisions or when it attempts to evaluate a situation. Sometimes rough estimates are made on some of these data; or better yet, some of these data may be reported over varying time intervals: a balance sheet may be issued only once per year; a plant manager may make estimates of waste and productivity monthly; the sales department may casually review the areas of maximum sales contact, may only briefly appraise the economy of the selling expenses incurred; etc.

Before objective managerial control can be attained—the type of control from which to influence and direct the economy—the events, acts, information, and circumstances must first be reported from every cost-provoking, profit-affecting, growth-determining area of the company. This information must be reported with regularity, speed, and accuracy.

Unrelated Data

An event is a happening—an act, a circumstance, something that has taken place. It is complete, self-contained, and factual. Some events are factual and straightforward. They are able to stand by themselves and need no other support. The new clerk added to the office receives x dollars per week as salary—that's the event, that's the fact. Y dollars of shipments are made in the week—this is also a report of what took place, an event.

This type of data is unweighted; that is, the fact or event does not in itself report on its economic effect on the company. The event is an item of pure, absolute data. We don't know whether it is good or bad for the company and by how much. These isolated events are poor managerial targets. Management should not take any action based on the report of these events. It must first make these data meaningful. To do that the data must have economic weight, economic perspective.

As it stands now, the events are *unrelated* data; that is, they have not been tested or measured up against another fact which they influence or control. The level of shipments per week may or may not be economical. We must first stack that factor up against the expenses of producing it, the impact that the shipped products had on the production economy, the effect on the capital position, etc.

In the MC technique, we refer to these unrelated data as *primary* data.

Primary data are defined as those data which cannot in themselves be used to predict or appraise objectively performance, economy, progress, trend, growth, movement, and profitability.

Primary data are used as the basis for making the necessary predictions and evaluations. Primary data are used as the ingredients for

various types of *ratios* which *do* give economic meaning to events and permit objective diagnoses, decision making, and assessments of all areas of a company's economy and activity.

Ratios and controls are established in three major areas of company activity. Accordingly, primary data must be accumulated regularly from the production, sales, and financial sources.

1. PRIMARY PRODUCTION SOURCES

There are two major sources of primary production data and events as discussed in this book:

A. Those involving factory labor

B. Those involving factory expenses and statistics and all administrative expenses and statistics

A. *Factory Labor*

Factory labor is one of the most variable elements in the entire manufacturing effort. The performance and economy of this labor exert strong influences on the total company economy. As the myriad values of the labor acts vary, so the production economy changes. It is essential that management have intimate control of the labor effort so that it can obtain local economies at the grass-roots operating level. The cumulative effects of the small economies can be additive and made an important part of profits; or they can cancel out; or they can add up negatively to rob the company of its rightful profits. Factory labor usually contains large amounts of *avoidability* and *reducibility*—the field is fertile for profit harvesting.

But what about *controllability*? Since management is dealing with *people* in the production effort, rather than with things, the production effort is highly controllable, that is, the *potential* for control is considerable. However, before control can be achieved, management must be able to evaluate the efforts of the people, appraise the economy with which people use other people, and assess the effectiveness with which other nonlabor and nonfactory services are used in support of the production activity.

All plants have weekly clock cards which are hung in a rack alongside of the clock in the employees' entrance. Usually once per week, these cards are posted to a payroll journal and totaled. While this information is considered primary data, it is not in the form which can be used for control, since its elements are not known. The journal is a listing of employees, their earnings, deductions, hours worked, and

sometimes their department. It is not economic-appraising data; it cannot be analyzed. It cannot tell us, for example:

Productivity of the workers
Effectiveness of the incentive stimulus
Economy of supporting indirect labor
Extent of avoidable expenses
Effectiveness of machinery maintenance
Billing capacity of the direct productive hour
Speed of expense recovery

With proper primary data, literally thousands of appraisals can be made from which management can take fast, confident action. Not only will these data allow penetrating evaluations at the grass-roots level, they will assess the over-all production effort and the extent to which it is harmonious with the activities of sales and with the capital and financial functions. First, however, the basic information regarding the life and environment of production must be identified. Then it must be reported and analyzed. Then, when it is given economic meaning by means of ratios, it can be evaluated.

Identify and Report Factory Labor. A going business requires human efforts of many different talents and skills. In attempting to identify and report the actions and costs of human effort, each category of labor must be consistently named and classified.

DIRECT-PRODUCTIVE LABOR. Productive labor, sometimes referred to as direct labor, is the actual applied effort.

Productive labor should be reported daily in written form. It must be related to the type of work done and to the equipment on which it is performed.

Not all a productive worker's time is productive. At times he experiences delays, such as waiting for materials or waiting for his machine to be repaired. Separating both types of delays provides the trouble-shooting targets, and these too must be reported in written form.

INDIRECT NONPRODUCTIVE LABOR. These are the people who support production, such as materials handlers; who service production, such as the shipping clerks and maintenance men; and who service the general plant, such as the porters and sweepers.

Daily tickets should be made out for all indirect people except those on permanent assignments: sweepers, shipping clerks, expediters, supervisors, and the like.

Workers' Daily Time and Production Tickets. The output and time consumed in work should be charged to the machine used, to the job or customer's order, and to the operation. All delays should be identified and reported. This is usually a part of a proper cost control.

In addition to its value in checking order profitability and contributing to the control of over-all factory economy, the installation of a production-reporting procedure is effective as a *psychological* cost-reduction tool. There is usually an immediate gain in the production economy when such a system is installed. People perform better when they are aware that their efforts are being observed. Supervisors also know that this is an indirect appraisal of their effectiveness, and their efforts tend to be better planned and closer to the scene of production.

The second positive surge comes when people know that their daily tickets are actually being *looked at* and *evaluated.* This is the giant step forward in industrial plant management and control. From this point on it is simple to get the gains from managerial action triggered by the evaluations. In many cases much less of management's time is required because the reporting procedure in itself clears up many loss areas heretofore left unpoliced and the targets are fewer and clearer.

But if managment vacillates or procrastinates on the action it should take or if it fails to look at the tickets and the workers discover this, then the reporting system will collapse.

Installing and getting a daily reporting system to work is simple technically and just requires time, patience, persistence, and *follow-through.* Especially at the beginning, when by historical practice workers had not formally been requested to give an accounting of their work output, there is bound to be fear and suspicion. This feeling must be dispelled by careful explanation as to the reasons for the information being reported. Cards should be reviewed with the workers and the foremen concerned. Including the foreman in the process plays a large part in helping him understand the goals of the system.

B. *Factory and Administrative Expenses and Statistics*

This source of primary production data refers to all other events bearing on production, except those facts listed on the factory labor payroll.

Both forms of primary data (factory labor and statistics) must be present and reported in order to assess further the effectiveness of the grass-roots activities and to provide a testing ground for future company movements.

Here as in the factory-labor area (Section A above) there are elements of avoidability and reducibility, but not to as large an extent. This category has elements which are of a more fixed nature and not readily subject to reducibility. Among them are rent, depreciation, power, etc. These are not easily changed. Administrative expenses, on the other hand, tend to remain fixed because of a management idea or concept. And very often their level is too high in relation to their productivity

and to their need in the organization. Only when the effect of their impact is measured in the production areas, in terms of their drag on production effort, is this lack of productivity recognized.

As in the factory labor area, there are interactions of these events which may or may not be optimum for a given set of circumstances, depending on how they are controlled and how they move with respect to the factory labor primary data.

2. PRIMARY SALES SOURCES

The amount of data that can be collected in this area is almost limitless. And yet from these sources is brought the grist for the manufacturing mill. These sources provide the contact and liaison with matters physically external to the business, but, even so, a prime determinant to its life and growth. In the market place, a company competes, observes the pulse of demand and trend, and attempts to reflect the effects of these at its home base.

Many small to medium-sized businesses do not tabulate sales and market information so vital to their operations. And those that do, don't interrelate the data to make them meaningful. Not only is this tabulation required to evaluate the effectiveness of the selling effort, it is essential for interrelating the data from other areas, so that balanced decisions are produced. What's the sense of incurring selling expenses to further penetrate the market if the company is at the point of uneconomical expansion or if the company's capital position will not stand the cost of equipment to support the penetration? Usually, in most smaller companies, these decisions are made subjectively, and often there are fairly fine lines between the right and wrong decision. The data must be properly weighted and integrated. Why push a product that does not provide the proper expense recovery in production?

The typical reports common to most businesses are the orders received per week or day, orders booked, and perhaps backlog figures. The latter assesses a running balance between the manufacturing velocity and the sales booking efforts. Orders received per week or per any period is an unrelated figure and cannot be intelligently used to evaluate the extent of the sales effort, let alone control it. Nor can it be used as a controller of internal economy until it has been related to another facet of the economy. "Backlog" also involves both production speed and sales velocity; it is not a control.

Needed from this source is the type of data which will permit objective appraisal of the sales effort as a separate activity (as for the production source) and then for later use in developing ratios with primary data from other sources.

Once data are obtained, summarized, and evaluated, many determinations can be made:

1. Are salesmen productive and implementing the directives of the company?
2. Are they selling to old, existing customers, where they are sure of a warm reception, instead of persisting in the obtaining of new accounts, not as easy to sell?
3. Is the salesman directed to that type of activity necessary for expense recovery in production to keep expensive facilities busy?
4. Is the amount of entertainment expenses related to departmental or individual salesman's productivity and performance?
5. Is the segment in the product-development expense which has been reserved for sales prospecting being exceeded? How is this related to market acceptance for the product?
6. What percentage of total sales by dollars and number of accounts to date is for new business? New products?

A total dollar sales performance figure hides the productivity of the man and the department. The accumulation of sales dollars after once booking a customer is not as major an accomplishment as the original booking. Where a salesman produces an acceptable amount of billing from many accounts, or where a certain portion of the accounts represents the tough presales effort, his record is considered productive.

7. How is the department's time and that of the individual salesman divided between servicing old customers and getting new ones? (How about the mortality rate of the customers being presently serviced and the effect this will have on the company ten years hence without the presence of new business? How about the increased movement of competition and the effect on acquiring new accounts?)
8. What share of the product and territory market is available to the company? How much has been obtained?
9. What does it cost to obtain the market potential in a given territory, and is it justified in terms of the sales expenses involved?
10. To what extent are selling prices being reduced in order to earn commissions?

Again here, as in the production sources of events and primary data, the evaluations that can be made, once the above information is available, are almost limitless.

Re: Market Studies and Surveys

This book is concerned with the accumulation of data on events and facts and then combining and integrating them so that decisions are not of the one-fact variety and are properly balanced in terms of the company's total economy. Data in the market-study-survey area are

really not facts. They are statistics based on opinions. Interrelating data of this type can confuse factual information to the extent of the inaccuracy of the judgment and opinions. Ratios and controls are set up assuming the existence of proper market opinion, which is so important to the conduct of the business.

The type of market data *not* reduced to primary data is that relating to:

1. Consumer acceptance opinions of the quality and function of the product
2. Selling-price-level opinions
3. Consumer opinions regarding design changes
4. Opinions on consumer buying habits
5. Opinions on consumers' preferences and prejudices

To make the point clear about the role of the above data in this book: they should be elicited; they are vital as part of the market-study program; but they cannot be used as factors in ratios which are set up to determine objective movement and to appraise performance, growth, economic trend, etc.

As a further example: the dollar amount of new business obtained by an individual salesman in a certain period; x per cent of total department expense spent on entertainment or on specifically calling on prospects for a given product; y percentage of quotation mortality involving z dollars in a certain period are all factual events. Statistical opinions which say what an item should sell for, how the product should be packaged, etc., are important and must be given management's attention, but they are not objective and cannot be reduced to ratios because management has no control over them.

There is just one exception to the above-stated procedure: information from company salesmen regarding their customers' total potential for the type of products bought can be significant and a measure of what might be observed later.

On the matter of industry or geographic potentials, information provided by government agencies and trade associations are the best sources and are considered factual enough for MC purposes.

Re: Sales Quotas

A standard is based on a *possible* performance. This means that management must have some control over what raw work it creates or deposits on which the workers are to perform. Thus, for example, from time-study standards, a worker in a leather tannery is required to dehair so many kips per hour to attain standard. The kips are there; so is the

equipment; and management knows that the task is reasonable and measurable. In other instances, management knows that a plant manager can deliver the required output at a waste level below 5 per cent; that an office manager can provide the general office services at ⅛ per cent of the annual sales income; that the controller can financially manage the enterprise at the forecasted level with an average circulating capital level of x dollars and with a standard of z dollars for distress discounts to customers plus interest on emergency bank loans, etc.

But who can measure the caprices of the market and tie a salesman's performance to it? Isn't that tantamount to putting a farm hand on quota for harvesting vegetables from a produce farm that the management hasn't even seen? A production worker has control over his effort and output; the work is there if he wants to do it. The salesman has no control over the sales quota; he doesn't even know if it exists.

The sales quota, *unlike a standard,* is a hope on management's part that the potential exists. It functions as an intimidating incentive—a wishful target. If the hope is supported by competent market analysis, then management has a guide, not a pay-off base.

Effective productivity control over salesmen takes place when sales management has enough information from all sales, market, and production areas to be able to key salesmen's efforts to the markets and to the areas of maximum profitability of the company. Therefore the best sales incentive compensation is one directly pegged to the day-to-day economic needs of the company, instead of volume for the sake of an unrealistic quota, rewarding the salesman for his contribution to the economic position of the company. This is a highly measurable criterion, and it works.

3. PRIMARY FINANCIAL AND CAPITAL SOURCES

There are two principal types of primary financial events:

A. Those relating to period operating performance
B. Those relating to the financial state of health at any instant

The first is found in the profit-and-loss statement, income and expense statement, etc. It is also found in the various schedules which are actually part and parcel of the P&L. These include the various overhead expense schedules for manufacturing expenses, selling and administrative expenses, fixed expenses, and the like.

The second is found in the balance sheet and in all its supporting

financial schedules such as liquid and working assets, fixed assets, current liabilities, etc.

A. *Period Performance*

The profit and loss statement reports how well management has *operated* the business in a past period with the tools furnished to it. Management sold the product, manufactured it, using labor, materials, equipment, and housing facilities, and by managerial talent produced a profit or a loss.

The categories or accounts under which P&L data are listed should be broken down finely enough so that analysis can be made in a consistent way. Thereafter, the same information should be reported for the same category. Overlap only misleads. Thus the lumping together of indirect materials and indirect labor in one expense account defeats the aim of analysis and control. Putting the depreciation of the company automobile in the sales expense account one month and in the administration expense account the next, where no change in use has occurred, defeats the aim of analysis and control.

Exhibit 11-3 shows a recommended format of a profit and loss statement. To be effective for control of manufacturing, such a statement should be produced frequently. In most cases, the impediment to a consistent practice in this connection is the difficulty of obtaining the figure for materials period usage and value.

The accounting procedure must be straightforward enough to permit the regular entry of data and postings to the various accounts. This quite naturally includes data for the balance sheet as well.

The P&L in itself is ineffective as a managerial tool. Its data are unrelated and unweighted. No management can really make an objective decision based on the magnitude of the administrative salaries alone nor on the amount of indirect materials in itself.

Moving averages of expenses or items on the operating statements do not contribute meritorious control. The moving average is really a device which makes the wide excursions in individual statements psychologically more attractive to management. The reason is quite simple. The function of a moving average is to smooth out the fluctuations so that some sort of visible trend emerges. This would be fine if the moving average automatically took into consideration the characteristic changes that occurred in the internal economy of a company in the period for which the averages were constructed.

Averages of any description tend to hide the facts. Surely a company experiences peaks and valleys in normal operations, and if all conditions remained the same, then a moving average can be considered as revealing some sort of trend, even though its use is still not effective as

a managerial control. But let's say that conditions did not remain the same. Suppose the product-volume mix seriously changed. This could affect the state of expense recovery, and a surge could occur, either way, which might enter into a moving average figure in much the same way as a so-called normal-period excursion. How would management know? The change in mix might be for the worse, which would show up as a drop on the curve, but management might accept it as a normal expected swing and therefore miss the opportunity for trouble-shooting it.

Moving averages make impressive-looking charts and graphs, but dependence on them for managerial control can be costly.

If it appears that there is a duplication of data in the financial source of primary data over that required for the production source, it is because the financial account lists the expense as a total for a period. What are desired in production source data are the specifics of the period expense. For example, machinery depreciation in the P&L is a total, but the production report will list this expense for each machine or production center. In other instances, like the period billing or overhead expense requested as a production report, this is simply a convenience, a way of marshaling all the information in one place and from there establishing the controls.

B. *State of Health*

The balance sheet pictures the financial state of health of the business at the instant the figures are listed. The balance sheet of the next operating period shows what effect the operating had on the company's financial state of health. In dollar terms, it shows to what extent the financial status has improved or worsened as a result of how operating changed the volume and velocity of the stream of capital flow. Exhibit 11-1 shows a basic balance sheet format.

Both balance sheet and profit-and-loss data must be available. One without the other is of little help in managerial decision making, especially when MC is to be employed. The comparison of both can be likened to that of a track athlete. His performance, that is, the length of the dash and the time taken, is to the profit-and-loss statement as the athlete's respiration, blood pressure, and pulse rate after the dash is to the balance sheet. The runner may perform well in the race but may drop dead afterward or be seriously limited in his future performances.

Here, in the balance sheet as in the profit and loss section, information must be properly divided and consistently reported.

The balance sheet, like the profit-and-loss statement, is inadequate as a managerial tool. What might be a proper state of health for one

condition in the company may not be for a changed state a short time later. Fixed assets alone or cash in the bank alone cannot be used to make managerial decisions.

The aim throughout this book, and indeed within the entire MC concept, is not to make accountants out of managers and executives. Even successful controllers who themselves usually have an early formal accounting training must think as businessmen and not as auditors or cost engineers. The aim is to take the mystery out of the statements and integrate their information into the stream of managerial action by interrelationships with other data in the company. The goal also is to focus attention on those areas of finance which ordinarily receive only casual attention and an attitude of waiting for the auditors to come in, while, in the interim, malignancies develop in the capital structure.

In analogic terms, the purpose is to help you to drive your automobile properly: to keep you to the right, to stop and go on clear signals, to indicate when to change course and how to make the turn, to persuade you to stop when sight or judgment is impaired, to warn of icy roads at unknown distances, to get you accustomed to the road, and to bring you safely home, relaxed and secure that you can make the entire trip all over again. However, our job is not to teach you the principles of internal combustion engines or fuel chemistry. Those tools are provided for you. You must learn their characteristics and how best to use them.

PROBLEMS

1. Discuss the importance of consistently classifying and reporting data.
2. Design a *job*-reporting ticket for productive workers.
3. Why segregate direct and indirect labor?
4. How can direct labor be identified?
5. Under what circumstances would you report daily machine output instead of individual worker output?
6. Explain the difference between a production standard and a proper sales quota.
7. What about a sales-performance "standard" or quota makes it conceptually different from a production standard?
8. Why aren't market-study data used in the MC concept?
9. What is the link between the operating performance and the statement of financial affairs? Explain how this link affects both areas.
10. How is a changing term on the P&L shown on the balance sheet?

CHAPTER 3 *Elementary Ratios for Evaluating Production*

Management's problems are wider in scope and more complex than they have ever been. This is due largely to the greater effect the small items now have on the company economy. Before the minimum wage law, the rural plant could give its big-city brother quite a battle on prices because of the greater control it had over its local employment market. There were also sizable differences in the costs of raw materials, power, rent, etc., which provided competitive advantages. All these factors gave one plant a considerable advantage over another.

Then the gaps began to close: companies competed on the basis of increased mechanization, faster and better product development, and quicker market tapping. Later, companies took a giant step ahead of their competitors with improved operational methods and wage incentives for production workers. Financially wise managers exploited the capital dollar and found better methods of financing; machine-hour rate cost estimating began to solve the problem of allocating overhead to product; management discovered how to use manufacturers' representatives.

The minimum wage became the great equalizer; the gap had narrowed appreciably.

The manufacturer who didn't have to worry about the effect of these competitive refinements was the man who made something that everyone wanted and no one else could make.

Acting on Primary Data

Acting on primary data is fallacious and can have negative impacts on the total economy. Profits in production are hidden in the small areas. Maintenance expenses may appear to be satisfactory, but may be out of proportion to the usage of the machine, to the direct labor effort, and to the value of the equipment. Or these expenses may be in line

with the running hours used, but out of line with the tax-reported depreciation expense, etc.

These facts or events in themselves cannot be the managerial targets. Management cannot appraise the economy, movement, or growth of its business by watching the gyrations of the numerous events that are always happening in production. The increases or decreases in the various activity factors cannot be used as a barometer until each has been given economic meaning.

Making Primary Data Meaningful

Primary data in themselves are a report of an event which has no economic meaning. They stand alone, being unrelated to anything else that they affect or that affects them. A piece of isolated, unrelated data —an event or circumstance—requires another piece of data to which it can be compared.

Management must know the reaction that a piece of primary data causes some place else before it knows anything at all about the real effect of the event. If a ball is thrown against a concrete wall, a measure of the force with which the ball was thrown is the force with which it was returned. Without the wall, there would be no quick way to find out how hard the ball was thrown. We also wouldn't know that 6 feet 6 was tall for a human being's height unless we could compare it with the average height.

So management cannot really appraise the sales department by the amount of sales made. At what sales expense level were they made? Are they profitable sales? Will the orders occupy underactive or already overburdened facilities? Do the orders call for the tying up of considerable working capital? How are the salesmen apportioned between new and old accounts? Are the sales made in territories which will help the company gain a needed foothold to entrench against competition?

Depending on the timing, conditions, and the specific economic needs of the company, a given quantity of sales can range anywhere from extremely positive to very negative.

To make events meaningful, each must be compared with the circumstances they affect or by which they are affected. If a car is driven 400 miles per day, this rates the driver's endurance but it says nothing about the car's economy. But if the car runs 300 miles on 20 gallons of gasoline, then the economy can be evaluated and is said to be 15 miles driven for every gallon of gasoline consumed. *Miles per gallon* then becomes an elementary ratio for evaluating the car's *gasoline* economy. However, this is not the only factor in the evaluation of gasoline economy. Rate of speed, which has an effect on what the miles per gallon will be, has to be included; that is, at the higher speeds, the car's econ-

omy will be less than 15 miles per gallon. Therefore the value of the first elementary ratio of miles per gallon will change as other conditions change.

It is exactly like this in any other area of the company. An indirect labor to direct labor ratio may be too low for one set of conditions and too high for another. Relationships must be optimized to the conditions immediately obtaining.

Elementary Ratios

When primary data are interrelated, they become meaningful to management. This allows management to take action on what they reveal. It is done by constructing ratios between pieces of primary data. Thus one piece is weighted against another for evaluation of effect.

There are two major considerations:

1. The way the ratio is constructed for the area it is to evaluate
2. The narrowness or broadness of the ratio, that is, the limitations of the ratio

Ratio Constructions. The number of angular degrees through which the *steering wheel* turns is no measure of the miles traveled by an automobile. Nor would the weight gain of a person be evaluated directly by the pounds of food eaten. Obviously, not all people eat food of the same calorie content, and not all people burn calories at the same rate.

Each ratio should be developed for a specific purpose, for a particular area, and the desirable movement of each ratio should be known in advance, that is, whether up or down is the positive direction. Ratios should not be expected to move linearly: double the running time of the equipment does not necessarily equal double the maintenance expenses. Some ratios move faster than others as they ascend the scale: down time may increase directly with setup time, but the supervisory expenses to direct labor may decrease with increased activity because of the semivariable nature of the supervisory loading. Ratios do not have absolute value; they are proportions and have only relative values. It is this value which is watched from period to period. Primary data are absolute, and we have seen that these data have no value unless they are related to something else. In the ratios, the primary data lose their identity and are evaluated by effect, not magnitude.

Ratio Limitations. An elementary ratio is a comparison of one piece of primary data with another. As such, any two pieces of primary data, no matter how small (as long as they are relevant), can be made into an elementary ratio. This ratio can evaluate an activity, an area, or an effort. However, a two-fact ratio evaluates with a specific qualification, but does produce a desired effect at the grass-roots level.

For example, work productivity is the ratio of earned hours to clock hours on incentive work. However, if the people were on incentive work for a tiny portion of the week, a high productivity does not figure prominently as a causative factor in the factory economy. Obviously, before productivity means anything, a factor has to be added for the proportion of the available work hours on which this productivity was obtained. A ratio of indirect labor to direct labor, showing the level of support required by the productive workers, is significant only for policing the expense trends or the directives of line management. It may not be a fair appraiser of a facet of the production economy because its positive movement may be opposite to what is positive for the entire production economy. For example, it is positive for this ratio to decrease. This shows that there is less indirect labor being spent to support the direct labor effort. However, when it goes down, it might cause bottlenecks in production, or there may not be enough service for direct productive workers and output might go down. On rising, this ratio might enhance the productive efforts, accelerate the work-in-process, and so improve the over-all factory economy.

Therefore other factors have to be added to this ratio to give it greater economic meaning. Elementary ratios, however, can be used for specific and limited purposes.

At any rate, unless elementary ratios are well defined and their purpose well conceived, they can be misleading.

As we said before, when a piece of primary data is born, it causes reactive data elsewhere, but not necessarily in one place. An elementary ratio has the qualification of a *particular place* where it has effect. The waits that occurred are affected by a direct labor elementary ratio based on a comparison between direct labor and waiting time; direct labor to down time is a direct labor elementary ratio affecting down time; direct labor to maintenance expense is a direct labor elementary ratio bearing on the maintenance effort; etc.

The effect of the direct labor event may have different effects on waiting time, down time, and maintenance expense. In some ratios, it is the direct labor that is the causative factor; in others, the direct labor is the recipient of the effect. Waiting time may affect the amount of direct labor applied, but the amount of direct labor applied may impact on the amount of maintenance incurred. Therefore no one elementary ratio can evaluate a broad area. These are for localized trouble-shooting and the uncovering of the generation of trends.

More Advanced Ratios

Production events are also related to events *outside* of the production area for lending even more economic weight to their evaluations. Thus we would have direct labor to sales; direct labor to administrative ex-

penses; direct labor to value of customers' returns; etc. These are discussed in Chapter 4, on advanced production ratios.

To get broader, more effective ratios for managerial action, higher-order ratios are required. They combine elementary ratios and separate primary data in a way which gives an evaluation of a larger area. These are called tertiary ratios and are also discussed in Chapter 4.

CONSTRUCTION AND DESCRIPTION OF SPECIFIC ELEMENTARY RATIOS

Payroll Analysis

Before elementary ratios can be developed, it is necessary to have the production events reported in proper form. As indicated in Chapter 2, this is accomplished by daily time and production tickets on which the magnitude and nature of the time spent are detailed. Then the information is collated and summarized on a payroll analysis. This record is an extension of the traditional payroll journal and can be kept separately in memo form if desired. Not only does the listing for each employee show his gross pay, deductions, and net pay, it also distributes his gross pay according to the nature, location, direction, and cost of the work he performed during the week.

This record shows instantly the *size* of the controllable cost elements, but we still have to go further to appraise their movements and true economic effect. Obviously, many judgments can be formed from just this analysis without further refinement. Although these opinions will probably be somewhat sounder than if they were made on just the basis of the unanalyzed payroll journal, they will not be weighted. The payroll analysis obviously has limitations. It indicates how and where the money was spent, but it doesn't show *how well* it was spent. Nor does it show how those expenditures impact on the other areas of the company.

There are probably thousands of different types of valid ratios that can be constructed from primary production data given by a payroll analysis. However, the aim should be the construction of just those ratios which are meaningful for the specific plant, considering also its other areas. Very often, management starts its MC program with simple production ratios, and then, after it has carried the plan through to the sales and capital areas, finds that it must go back to production to develop ratios which are needed as terms in these other two areas.

Each industry has criteria for ratio selection. Some ratios are more meaningful to one industry than to another. A radio-assembly plant would not care much about machinery running time or the velocity of fixed expense recovery. The company would probably be more interested in assembly versus wiring time for various products. A foundry

might be interested in interoperational ratios like coremaking versus moldmaking. A folding-carton plant is interested in cut and crease versus stripping, etc.

The elementary ratios have these functions:

1. To evaluate an economic area.
2. To evaluate an activity.
3. To evaluate human performance.
4. To be a part of a more advanced control.
5. To be a cross check on cost estimating and budgeting.
6. To be the best form of historical data. (If nothing else, events are controlled from soaring by proving to people that under the same circumstances, their past performances were better. This is not done fairly with unrelated primary data.)

Specific Data and Ratios

Exhibit 3-1 shows the primary data extracted from a payroll analysis. The plant selected is engaged in the manufacture of a line of proprietary

EXHIBIT 3-1. PRIMARY PRODUCTION DATA, FROM PAYROLL ANALYSIS

Item	Code	Dollars	Code	Hours
Total gross paid payroll	1	23,106 00	24	11,714
Total clocked payroll	2	22,057 00	25	11,160
Direct labor:				
On standard: Earned	3	6,156.30	26	3,340
Clock			27	2,842
Off standard: Clock	4	6,643 65	28	3,729
Total direct labor	5	12,799 95	29	6,571
Indirect labor:				
Down time: Miscellaneous waits	6	1,706 00	30	964
For equipment repairs	7	69 75	31	37
For tool repairs	8	118 40	32	64
Excess direct labor: Jig and die trouble	9	75 70	33	42
Equipment trouble	10	192 50	34	110
Material trouble	11	78 35	35	41
Other: Tool and fixture making	12	1,113 60	36	392
Setup	13	402 30	37	201
Maintenance and repairs	14	782 10	38	322
Salvage, rework, reprocess	15	563 70	39	320
Service	16	1,746 80	40	936
Supervision	17	1,716 00	41	560
Factory engineering	18	1,297 00	42	440
Factory clerical	19	304.00	43	160
Total indirect labor	20	10,166 20	44	4,589
Direct labor subsidy (lost)	21	290 15	45	159
Direct incentive premium (gained)	22	909.15	46	498
Indirect incentive premium	23	139.85	47	56

consumer products and in addition sells some open capacity time. The plant employs approximately 275 people, including press room, welding, metal cleaning, metal finishing, screw machines, secondary operations, subassembly, final assembly, materials handlers, machine shop, receiving, stores and shipping, sweepers and porters, factory clerical, manufacturing engineering, production manager, plant manager, and staff.

Each of the items appearing in Exhibit 3-1 is given a code number which is used for convenience in constructing the elementary ratios. These range from numbers 1 to 47.

Exhibit 3-2 is a partial list of typical elementary ratios that can be developed from the primary data appearing in Exhibit 3-1. The formulas use the aforementioned code numbers; the actual values are then substituted and the value of the ratio computed. To the extreme right of Exhibit 3-2 is the letter U or D. This refers to whether an upward or downward movement of the ratio value is considered positive. For example, Ratio III, evaluating work standards coverage, is marked U, indicating that as the ratio value increases, so does the amount of standards coverage; and this is desirable and therefore positive. On the other hand, Ratio XII, which evaluates excess cost, is marked D, indicating that as the ratio value decreases, there is less excess cost incurred, and of course this is desirable and positive.

RATIO DESCRIPTIONS

Listed below are brief descriptions and uses of some of the ratios given in Exhibit 3-2.

RATIO I: GROSS PRODUCTIVITY RATIO

$$\frac{\text{Earned direct hours on standards}}{\text{Clock direct hours on standards}} = \frac{26}{27}$$

This ratio is a comparison between the elapsed hours (by the clock) that was spent on incentive-rated operations and the equivalent hours that was earned subsequently as a result of effort applied to obtain bonus moneys. The ratio evaluates the percentage of additional hourly pay being earned by workers on incentive or measured direct operations. This percentage shows the efforts being put forth by the workers as measured against a work standard. If a measured day-work plan is in effect, the usual productivity attained will be typically under 100 per cent.

The ratio also measures the fairness of the production standards: if workers are putting forth an equitable amount of effort and the pro-

EXHIBIT 3-2. ELEMENTARY PRODUCTION RATIOS (PLANT-WIDE)

Ratio no.	Ratio title	Formula	Substituted value	Ratio value	Positive direction
I	Gross productivity*	$\frac{26}{27}$	$= \frac{3,340}{2,842}$	= 1 175	U
II	Net productivity*	$\frac{27 - 45 + 46}{27}$	$= \frac{3,181}{2,842}$	= 1.12	U
III	Work standards coverage*	$\frac{27}{29}$	$= \frac{2,842}{6,571}$	= 0 433	U
IV	Performance index*	$\frac{27 - 45 + 46}{29}$	$= \frac{3,181}{6,571}$	= 0 484	U
V	Improvement index*	$\frac{27 - 45 + 46}{25}$	$= \frac{3,181}{11,160}$	= 0 286	U
VI	Worker standards consistency*	$\frac{45}{46}$	$= \frac{159}{498}$	= 0 319	D
VII	Indirect support*	$\frac{44}{29 + 46}$	$= \frac{4,589}{7,069}$	= 0 649	D
VIII	Indirect support cost	$\frac{20}{5}$	$= \frac{10,166.20}{12,799.95}$	= 0 795	D
IX	Indirect usage*	$\frac{44}{24}$	$= \frac{4,589}{11,714}$	= 0.391	D
X	Indirect usage cost	$\frac{20}{1}$	$= \frac{10,166.20}{23,106.00}$	= 0.446	D
XI	Subsidy	$\frac{45}{27}$	$= \frac{159}{2,842}$	= 0.056	D

XII	Excess cost*	$\frac{6+7+8+9+10+11+15+21}{5}$	$= \frac{3{,}094.55}{12{,}799.95}$	$= 0.241$	D
XIII	Down-time cost	$\frac{6+7+8}{5}$	$= \frac{1{,}894.15}{12{,}799.95}$	$= 0.148$	D
XIV	Excess direct labor cost*	$\frac{9+10+11}{5}$	$= \frac{346.55}{12{,}799.95}$	$= 0.027$	D
XV	Tool and fixture cost	$\frac{12}{5}$	$= \frac{1{,}113.60}{12{,}799.95}$	$= 0\ 087$	
XVI	Setup index*	$\frac{37}{29}$	$= \frac{201}{6{,}571}$	$= 0\ 0306$	D
XVII	Setup cost	$\frac{13}{5}$	$= \frac{402.30}{12{,}799.95}$	$= 0.0314$	D
XVIII	Maintenance and repair index*	$\frac{38}{29}$	$= \frac{322}{6{,}571}$	$= 0.048$	D
XIX	Maintenance and repair cost	$\frac{14}{5}$	$= \frac{782.10}{12{,}799.95}$	$= 0.0611$	D
XX	Service index	$\frac{40}{29}$	$= \frac{936}{6{,}571}$	$= 0\ 142$	D
XXI	Service cost	$\frac{16}{5}$	$= \frac{1{,}746.80}{12{,}799.95}$	$= 0\ 136$	D
XXII	Supervisory ratio	$\frac{41}{25}$	$= \frac{560}{11{,}160}$	$= 0\ 0502$	D
XXIII	Supervisory-production	$\frac{41}{29}$	$= \frac{560}{6{,}571}$	$= 0\ 0853$	D
XXIV	Factory engineering cost	$\frac{18}{5}$	$= \frac{1{,}297}{12{,}799.95}$	$= 0.101$	D

EXHIBIT 3-2. (*Continued*)

Ratio no.	Ratio title	Formula	Substituted value	Ratio value	Positive direction
XXV	Factory clerical cost	$\frac{19}{5}$	$= \frac{304}{12,799.95}$	= 0.0236	D
XXVI	Support index	$\frac{40 + 41 + 42 + 43}{29}$	$= \frac{2,096}{6,571}$	= 0.319	D
XXVII	Support cost	$\frac{16 + 17 + 18 + 19}{5}$	$= \frac{5,063.80}{12,799.95}$	= 0.396	D
XXVIII	Incentive support	$\frac{(46 - 45) + 47}{29}$	$= \frac{395}{6,571}$	= 0.0601	U
XXIX	Incentive cost	$\frac{21 + 22 + 23}{5}$	$= \frac{1,339.15}{12,799.95}$	= 0 1048	
XXX	Setup effectiveness*	$\frac{37}{26}$	$= \frac{201}{3,340}$	= 0 0602	D
XXXI	Maintenance effectiveness	$\frac{38}{26}$	$= \frac{322}{3,340}$	= 0 0965	D
XXXII	Productivity planning*	$\frac{22}{6}$	$= \frac{909.15}{1,706.00}$	= 0 533	U
XXXIII	Direct usage cost	$\frac{5}{1}$	$= \frac{12,799.95}{23,106.00}$	= 0 554	U
XXXIV	Direct usage index	$\frac{29 + 46}{24}$	$= \frac{7,069}{11,714}$	= 0 605	U
XXXV	Variable indirect	$\frac{6+7+8+9+10+11+13+14+15}{20}$	$= \frac{3,988.80}{10,166.20}$	= 0.393	U

XXXVI	Variable indirect-direct	$\frac{6+7+8+9+10+11+13+14+15}{5}$	$= \frac{3,988.80}{12,799.95}$	= 0.312	D
XXXVII	Premium avoidable cost	$\frac{22}{14+15}$	$= \frac{909.15}{1,345.80}$	= 0.675	U
XXXVIII	Avoidable content	$\frac{14+15}{5}$	$= \frac{1,345.80}{12,799.95}$	= 0 105	D
XXXIX	Machinery-labor economy	$\frac{7+10+14}{5}$	$= \frac{1,044.35}{12,799.95}$	= 0 0816	D
XL	Productivity, indirect	$\frac{44}{24} \times \frac{29}{26}$	. . ..	= 0.773	D
XLI	Service-payroll index	$\frac{40}{24}$	$= \frac{936}{11,714}$	= 0.079	D
XLII	Direct-productive index	$\frac{29+46}{44+45}$	$= \frac{7,069}{4,748}$	= 1.49	U
XLIII	Productivity yield index	$\frac{27-45+46}{24}$	$= \frac{3,181}{11,714}$	= 0 272	U
XLIV	Indirect yield index	$\frac{27-45+46}{44}$	$= \frac{3,181}{4,589}$	= 0.694	U
XLV	Net payroll productivity	$\frac{29-45+46}{24}$	$= \frac{6,910}{11,714}$	= 0 59	U
XLVI	Gross payroll productivity	$\frac{29-45+46}{25}$	$= \frac{6,910}{11,160}$	= 0 619	U
XLVII	Service-wait index	$\frac{6+16}{5}$	$= \frac{3,452.80}{12,799.95}$	= 0 270	D
XLVIII	Indirect payroll	$\frac{44+45}{24}$	$= \frac{4,748}{11,714}$	= 0 405	D

* Described in text.

ductivity remains low, then this is evidence of "tight" standards, that is, standards which make too much of a demand on workers. Conversely, a high productivity figure may not necessarily mean high effort applied; it might mean that the work standards were set too "loose," making the goal of a fair day's work easy to attain. In any event, an incentive recovery statement will quickly test the equity of the plan. The productivity is based on the fact that 100 per cent is the pace at which the workers earn their full base hourly pay rates and no subsidy is being paid by the company. This ratio is too narrow for appraisal of plant economy since it does not reveal the number of applied direct labor hours which was subjected to the increased productivity. As an example, a factory uses 1,000 hours of direct labor a week, 20 of which were covered by work standards. Productivity of 150 per cent was attained on these 20 hours, meaning that the factory got the benefit of an additional 10 hours of direct labor and that the 20 clock hours became 30 earned hours. Comparing that 50 per cent increase on 20 hours to the total applied time of 1,000 hours makes the gain insignificant, except for the fact that the company knows that this kind of result is *available* if pursued properly. It is obvious, then, that 150 per cent productivity on 20 clock hours is not as positive as 110 per cent on the 1,000 hours. A proper appraisal of productivity is one which includes coverage and the losses due to subsidizing substandard workers.

RATIO II: NET PRODUCTIVITY RATIO

$$\frac{\text{Clock DL hr on stds.} - \text{DL subsidy hr} + \text{direct incentive prem. hr}}{\text{Direct clock hours on standards}} = \frac{27 - 45 + 46}{27}$$

This ratio is essentially the same as Ratio I, except that it takes into consideration the number of subsidy hours the company was required to pay for under a guaranteed-base-rate plan. Ratio I shows the stimulus made possible by the existence of the wage incentive. Productivity is reduced to its proper economic level, in spite of the paid productivity shown by Ratio I. Here's how it works:

Operator	Clock hr	Earned hr	Paid hr	Premium hr	Subsidy
John	40	48	48	8	0
Joe	40	32	40	0	8
Total	...	...	...	8	8

In the above example, not only does the company willingly pay John the 8 premium hours, in return for above-standard output, but it is required to pay the full 40 hours to Joe, *regardless of the number of hours earned,* because of his 40 clock hours' presence in the company. The company makes up or subsidizes the difference between the time earned and paid, and this represents a loss, an excess cost.

RATIO III: WORK STANDARDS COVERAGE RATIO

$$\frac{\text{Clock direct hours on standards}}{\text{Total direct labor clock hours}} = \frac{27}{29}$$

This ratio compares the number of clock hours spent on incentive-rated operations with the total paid direct labor hours (which includes additional hours earned on incentive). Sometimes a foreman will take a worker "off standard" even though there may be a "rate" for the job. Sometimes the worker will perform direct work for which no work standard exists. This ratio shows just what portion of the total direct labor had work standards applied to it. From the primary data of Exhibit 3-1, less than half of the operations were "on standard." This ratio provides a control over the efforts of the group establishing the production standards, usually the industrial engineering or time-study section. It also provides a control over the habits of foremen in their application of the work standards. Where foremen have not been properly oriented to the state of economy provided by a work standards program, they tend to apply standards when it is convenient to their way of operating. Very often, they take that path as the one of least resistance, when pressure from workers begins to build up. Workers may claim nonstandard materials, methods, or layout and claim, therefore, that the standards do not apply. In this way, the direct time spent is not subject to measurement and the workers can work at any pace without fear of a subsidy being placed against them. This usually occurs when the workers are not too convinced of the merit of the wage incentive plan and almost always occurs in the stages of a measured daywork plan when seriously substandard workers are being counseled to upgrade their efforts. And of course, in a world of people, the element of collusion exists. This control provides the clue. Of course, the ratio will report lack of standards coverage due to legitimate difficulties experienced in production, which make standards inapplicable. This can be due to trouble with tools, dies, jigs, fixtures, equipment, and materials. The costs of these difficulties, which extend the standard amount of direct labor which should have been used under standard conditions, is shown under indirect labor to excess direct labor in Exhibit 3-1. The

ratio sets the target for managerial action once the movement of this and other ratios is interrelated as described in Chapter 5.

RATIO IV: PERFORMANCE INDEX

$$\frac{\text{Clock DL hr on stds.} - \text{DL subsidy hr} + \text{direct incentive premium hr}}{\text{Total direct labor clock hours}} = \frac{27 - 45 + 46}{29}$$

This ratio relates the "net earned hours" (earned hours less any subsidy) to the total paid direct labor hours. In essence, it shows what percentage of the total direct hours was standardized and the effort put forth on those so standardized. In other words, it appraises the economy of the total direct labor, considering the coverage and application of work standards, the productivity attained on that time, and the total direct labor involved. If the work is direct-productive labor, it can be measured—all modern proponents of time study and work measurement are agreed on this point. If the difficulties are exposed and action taken, the standards can be applied on all direct labor. In that case, the ratio is a positive indicator of the progress in this direction. In plants operating an equitable wage incentive plan, where the management is progressive and acts on trouble spots, the index number can range between 1.20 and 1.40 (if 100 per cent is considered the point of fully earned base rate).

RATIO V: IMPROVEMENT INDEX

$$\frac{\text{Clock DL on stds.} - \text{DL subsidy hr} + \text{direct incentive premium hr}}{\text{Total clock hours}} = \frac{27 - 45 + 46}{25}$$

This ratio relates the net earned hours to the total payroll hours. It appraises the net effect of productivity economy on the total payroll. It will move at a slower rate than Ratio IV because of the presence of more fixed hours of use in the total payroll. The hours of use of direct labor is more a direct function of volume or activity. This ratio is valuable for appraising the contribution that the wage incentive plan makes to the factory payroll and does so without the full volatility of the direct labor usage.

Often, in the process industries, where the capital equipment involved is large and its usage keyed to chemical formulas or consumption of raw materials, the direct labor variances are small enough to be neglected and evaluations are made on a total payroll basis. In the

manufacture of sanitary food cans, for example, a fixed crew is used to feed a machine because of the fixed number of work stations involved. The direct labor clock hours remains more or less unchanged, but the earned hours, a function of the number of cans placed per hour and the amount of down time caused by jamming through careless placement, compared with the total payroll is a valid indicator of improved productivity.

This ratio evaluates the economic balance between net productivity and the level of indirect labor supporting it. When the value of this ratio remains the same with increases in net productivity and coverage, it is usually caused by a proportionate increase in indirect labor, which boosts the entire payroll.

RATIO VI: WORKER STANDARDS CONSISTENCY RATIO

$$\frac{\text{Direct labor subsidy hours}}{\text{Direct incentive premium hours}} = \frac{45}{46}$$

This ratio compares the "lost" hours with the "gained" hours. It shows by what quantity of hours the workers failed to earn their task and relates that to the number of extra paid hours the workers received by exceeding their task.

It is obvious that if workers both fail to reach a normalized pace and exceed the pace, within the same week, either the workers are inconsistently applying their efforts or the work standards were not established uniformly; that is, there was an inconsistent bonus-earning opportunity introduced into the way the standards were set. This is usually caused by improper speed rating, or "leveling," on the time study. It produces both "loose" and "tight" standards, and in the case of this ratio it is more likely applicable to standards than workers. If the standards are equitable, the workers will *work.*

At the spot-welding department at this plant, 42 direct incentive premium hours were earned and in the same department for that same week 42 were lost because of below-standard productivity. This is either a case where the spot welders are alternately slow and fast but the standards are *proper* or where the effort applied is consistent but the standards set *improperly,* thereby creating varying bonus-earning opportunities. Either circumstance can be determined by reference to the individual operator's daily time and production tickets, but this ratio points up the condition. If the ratio has a value of 1.00, as in the case of the spot-welding department, it is difficult to determine which reason is at work. This is largely a function of whether the workers or the standards are unknown and untried. Generally, however, where both

the workers and the standards are known, a ratio value anywhere near 1.00 is cause for investigation. In a healthy productivity situation, where workers make proper effort on equitable work standards, then as the subsidy hours decrease, the premium hours increase. Often the direction which new incentive plans take can be evaluated by use of this control.

RATIO VII: INDIRECT SUPPORT RATIO

$$\frac{\text{Total indirect labor hours}}{\text{Total DL clock hr + direct incentive premium hr}} = \frac{44}{29 + 46}$$

This ratio shows the number of hours of indirect labor being used in comparison with the direct labor hours employed. Besides being useful in budgeting and for rewarding supervisory performance, it establishes an optimum usage. Very often productivity will surge, under incentive stimulus, and this ratio will rise out of proportion, creating an uneconomic situation. In other words, if direct production workers require an uneconomical increase in indirect services to support their increased productivity, then the advantages of the incentive plan become academic and questionable. If the week-to-week movements of Ratio IV are plotted on the same graph as Ratio VII and the latter moves ahead faster, this is an indication that productivity increases could rise to an uneconomical point.

In the movement of data of Chapter 5, it is clear that, either because more people are on incentives or because of the higher productivity of fewer people, or both, the gains are being diminished for the third and fourth week.

RATIO IX: INDIRECT USAGE RATIO

$$\frac{\text{Total indirect labor hours}}{\text{Total paid hours}} = \frac{44}{24}$$

This ratio evaluates what portion of the gross paid hours was spent on indirect labor, by showing the indirect labor effort in relation to the total payroll. It is useful to the smaller companies when starting a ratio-analysis system. In this type of ratio, management can see the effect of increased activity on the indirect labor expense portion of factory overhead. This is one of the items that have to be evaluated when expansions are planned. Since people are employed as whole bodies, increases in this ratio with higher volume will be manifested in steps rather than in smooth curves. A foreman supervises 25 people as well as 20, but when 35 people are engaged, then possibly an additional foreman has to be employed. In deciding on the expansion, the break point has to

be determined. For the sake of discussion, this might be 32 people. At that point, then, all cost increases at this point have to be evaluated and compared with the gains estimated from the expansion. This ratio provides just one of many factors. More on the worth of changes in later chapters.

RATIO XII: EXCESS COST RATIO

$$\frac{6 + 7 + 8 + 9 + 10 + 11 + 15 + 21}{5}$$

Ratio XII starts the more incisive type of control. This index compares the avoidable costs with the productive labor cost. In this case, the ratio shows that for every dollar spent for productive direct labor in the primary data of Exhibit 3-1, over 24 cents in addition was wasted unnecessarily. This control is valuable for uncovering excesses produced by increases in productivity. As productivity rises, this control should be checked to see that the rise is not matched by increases in excess costs. This problem is handled in Chapter 4 on Advanced Ratios.

RATIO XIV: EXCESS DIRECT LABOR COST RATIO

$$\frac{9 + 10 + 11}{5}$$

This ratio indicates how many more cents should be added to the existing direct labor dollar to pay for direct labor excesses. The control shows to what extent equipment and material troubles prevent the full application of standards. The ratio sets the stage for managerial action. It checks the accuracy of data given to management which ostensibly report on various difficulties throughout the plant. What happens in small amounts in the experiences of local foremen is bound to be overlooked. Management economics should always be concerned about the accumulation of small costs so that it can be in a position to predict what certain changes will cause. In the case of item 6 (miscellaneous waits) in Ratio XIII, this is an opportunity for investigating how well the foreman is scheduling or how well it is being done for him. These waits are generally waits for material, for instructions from the foreman, for getting tools, for setup completion, for work orders, etc. A lack of planning, close supervision, or both, results in a fairly high figure in the ratio. In this specific case, for the 6,571 direct hours applied, 964 more is wasted on the various waits. It amounts to some 14.7 per cent and is considered excessive for the type of manufacturing operation. If this item continues to be high, it would be worthwhile setting up a separate ratio for it: $^{30}/_{29}$ for the specific control of that expense.

RATIO XVI: SETUP INDEX

$$\frac{\text{Setup hours}}{\text{Total direct labor clock hours}} = \frac{37}{29}$$

This ratio shows how much setup time is required for each direct labor hour. It is best applied by department or to groups of similar machines. It refers to the time that the setup man takes to make the setup and *not* the time of the operator waiting for it to be completed. This index is mostly a measure of setup productivity and is really not considered a loss item. It is valuable in checking out the setup times estimated. The effect of setup time on over-all production can be seen by relating this ratio to the number of running hours of equipment. Obviously, as setup time increases, especially if the waiting for setup time (operator's time) is added, the time available for running is reduced. The ratio shows the general movement between the two. This control is also used as a basis for paying an indirect incentive to setup men. As an example, take the figures in the payroll analysis: for 6,571 hours, 201 are employed for setting up. Theoretically, that means that if setups took no time, the available time for running would be greater. Not only would it increase plant output, it would increase the expense recovery ability of facilities. One factor, then, in the setup man's incentive could be the setup ratio as described herein. This stimulates his availability and completion of the setup.

What about the quality of the setup? What factor can be added to the above ratio to ensure a quality setup? This is easily done if it is remembered that a quality setup allows the operator to proceed without interruption, secure that the setup won't come apart at the seams. In this environment, higher productivity is possible. Therefore the second factor in the setup man's incentive can be the average productivity of the operators on whose machines he performs setup work.

RATIO XVIII: MAINTENANCE AND REPAIR RATIO

$$\frac{38}{29}$$

This ratio shows how much maintenance and repair time is required for each direct labor hour. Like Ratio XVI, it is best applied by department or by groups of similar machines. Its development here is for illustrative purposes. Of the 322 maintenance and repair hours shown on the analysis (38), 34 were applied by the operators themselves and the balance by the machine-shop personnel. The 56 hours applied by the tool and die makers was involved in repairs to tools and dies; the 32 hours applied by the machinists for the repairs, to jigs and fixtures; and the 200 maintenance hours, for replacing and freeing bearings in

equipment, for maintaining air lines, etc., and for general preventive maintenance. All this time is reported by each man daily and charged to particular machines, jigs, tools, or other categories to enable a more realistic appraisal of the economy.

Ratio XIX is the dollar equivalent of the Ratio XVIII. It shows the number of cents spent for maintenance and repair compared with the direct labor dollar. This figure is valuable in checking out the yearly expense budget and for seeing the trends in this expense with changes in direct labor. When this time and expense are charged against specific tools and machines, etc., an economic appraisal of the value of keeping the tools can be made.

RATIO XXX: SETUP EFFECTIVENESS RATIO

$$\frac{37}{26}$$

This ratio compares setup hours with earned direct labor hours and assesses the effect that the quality of the setup has on running time and productivity. Often, when setup men are not tied into the productivity earned by the workers on machines which they set up, this ratio value climbs.

This costly circumstance occurs in the early stages of a production incentive plan that has failed to consider the reactions of the setup men. The latter sometimes react by keeping workers waiting longer than necessary before putting in an appearance, by prolonging the act of setting up, and by performing the setup in a manner which causes difficulty to the operators. The first two circumstances limit bonus-earning time and premiums; the third upsets the pace, rhythm, and continuity so necessary for the attainment of higher productivity levels. Where products are relatively stabilized and the size of the runs fairly uniform, a fluctuation in this control is a danger signal. In a corrugated-container operation, this ratio went from 0.14 to 0.21 in three weeks—three weeks after the new incentive plan was installed that *did not include* the setup men.

Ratio XXXI is very similar. It evaluates the effect that the quality of the maintenance has on running time and productivity. Like Ratio XXX, it climbs when maintenance men are not included in the incentive. The reactions of the maintenance crew are similar, and so are the effects. In an electrical-devices plant, an assembly line of twenty-three people was stopped for an entire day while fairly minor repairs were being made. The entire line was on a production incentive which normally allowed them to earn about 125 per cent for the full day. This meant that some workers lost two hours of premium pay for that day

while they were assigned to "make-work" jobs. Some were sent home for the day at a cost to them of ten hours pay. The best plan is to include all indirect workers in the incentive. If it was not considered at the start of the plan, a glance at the movement of this ratio might induce management to respond. At any rate, a definite trend should be acted upon before the effect becomes obvious and management is placed in the position of acquiescence.

RATIO XXXII: PRODUCTIVITY PLANNING RATIO

$$\frac{22}{6}$$

This ratio relates the cost of the direct incentive premium to the cost of the miscellaneous wait. It compares the impact that waiting time has on the incentive earnings.

If the waiting time decreases with no change in premium earnings, it indicates that workers are applying enough effort to overcome the drop in clock hours on which they can earn a bonus. This would raise the value of the ratio. However, through poor scheduling it is possible for the incentive premium to rise with an *increase* in down time. This would indicate a tendency to favor long runs on simple operations on which premiums could be earned easily and disinterest in work of a more difficult nature.

The data given show that 53 cents of incentive premium pay are spent for every dollar spent for waiting time. The premium pay could apply to a small percentage of direct labor, and the waiting to the "unstandardized" direct labor, which would be ironic. Large drops in this ratio could show that managerial attention is applied principally to the incentive operations to the neglect of the others. This often happens in the supervisors' overzealous attempt to acquire the incentive work, and of course, unless controlled, this preoccupying act adds a negative aspect to the incentive.

Many other ratios can be developed other than those developed in Exhibit 3-2. Ratios by *department* for the use of departmental supervisors and for the interest of the plant manager can provide more specific data on which to take action. In the case of excess costs or maintenance labor or subsidy expenses, it is desirable to pinpoint the exact area of provocation. In some industries, it is extremely valuable to develop inter- as well as intra-department controls. In the case of the graphic arts industry, it is important to know the relationship between the composing room and make-ready time as an evaluation of the complexity of the jobs passing through within a given period.

In the case of, say, a manufacturer of flooring, where he also con-

tracts for its installation, a relationship between the labor of production and of laying would prove to be very enlightening. Depending on the characteristics of that enterprise, the maximum profit may be made in either the production or the laying area. Obviously, this evaluation could lead to some rapid decision making.

A similar case may be that of a manufacturer of pumps who makes his services available for field installation. Here again, it is desirable to know which effort is producing the profits. In one instance in the author's experience, it was found that the profit was being made at the installation end and losses were being sustained in the actual manufacture. The production setup was antiquated and required a tremendous capital investment to modernize it. From various analyses, the owners decided to farm out most of the heavy machining operations. These operations had cost them an excessive amount when they made it on their own equipment. They sold their old equipment and modernized part of their building and built an area for light fabrication and assembly. Most of their production became a final-assembly type, and in this way they controlled the quality of their product and protected their name and reputation. They then proceeded to sell with more confidence than ever before and actively promoted their installation service, which had previously given them feelings of insecurity.

In a large maintenance operation contracts were written for motors, neon signs, and the like. Mechanics worked inside the shop on repairing motors or signs which had been "pulled." Other mechanics serviced the equipment on the customers' premises. This called for ratios on material and parts control, productivity of inside and outside men, the amount of "support" each would get in order to produce the same amount of contract billing, etc.

In a candy factory, ratios were set up to predict the crews required on the chocolate-enrobing line with changes in the type of final package —the piece mix.

Criteria for Development of Ratios

Not all industries react to change in the same way; each has its own special personality. This implies that *evaluation* must be the first step.

Evaluation by percentages may be misleading. Suppose that in an industry which assembles expensive components, where the selling price is based on a luxury demand, the direct labor is 2 per cent of the sales dollar. From the percentage viewpoint, the opportunity for savings may appear slight. Let's further suppose that the yearly labor expended runs into the hundreds of thousands of dollars while still remaining at the 2 per cent level of the sales dollar. There should be no question that investigation and control would be a worthwhile effort.

Criteria for determining when and how to develop control ratios should be given weights according to:

1. The absolute magnitude of the money involved in an area
2. The extent of volatility
   a. Its movement in relation to events
   b. Its reducibility and controllability
   c. The ease and cost of reporting it
   d. Its function as a clue or indicator to other important areas

The Management of the Elementary Ratios

The ratios developed provide managers with an appraisal of various areas. When these ratios are translated into a more condensed form, rapid decision making can be made. These are called advanced ratios. Obviously, the level of these advanced ratios is related to the echelon at which they are going to be used. A plant manager may not be interested in the down-time ratio in the spot-welding department; this should be the special concern of the welding foreman. The plant executive may not even want to concern himself with that figure plant-wide, feeling that it is more in the province of the general foreman or plant superintendent. Nevertheless, gains from all the detailed areas provide profits.

A plant manager should be interested more in week-to-week movement in his plant's economy. Of the myriad areas represented by the previous analysis, especially if it is broken down departmentally, some always improve, some worsen. The question in the mind of the plant manager is, what is the net effect? Have I gone ahead or slipped backward? How well have my subordinate supervisors taken care of the losses so that they don't recur? And have they been made sufficiently aware of where profits are germinating so that those likewise can be recognized and preserved?

Suppose that a new week's figures show a drop in Ratio I, Gross Productivity. Is he to charge in and take action? Suppose Ratio IV, Performance Index, increased? Wouldn't that be a sign of forward movement? But suppose that with an upturn of Ratio IV, Ratio V, Improvement Index, decreased, what then? A glance at the construction of the ratios will show that if Ratio IV increased with a decrease in Ratio V, the offender lay somewhere in the indirect labor category. If both Ratios IV and V move up, the manager can feel secure that there is a positive current throughout his production force. If these two controls go in different directions, a glance at which other ratios became negative sets the stage for his action.

He explains this circumstance to the foreman or supervisors concerned and then observes the changes that take place in it in future

weeks. Of course, these two ratios do not report on the entire production picture since the economy of indirect labor or the quality of production has yet to be assessed in relation to the productivity improvements. The integration of additional facets of the production economy is a subject of the next chapter. However, let us continue to explore various specific areas before going on to the next chapter.

Suppose the *support* ratios dropped, giving a sign of forward movement. Is this good or bad? The first thing to check is whether or not what they were supporting suffered. If shipments decreased, maybe the lack of materials handlers or insufficient warehousemen was the reason why.

And it's still possible for Ratio XIV, Excess Direct Labor Cost, to increase and for Ratio XII, Excess Cost, to decrease in the same week. If the reverse is true, then the difficulty lies in either excessive down time, rework, or both.

In general, these ratios show how well the individual acts were performed, how well the money was spent, and to what extent those acts affected other cost areas of the company. These indices showed that a certain portion of the payroll was used productively, wastefully, and for the furtherance of the manufacturing effort. They showed how certain acts caused waste of materials, of time, and of the tools of production. The controls also showed the effect they were having on efforts and expenses outside of the production area.

Regardless of their level, whether controls are the simple ones which define very narrow areas or the more sophisticated ones given in the next section, they are ineffective unless used immediately. And again it must be stressed that just by the act of discussing them with the line people, a positive effect will be obtained. The excuses of one sort or another typically used to explain away certain excesses will disappear very quickly.

This is another way of saying that when management has the proper evaluation, the proper answer, the correct information at its fingertips, and this fact is advertised widely throughout the organization, people will become responsive to managerial direction, will not hide the facts, and will seek guidance.

The targets are then brought into sharper focus, management has the right ammunition, and the aim is unclouded and direct.

PROBLEMS

1. Give the possible consequences of acting on each of the following pieces of unrelated data:
   a. Low productivity
   b. High indirect labor

c. High sales expenses
d. Excessive interest charges
e. Old machine
f. Large inventory

2. Take five elementary production ratios and show conditions under which their use can be positive; negative.
3. Set up five elementary production ratios (not listed in text) involving:
   a. Machinery running hours
   b. Waiting time
   c. Pieces produced
   d. Maintenance hours

   and *explain* their uses and application (each ratio must have at least two of the above four terms in their expression).
4. What factor(s) would you add in the five ratios of Problem 2 to make the rises positive? Negative?
5. Explain the uses of the following ratios and the activities affecting their value and discuss under what negative and positive circumstances they may rise or fall:

a. Ratio VIII
b. Ratio XI
c. Ratio XIII
d. Ratio XV
e. Ratio XVII
f. Ratio XXI
g. Ratio XXVII
h. Ratio XXVIII
i. Ratio XXIX
j. Ratio XXXIII
k. Ratio XXXIV
l. Ratio XXXV
m. Ratio XXXVI
n. Ratio XXXVII
o. Ratio XXXVIII
p. Ratio XXXIX
q. Ratio XL
r. Ratio XLI
s. Ratio XLII
t. Ratio XLIII
u. Ratio XLIV
v. Ratio XLV
w. Ratio XLVI
x. Ratio XLVII
y. Ratio XLVIII

CHAPTER 4 *Advanced Ratios for Evaluating Production*

A tabulation of production events, primary data, is inadequate for evaluating production. Primary data are absolute data; their magnitude is known, but their effects remain unknown until they are related to some other relevant event. Statements of hours worked, or payroll amounts, or pieces produced, etc., do not set up targets for managerial action.

Nor is action taken on the basis of the *movement* of these events, any less superficial. This is attempted when moving averages of absolute, primary data are used for evaluation and control. The data are still the same; their character hasn't changed, it's still unrelated data, and what's worse, it's *averaged.*

Advanced Ratios Needed

The basic, or elementary, evaluation of production is accomplished by means of the type of ratios shown in Chapter 3. All facets of the production economy can be interrelated by means of these simple ratios. However, they have their limitations:

1. They are localized and evaluate only the effectiveness and the economy of factory labor.
2. They are cumbersome and too detailed for upper-managerial use.

Broader Evaluations. Elementary production ratios are used to pinpoint any area of factory labor, and they are a necessary tool for supervisory effort closer to the scene of action. However, in most cases and inadvertently, line action is taken without regard for the effect on the total productive state. This is characteristic of the way the levels of communication exist within producing organizations. While it should be management's desire to see that supervisors police every economy-effecting area in the plant, they should be taught the difference between avoidable costs, excess costs, and supporting expenses. Then supervisory

action can be carried on with the motive of economic optimizing rather than arbitrary expense reduction.

To see that this is done, management needs broader, more inclusive ratios. Other factors bearing on the factory economy must be added to these ratios to give them further economic meaning.

Facts and events must be related to other facts or circumstances which they control or on which they depend. Then the results can be examined in weighted perspective. Exhibit 3-2 showed the ratios which were developed from primary payroll data listed in Exhibit 3-1. These ratios compared one fact with another or with several others, and in

EXHIBIT 4-1. PRIMARY PRODUCTION DATA, FROM NONPAYROLL SOURCES

Item	Code	Amount
Manufacturing occupancy	a	72,000 sq ft
Shipments (adjusted for overlap)	b	$98,400
Machinery repair costs (parts + outside labor)	c	$1,140
Dollar value of waste produced in plant	d	$920
Cost of returns rejected from customers	e	$4,660
Total machinery depreciation in period	f	$1,900
Sales, general, and administrative payroll	g	$4,160
Total overhead expenses in period (except *all* labor)	h	$15,880
Machinery running hours	j	3,050
Fixed expense segment of total overhead	k	$8,060
Maximum economical machinery running hours	l	5,000

this way the facts compared were given economic meaning. The ratios of Chapter 3 involved factory labor only, and there was no interrelationship between that labor and some of the factory nonlabor costs, namely, the factory expenses. Nor was there any attempt to integrate the factory labor economy with the administrative costs or with sales.

Obviously, there are optimum relationships between a factory labor effort of maintaining a machine and the amount of depreciation expense incurred in the ownership of the machine. The latter item, of course, is a nonlabor factory expense. Similarly, the various components of the factory labor effort, with and without the nonlabor factory expenses, should bear some relationship to the expenses of administering and managing the business. For example, it is useful to observe and ultimately control the amount of "drag" that the administrative expense places on the direct productive hour. It is the amount which must be overcome before the productive hour can be profitable, and this figure varies widely for companies of similar size in the same industry. It is likewise of value to evaluate the productive hour or the space in terms of sales.

Ratios which interrelate factory labor, nonlabor factory expenses, administrative expenses, and such performance data as sales and cost of rejects from customers constitute the advanced production ratios.

The primary data for these ratios are taken from Exhibits 3-1 and 4-1. This information is based on the normal records of the company and is easily obtainable. The data shown are for the same plant as described in Chapter 3.

Exhibit 4-2 is a partial list of typical advanced ratios which interrelate the areas mentioned above. The formulas use code numbers and letters which refer to the two pieces of primary data (Exhibits 3-1 and 4-1), as explained in the previous chapter. The actual values are substituted, and the computation made. At the right is the designation U or D, which indicates whether the positive movement of the ratio is upward or downward.

Listed below are brief descriptions and uses of some of the ratios in Exhibit 4-2:

ADVANCED RATIO DESCRIPTIONS

RATIO A: SHIPMENTS–PAYROLL COST RATIO

$$\frac{\text{Shipments}}{\text{Total gross payroll}} = \frac{b}{l}$$

This ratio compares the shipments made in a period to the total gross payroll. The control is used to confirm other data but is a rough indicator of the payroll return. In this case the company is receiving $4.27 for every dollar spent in gross payroll. The ratio is generally used as one of the first in a control program. For reasons of changing product mix and overlap, the ratio is valid as an indicator of trends rather than as a measure of performance. Not only is this ratio affected by the magnitude of the payroll, it is, of course, influenced to the same extent by the sales effort. A severe drop would be reason for investigating excesses in the plant, an insufficiency of selling effort, or the validity of a revised product mix.

RATIO F: NONLABOR EXPENSE PRODUCTIVITY RATIO

$$\frac{\text{Shipments}}{\text{Total nonlabor overhead expenses}} = \frac{b}{h}$$

This ratio compares the value of the shipments with the nonlabor overhead expenses incurred during the period and shows how much return is provided for every dollar of nonlabor overhead expenses. In this example, the company receives back in sales $6.20 for every dollar of nonlabor overhead. Compare this with the return from the direct

EXHIBIT 4-2. ADVANCED PRODUCTION RATIOS (PLANT-WIDE)

Ratio no.	Ratio title	Formula	Ratio value	Positive direction
A	Shipments–payroll cost*	$\frac{b}{1}$	= 4 27	U
B	Shipments–payroll	$\frac{b}{25}$	= 8 81	U
C	Shipments–direct return	$\frac{b}{5}$	= 6 68	U
D	Shipments–direct hour return	$\frac{b}{29}$	= 14 95	U
E	Shipments–manufacturing space	$\frac{b}{a}$	= 1 365	U
F	Nonlabor expense productivity*	$\frac{b}{h}$	= 6 20	U
G	Machinery economy*	$\frac{7 + 10 + 14 + c}{f}$	= 1.15	D
H	Waste	$\frac{d}{b}$	= 0 00935	D
I	Reject	$\frac{e + 15}{b}$	= 0.053	D
J	Productivity economy*	$\frac{22}{14 + 15 + d}$	= 0.401	U
K	Incentive economy	$\frac{22}{d + e}$	= 0.163	U

L	Quality index	$\frac{d + e}{1}$	= 0.242	D
M	Incentive quality*	$\frac{22}{9 + 10 + 11 + 14 + 15 + 21 + 23 + d + e}$	= 0.118	U
N	Administrative usage*	$\frac{g}{5}$	= 0.325	D
O	Administrative load*	$\frac{g}{29}$	= 0 634	D
P	Productive load*	$\frac{g + h + (1 - 5)}{29}$	= 4.62	D
Q	Productive load cost	$\frac{g + h + (1 - 5)}{5}$	= 2.47	D
R	Overhead return*	$\frac{b}{g + h + (1 - 5)}$	= 3.24	U
S	Indirect trend	$\frac{20}{b \times 1}$	= 0.0000045	D
T	Direct trend	$\frac{5 \times b}{1}$	= 55,300	
U	Productive expense*	$\frac{h}{29}$	= 2.42	D
V	Machinery utilization	$\frac{f \times a}{j \times b}$	= 0.456	D
W	Total hourly expense recovery	$\frac{h}{j}$	= 5.21	D
X	Machinery economy (if Ratio G is not used)	$\frac{c}{f}$	= 0.60	D

EXHIBIT 4-2. (*Continued*)

Ratio no.	Ratio title	Formula	Ratio value	Positive direction
Y	Waste and reject velocity	$\frac{e + d}{j}$	= 1.83	D
Z	Nonlabor expense usage	$\frac{h}{5}$	= 1.24	D
A′	Maintenance-sales	$\frac{7 + 10 + 14 + c}{b}$	= 0 022	D
B′	Fixed hourly recovery	$\frac{k}{j}$	= 2.64	D
C′	Depreciation recovery	$\frac{f}{j}$	= 0 623	D
D′	Service-activity index	$\frac{40}{j}$	= 0 307	D
E′	Activity-excess index	$\frac{j}{30 + 31 + 32 + 33 + 34 + 35 + 37 + 38 + 39 + 40}$	= 1 003	U
F′	Productivity load	$\frac{26}{g + h}$	= 0.167	U
G′	Production load	$\frac{29}{g + h}$	= 0.0328	U
H′	Activity load	$\frac{j}{g + h}$	= 0 1525	U
I′	Activity support index	$\frac{6 + 16}{j}$	= 1.13	D

EXHIBIT 4-2. (*Continued*)

Ratio no.	Ratio title	Formula	Ratio value	Positive direction
J′	Excess support index	$\frac{(6 + 7 + 8 + 9 + 10 + 11 + 15 + 16 + 21) \times 1}{5}$	= 8730	D
K′	Activity recovery index	$\frac{g + h}{j}$	= 6.58	D
L′	Billing–productivity return	$\frac{b}{27}$	= 34.6	U
M′	Machinery hourly cost	$\frac{7 + 10 + 14 + c}{j}$	= 0 718	D

* Described in text.

labor dollar, $6.68, and some idea of the overhead burden is apparent. The nonlabor overhead expense package consists naturally of the variable and the fixed elements. Therefore one would expect to see a fast rise in this ratio with an increase in sales. As sales increase, those expenses associated directly with activity would increase almost in proportion, with the fixed elements increasing in broad steps. In between the increasing steps, the fixed expenses would be absorbed faster, justifying a possible increase in selling expenses to obtain the additional sales.

This ratio is vulnerable to changes in product mix, that is, if worker performance is acceptable and sufficient sales effort is applied, a drop in the ratio value could be indication of a less satisfactory product mix.

RATIO G: MACHINERY ECONOMY RATIO

$$\frac{7 + 10 + 14 + c}{f}$$

This control compares the cost of down time due to machinery troubles, the cost of lost direct labor time, the cost of paying a maintenance and repair crew, plus the cost of outside repair labor and outside parts with the machinery depreciation in the period. In this case, the ratio shows that for every dollar of depreciation expense, $1.15 is spent to keep it going. If this figure applies to an individual machine, then it is high time to look into the question of discarding the machine. Actually, it may be more economical to purchase a new machine on the basis of this over-double depreciation expense figure, but the move would first have to be tested in the capital area to check the effect of the purchase on the company's state of health and financial flexibility.

RATIO J: PRODUCTIVITY ECONOMY RATIO

$$\frac{22}{14 + 15 + d}$$

This control evaluates the productivity surges in terms of the damage it may do to machinery, materials, and products. If a steady decrease develops in this control, it indicates that machinery, products, and materials are being abused for the sake of more incentive premium moneys. As mentioned previously, the incentive plan is effective only when its stimulus does not negatively affect other areas of the economy. An effective control over this circumstance is the use of supervisory incentives; this ratio shows whether the plan is working. In this payroll analysis, a little over 40 cents is being wasted on these excesses for every dollar of incentive premium paid out. Even slight drops in this ratio should be carefully investigated and acted upon.

One of the main goals of an investigation is to localize the offending event. The same ratio value can be produced at a few highly productive work centers, or it may reflect the over-all quality of supervision acting on nominal levels of output.

RATIO M: INCENTIVE QUALITY RATIO

$$\frac{22}{9 + 10 + 11 + 14 + 15 + 21 + 23 + d + e}$$

This ratio relates the incentive premium moneys to the kind of excess costs and expenses usually provoked by the drives for bonus money. It can be called the proof-of-the-pudding control of the over-all economy of the incentive plan. In this ratio, all excesses are related to the incentive premiums paid. The reciprocal of the ratio is interesting ($\$7{,}702.35/909.15 = \$8.48$), which states that for every dollar of incentive premium paid, $8.48 worth of excesses was produced. Not all excesses can be attributed to the incentive stimulus, but if those excesses rise consistently with productivity, then the incentive is a definite contributing factor and the company would be best advised to find its economical productivity level (see Exhibit 5-14).

RATIO N: ADMINISTRATIVE USAGE RATIO

$$\frac{g}{5}$$

This is a comparison between the factory and the administrative labor expense. If the same administrative expense could support a higher payroll, it would be an economical trend. In this case, $0.325 is being spent for administrative, selling, and general expenses for every $1 of gross factory payroll. No appreciable change takes place in the ratio unless cutbacks in production activity occur. This is one of the ratios that is of interest to the general manager. It is his control on the habits of the administrative staff in regard to staffing the various functions.

With cutbacks in production, reductions in the administrative staff cannot be made in direct proportion. Typists are still needed to type invoices, even though the quantity on each bill is less. However, jobs can be combined, and some reductions can be made. This is a matter of job analysis. The author has seen situations in offices where relatives of an officer of the company were unnecessarily added to the office staff. Later, when people were needed in another department, the office supervisor violently objected to the transfer of any of his people even though his work load was unchanged. He had absorbed extra people

whom he didn't really need at the start who became habit and part of his assignment pattern.

With the characteristics of office operations, the chances are that a 20 to 40 per cent increase in clerical staffing could be absorbed without difficulty, with everyone looking and being busy. This is the result of an unhealthy habit pattern—a trap—into which many office supervisors fall. The solution to this practice lies in proper counseling and an office supervisory incentive.

To a more subtle extent, executive staffing usually requires a large surge in payroll productivity to justify its existence. This ratio dramatizes the effect of such staffing and the possible justification in terms of production.

RATIO O: ADMINISTRATIVE LOAD RATIO

$$\frac{g}{29}$$

Ratio O shows the sum of money that is spent on administrative services for each direct labor hour. In this case the figure is almost 64 cents. Looking at this control in another way, it shows the number of direct labor hours that each administrative dollar can support. In this case it is 6,571/$4,160 = 1.58 hours. The ratio shows the amount of load on the direct labor imposed by the administrative functions of the company. This index gives an excellent test of internal managerial economy and helps strike a balance between the two areas. It is especially valuable in pretesting some of the effects of proposed expansions. Immediately after an expansion, either in staffing or in space, the index spurts up considerably. This is usually not the case when expansion is done purely in terms of additional equipment. From this ratio management can determine whether it is getting all it can out of its space utilization and administrative labors.

RATIO P: PRODUCTIVE LOAD RATIO

$$\frac{g + h + (1 - 5)}{29}$$

This ratio is an even closer evaluation of the burdens imposed on the direct labor effort. It actually shows the return for each productive hour that the company must get to break even, an essential control for higher-managerial control. In this case, for every hour spent in productive labor, $4.62 is being spent in overhead. (It is important to point out that this ratio should not be the signal to cost production accordingly, because proper costing is a function of the usage of facilities and many other matters. Ratio P is an average of the activity of all the prod-

ucts which passed through the plant in this week's period. Therefore, as an average, this ratio is a week-to-week typical profit-and-loss ratio of total overhead to direct labor. This control is valuable in budgeting and for the pretesting of expansions and contractions.)

RATIO R: OVERHEAD RETURN RATIO

$$\frac{b}{g + h + (1 - 5)}$$

Ratio R shows the rate of total overhead turnover. In this case, it is 3.24 times. Looking at the ratio in reciprocal form, total overhead for this week's period is \$30,346.05/98,000 = 30.9 per cent of the sales dollar. Neglecting for the moment the effects of the fixed and variable components of total overhead which can be compensated for in the method chosen for graphic representation, this index shows the impact of activity on expense absorption and is a valuable managerial tool.

RATIO U: PRODUCTIVE EXPENSE RATIO

$$\frac{h}{29}$$

This ratio shows the movement of the total overhead expenses (except all overhead labor) in relation to the number of productive hours. Often it provides the clue to expense excesses caused by abuses of the wage incentive system. For example, if the ratio habitually has different values for the same number of direct labor hours, it is possible that it is due to a variance in the proportion of the direct labor hours spent on incentive work. In other words, the same total number of direct labor hours can encompass different levels of clock hours on standard and the amount of hours earned in relation to the hours off standard. Sometimes when both the incentive coverage and the premium hours are high, the same total direct labor hours can produce a wide increase in the nonlabor overhead expenses. In digging into such a condition, management may discover noncapitalized purchases of small tools to accelerate productivity at a level uneconomical to the gains being obtained under the incentive plan. This ratio provides the control.

Condensed Evaluations. At any managerial echelon, the higher level should have a check on the subordinate levels to evaluate their managerial effectiveness and assess how well they use the managerial tools given to them. By so doing, the upper levels are invariably appraising larger segments of the controllable areas than those normally evaluated by subordinate levels. It is burdensome and impractical for upper management to have to wade through each and every elementary ratio to find out how well a broad economic area is faring.

Over-all effects, composed of the pluses and minuses always normal to production activity, should be presented to upper management in condensed form.

Upper management wants an appraisal of its key men in terms of the performances each is obtaining from the area under its particular control. It wants a yardstick that can be grasped at a glance. Contributing causes can be uncovered when necessary. Once these condensed appraisals reveal an over-all negative condition, then the elementary ratios are consulted to pinpoint the real offender. The same is done for positive conditions, since sound management also includes policing the profit areas and capitalizing on them.

Elementary ratios are combined to form what are called *tertiary* ratios. These condense the effect of activities in several small, but common, areas. Tertiary ratios are composed of elementary ratios, primary data from labor and other sources and from some of the advanced ratios previously given in the first section of this chapter.

Exhibit 4-3 is a listing of some of the ratios developed from these data and still refers to the same plant data introduced in Chapter 3. The following are descriptions and uses of some of these ratios:

TERTIARY RATIO DESCRIPTIONS

TERTIARY RATIO AA: PERFORMANCE-EXCESS INDEX

$$\frac{\text{Ratio IV}}{\text{Ratio XII}} = \frac{27 - 45 + 46}{29} \div \frac{6 + 7 + 8 + 9 + 10 + 11 + 15 + 21}{5}$$

This ratio measures the effect that productivity and wage incentive earnings have on excess costs. A rise in the earned hours, if *not* followed by a corresponding and proportionate increase in down time and other excess costs, is positive. This will cause a rise in the ratio. Another positive movement would be a reduction in the excess costs for the same productivity. In some cases, the latter circumstance is to be preferred. For example, many plants should not raise their productivity and output above a certain level. This will be explained in detail later in the book. Briefly, however, the capital structure of some plants is so poorly designed that it prevents operating anywhere near normal capacity. The higher productivity levels threaten the financial position of some of these companies because of the excesses that the high output creates, such as carrying levels of inventory too great for the working capital or net worth of the company. In that case, productivity for its own sake may have to be subdued in favor of a modest level, but with the excesses in labor firmly under control.

When excess costs rise faster than productivity, whether or not the

EXHIBIT 4-3. TERTIARY PRODUCTION RATIOS (PLANT-WIDE)

Ratio no.	Control area	Formula	Ratio value	Positive direction
AA	Performance-excess index*	$\frac{\text{Ratio IV}}{\text{Ratio XII}}$	= 2.06	U
BB	Performance-service index*	$\frac{\text{Ratio IV}}{\text{Ratio XXI}}$	= 3.56	U
CC	Performance-shipments-payroll index*	Ratio IV × Ratio B	= 4 27	U
DD	Improvement-billing index	Ratio V × Ratio B	= 2 52	U
EE	Support-administrative index*	Ratio XXVII + Ratio N	= 0.721	D
FF	Incentive-excess index*	$\frac{3 - 21}{2}$ + Ratio M	= 0.385	U
GG	Payroll-excess index	$\frac{(3 - 21)/2}{\text{Ratio XII}}$	= 1.11	U
HH	Performance avoidability index*	$\frac{\text{Ratio IV}}{\text{Ratio XXXVIII}}$	= 4 61	U
II	Billing–excess cost index*	Ratio D × Ratio XII	= 3.60	D
JJ	Billing-excess-velocity index	Ratios B × Y × XII	= 3.88	D
KK	Overhead–cost recovery index	$\frac{\text{Ratio XXVII} + \text{N} + \text{Z}}{\text{Ratio A}}$	= 0 459	D
LL	Overhead activity index*	$\frac{\text{Ratio XXVII} + \text{N} + \text{Z}}{\text{j}}$	= 0.00643	D
MM	Service justification index	$\frac{\text{Ratio V}}{\text{Ratio XXI}}$	= 2.10	U
NN	Performance supervision index	$\frac{24 \times \text{Ratio IV}}{40}$	= 6.12	U

EXHIBIT 4-3. (*Continued*)

Ratio no.	Control area	Formula	Ratio value	Positive direction
OO	Fixed recovery return	$\text{Ratio D} \times \left(\frac{j}{30+31+32+33+34+35+37+38+39+40}\right)$	= 15.00	U
PP	Overhead drag index	$\frac{\text{Tertiary Ratio EE}}{j}$	= 0.000236	D
QQ	Performance-overhead index	$\text{Ratio IV} \times \frac{26}{g+h}$	= 0 0809	U
RR	Performance–payroll productivity index	$\text{Ratio IV} \times \frac{29}{g+h}$	= 0.0159	U
SS	Performance activity index	$\text{Ratio IV} \times \frac{j}{g+h}$	= 0.0739	U
TT	Improvement activity index	$\text{Ratio V} \times \frac{j}{g+h}$	= 0.0435	U
UU	Shipments-space-payroll index	Ratio B × Ratio E	= 12 05	U
VV	Incentive-quality index	$\frac{\text{Ratio XLVIII} \times (d+e)}{\text{Ratio I}}$	= 1,925	D
WW	Incentive–down time index	$\frac{\text{Ratio XLVIII} \times (30+31+32)}{\text{Ratio I}}$	= 368	D
XX	Incentive-excess index	$\frac{\text{Ratio XLVIII} \times (d+e+6+7+8+9+10+11)}{\text{Ratio I}}$	= 2,700	D
YY	Expense-productivity index	Ratio F × Ratio V	= 1.77	U

* Described in text.

productivity stands still, then the productivity is being obtained uneconomically and indicates a need for action. An inordinately high amount of subsidy hours can reduce this ratio, indicating a possible supervisory pressure in some quarter. Where production standards have not been set with a consistent bonus-earning opportunity, that is, where both "tight" and "loose" standards coexist, as often happens, the foreman might parcel out the loose ones to a few favorites and reserve the tight ones for the rest of the workers. The tight standards produce a great subsidy large enough to overbalance the premium hours earned by the few. Usually, this practice is accompanied by grants of "waiting time" or of other types of down time to further boost the earnings of the few. Both of these actions will show up as a drop in this tertiary ratio. If the action of this ratio is erratic from period to period, where Ratio IV by itself is not so valuable, then it is an indication that something out of the ordinary is occurring.

TERTIARY RATIO BB: PERFORMANCE-SERVICE INDEX

$$\frac{\text{Ratio IV}}{\text{Ratio XXI}} = \frac{27 - 45 + 46}{29} \div \frac{16}{5}$$

This tertiary ratio measures the economic effect of providing service functions to incentive workers. It evaluates the optimum level of service support to the production workers. Often, in striving for large increases in productivity, many materials handlers and other service workers will be added. At some point, the addition of the servicing function gets too big for the output obtained from increased productivity. This is the saturation point. Nevertheless, a 10 per cent increase in service may effect an over-all 3 per cent increase in productivity, and the accelerated expense recovery produced from this increase in productivity is great enough to pay for the 10 per cent service cost rise. This is economical. However, as the service costs rise, there is a point at which the productivity does not rise as fast to provide enough recovered savings to justify the service cost increase, and it is the point at which to stop (see Exhibit 4-4).

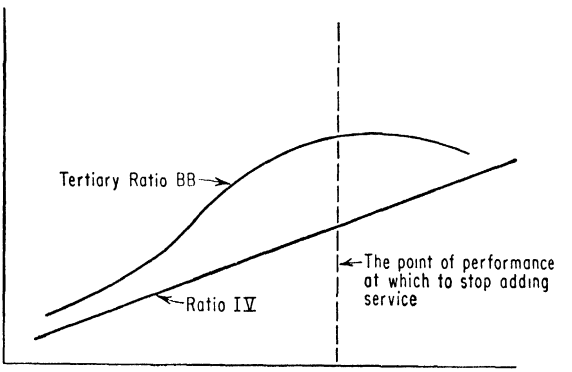
TERTIARY RATIO CC: PERFORMANCE-SHIPMENTS-PAYROLL INDEX

$$\text{Ratio IV} \times \text{Ratio B} = \frac{27 - 45 + 46}{29} \times \frac{b}{25}$$

This tertiary ratio can be termed a profit-opportunity ratio. Increases in production payroll utilization and the period's billing will make this ratio value increase provided the indirect labor does not rise out of proportion and provided a proper balance between the direct labor and

the total payroll is maintained. Naturally, this ratio is most sensitive to the period billings and for that reason serves to alert sales of the production potential available to them on which profits can be made. If production adds indirect labor either through excesses or through increased manning and this does not result in increased billing, the ratio will drop, calling this circumstance to the attention of management. This may or may not be significant, depending on the state of affairs at the moment. Perhaps the additional indirect labor was to minimize the returns from customers, in which case Ratio L should be consulted. Perhaps the percentage of direct labor in the total payroll rose without an increase in billings. It could be the result of a lower total payroll

EXHIBIT 4-4. SELECTING AN OPTIMUM BY COMPARATIVE MOVEMENTS OF RATIOS



or an inability of sales to sell the plant's capacity. This is cause for rapid trouble-shooting.

TERTIARY RATIO EE: SUPPORT-ADMINISTRATIVE INDEX

$$\text{Ratio XXVII} + \text{Ratio N} = \frac{16 + 17 + 18 + 19}{5} + \frac{g}{5}$$

This ratio evaluates the "drag" of the fixed labor on the direct labor. It measures the number of cents spent for sales clerical, general, administrative, and factory-clerical, supervisory, engineering, and clerical talents in comparison with the direct labor. In Exhibit 4-3 the amount shown is \$0.721. This ratio is most valuable in budgeting for a future period and for projecting just what the effect will be of adding to this labor. For example, if a \$75-per-week clerk is added, the effect on sales to maintain the same profit is roughly an additional \$50,000 sales per year. This is easily arrived at by considering Ratio C and this tertiary ratio; namely, \$0.721 of fixed labor cost per direct labor dollar produces

$98,400 worth of period sales. Of course, it is a rough approximation because of the presence of seasonal peaks. However, evaluating this type of impact is enough at times to halt an emotional decision.

TERTIARY RATIO FF: INCENTIVE-EXCESS INDEX

$$\frac{3 - 21}{2} + \text{Ratio M}$$

$$= \frac{3 - 21}{2} + \frac{22}{9 + 10 + 11 + 14 + 15 + 21 + 23 + d + e}$$

This is a compositized type of ratio which integrates the increases in productivity throughout the plant, regardless of incentive coverage, with the trend of the excesses used and the premium moneys earned. The left-hand term of the ratio shows what the net earned dollars is in the total base payroll. Obviously, this term can increase by rises in the number of hours on standard, increases in the amount of premium hours (productivity), reductions in subsidy, or any combination of all three.

If an increase in the left-hand term is due mainly to surging productivity, a relatively larger direct incentive premium (22) will occur. If the increase in productivity is produced at the sacrifice of excess costs or quality, the denominator of Ratio M will rise, thereby reducing the value of the term. Ratio M is somewhat more volatile than the left-hand term because changes in the premium occur usually at a faster rate than the denominator of Ratio M or of the left-hand term. Therefore, as long as excesses are in proportion, the rises in the total expression will be rather uniform. However, if the same premium was earned coincidentally with a large subsidy, the left-hand term will drop and the right hand term will drop even more because of the presence of the subsidy cost (21) in the denominator.

In some assignments the author referred to this ratio as "the cost of improvement" index. In a company there was a plant-wide drive for improved quality. Waste, and the contributing causes for waste and rejects, were thoroughly analyzed and policed. Additional inspectors were placed at the end of the assembly line to ensure a minimum of rejects from customers. Surely these were laudable efforts. But were they economical? Was the company spending more to control the quality than the gains it was getting from the improved level? In other words, would the company have enjoyed a higher economy by tolerating a higher level of waste and rejects? The trend was uncovered by this tertiary ratio. What happened was that the level of the waste and rejects dropped, and so did the denominator of the right-hand term. Most of the shop was on incentive, and as more people were added to

inspect and control quality, the incentive coverage dropped and so did the level of incentive premiums. This decreased the numerator of the left-hand term, raised its denominator, and decreased the numerator of the left-hand term. The result? A severe drop in the ratio and immediate remedial action to find the optimum.

TERTIARY RATIO HH: PERFORMANCE AVOIDABILITY INDEX

$$\frac{\text{Ratio IV}}{\text{Ratio XXXVIII}} = \frac{27 - 45 + 46}{29} \div \frac{14 + 15}{5}$$

This tertiary ratio evaluates the effect of both the incentive coverage and the productivity on the equipment and on quality. Any rapid increase in productivity can be negated by an excess in the maintenance and repair of equipment and an excess of rework or both. If the maintenance, repair, and rework increase at the same rate as the direct labor, the value of Ratio XXXVIII will decrease, thereby tending to increase the value of the tertiary ratio. But if the total direct labor cost (5) rises in Ratio XXXVIII, so will the denominator of Ratio IV, which reduces the expression even further. If, however, the coverage and productivity are such as to overcome this steady increase in maintenance, repair, and rework costs, the direction of the ratio value may be changed. The idea behind this ratio is that a linear relationship between maintenance, repair, and reprocess costs and the direct labor used is, in some industries, uneconomical. The underlying thesis here is that these excesses go in spurts, and not as a direct tie-in to indirect labor. In a sense, the ratio evaluates the economic use of direct labor, i.e., performance economy.

TERTIARY RATIO II: BILLING-EXCESS COST INDEX

$$\text{Ratio D} \times \text{Ratio XII} = \frac{\text{b}}{29} \times \frac{6 + 7 + 8 + 9 + 10 + 11 + 15 + 21}{5}$$

This tertiary ratio is used to show, dramatically, the lost use of direct labor as a producer of sales. In this ratio the percentage lost in the total direct labor is being multiplied by the billings produced for each direct labor hour. In a sense, it shows the direct labor hourly sales loss; that is, if billing per direct labor hour is $15 and 25 per cent of the direct labor cost is excessive, then $3.75 of the billing per direct labor hour is lost, or another way of looking at it is that only 75 per cent of the direct labor used could have produced the same billing if none was wasted. The speed with which the ratio changes with variations in the excesses indicates in what areas they are occurring. This is the reason for using the terms of direct labor hours as well as direct labor costs.

TERTIARY RATIO LL: OVERHEAD ACTIVITY INDEX

$$\frac{\text{Ratio XXVII} + \text{Ratio N} + \text{Ratio Z}}{\text{j}} = \left(\frac{16 + 17 + 18 + 19}{5} + \frac{\text{g}}{5} + \frac{\text{h}}{5}\right) \div \text{j}$$

This is a vital tertiary ratio in industries that have high fixed investment costs. Those are the type in which facility costing (machine-hour rates) should be used to ensure the proper allocation of overhead expenses. This is true in all industries which are in the business, actually, of selling machine time and that have a variable product mix. In the numerator, we have a figure for the total overhead loading which must be borne by each direct labor dollar. In the case at hand, this figure is $1.961; that is, for every dollar spent on productive direct labor in the plant, $1.961 in overhead must be spent to support it. And this amount for support must be recovered consistently in the selling prices before a profit is made. As this amount is reduced, so is the company's breakdown point, which means it is then able to make a profit over a wider range of sales. As this value increases, the company loses its elasticity and makes profits over a narrower range of sales.

Dividing this figure by the machinery running hours gives an indication of the degree of likelihood that the plant activity resulting from sales efforts will absorb this sum. In other words, if the company has a high total overhead for its direct labor dollar, then it becomes less serious as the plant is kept more active by sales. However, in order to make a consistent profit on those sales, the actual, not "guesstimated," costs must be known. Where a high-fixed-cost industry uses the traditional method of allocating overhead on the basis of direct labor, it will be victimized by its product mix or the mix of its facilities usages and this ratio won't be as accurate as it can be.

In a sense this ratio can be called an overhead cost recovery ratio since it does show the impact of activity changes on fixed overhead expenses.

PROBLEMS

1. Give the possible consequences of acting on each of the following elementary production ratios:
   - *a.* Ratio II
   - *b.* Ratio IV
   - *c.* Ratio IX
   - *d.* Ratio XI
   - *e.* Ratio XV
   - *f.* Ratio XVI
   - *g.* Ratio XXII
   - *h.* Ratio XXVI
   - *i.* Ratio XXXV
   - *j.* Ratio XXXVII
   - *k.* Ratio XLIII

2. Construct five advanced production ratios (not listed in text) involving:
   a. Overhead expense total
   b. Depreciation
   c. Running hours
   d. Productivity
   e. Down time
   (Each ratio must contain three of the above five terms in its expression.)
3. Explain the uses of the following ratios and the activities affecting their value and discuss under what circumstances (negative or positive) they may rise or fall:
   a. Ratios A, B, C
   b. Ratios D, E, H
   c. Ratios I, K, L
   d. Ratios Q, S, T
   e. Ratios V, W, X
   f. Ratios Y, Z, A′
   g. Ratios B′, C′, D′
   h. Ratios E′, F′, G′
   i. Ratios H′, I′, J′
   j. Ratios K′, L′, M′
4. *a.* Explain the value of condensed or tertiary production ratios.
   b. Would this type of ratio be effective for a group foreman?
   c. Develop three tertiary production ratios for three different levels of management. Identify and explain each.
   d. Develop three tertiary production ratios of three different "speeds." Identify and explain each.
5. Explain fully what is meant by ratio "sensitivity."
6. Construct five tertiary production ratios (not listed in the text) incorporating at least three of the following elementary and/or advanced production ratios and explain thoroughly the uses of each:
   a. Ratio K′
   b. Ratio II
   c. Ratio V
   d. Ratio E′
   e. Ratio XXXII
   f. Ratio F′
   g. Ratio M′
   h. Ratio XXXIX
   i. Ratio XLVII
7. Explain the uses of the following ratios and the activities affecting their value and discuss under what circumstances (negative or positive) they may rise or fall:
   a. Tertiary Ratios DD and GG
   b. Tertiary Ratios JJ and KK
   c. Tertiary Ratios MM and NN
   d. Tertiary Ratios OO and PP
   e. Tertiary Ratios QQ and RR
   f. Tertiary Ratios SS and TT
   g. Tertiary Ratios UU and VV
   h. Tertiary Ratios WW, XX, and YY

CHAPTER 5 *Managerial Control of Production*

The last two chapters dealt with how various events and facts are related to each other to form weighted evaluations of certain areas by means of ratios developed from factory labor events. Other more advanced ratios are constructed by adding nonlabor expense elements and items of general overhead. These ratios allow pinpointed appraisals of various manufacturing areas. The detailed ratios are used principally by line managers and others closely identified with the supervision of local production efforts.

To make broader evaluations which are more convenient for higher management, third-order, or tertiary, ratios are developed. These ratios are constructed by combining earlier ratios in composite patterns. While the pinpointing is not as sharp, the user has a fairly accurate indication of movement and trend. And since they are presented frequently, remedial action could even be taken on the basis of such tertiary ratios.

Evaluation versus Control

The elementary, advanced, and tertiary types of ratio present an on-the-spot appraisal of an event covered by the ratio. The ratio value in itself does not constitute control.

The value of any ratio at any one time provides an evaluation of the factors included in that ratio. Comparing the ratio value of one period with its value at a later time shows whether those included factors have improved or regressed. However, it does *not* show how that improvement reacted on the other areas of the company's economy. Control occurs only when the movements of several significant ratios are plotted simultaneously and observed from period to period. Then managerial action taken in any area is not only depicted in the ratio including that area, but is observed by the way other changes take place in the company.

Control spots just how the various events are interwoven so that

management is guided to a balanced and weighted decision. This is essential in the type of competitive economy where expense changes are subtle and often hidden and where the creeping change might be too small to be seen. Proper managerial control depends on thorough data integration.

Valid and sound appraisals can be made by comparing the value of a ratio for one week with the same ratio during following weeks. Following these fluctuations, management can be guided to areas of profit leaks or profit making. But if the manager acts on any one of these ratio movements without first testing how that act will affect the rest of the company, he is attempting to use autonomous control, which is not far removed from the "single-fact" type of management. He should be not only evaluating the movements in, say, the production economy, but also measuring the changes which occur in the sales and capital areas as a result of the production movements. How else can management possibly make a decision in depth?

Consider, for example, a machine center where expenses rose faster than the decrease in unit costs, indicating a lack of economy at the higher speed levels. Perhaps finding, and operating at, the most economical cost level will severely limit the capacity of the plant. This might mean purchasing additional equipment, farming out work, running a second shift, or taking other action to fill the gap. Or it might mean running the machines at the upper limit irrespective of the out-of-proportion increase in maintenance costs.

In the former case, there may be space limitations or capital shortages to prevent such a step. If the latter is resorted to, management must budget so as to have capital available when replacement is necessary. If capital and space are both available for the former, then the cost for the use of the capital would have to be added. But this cannot be the entire story! What might influence management toward a decision to replace now, rather than run the machine at the excessive maintenance level, is the value of this purchase on the market picture. This is a function of the cost of obtaining additional sales to fill the added capacity of the new machine and the existing market saturation. How does the profit on the additional sales compare with the cost of the use of the capital to purchase the machine? Which will outlast which and within what time?

Managing on the basis of single facts and events can be disastrous. One company got to the verge of bankruptcy by the simple act of agreeing to 60-day terms instead of their net 30-day accounts receivable policy, to just *one* large customer. The electronic plant supplying components to this customer had to stock its raw materials for an average of two months, and its production cycle was also two months, mak-

ing the cash-to-cash cycle six months. The manager agreed to these longer terms because the order was substantial and the customer important.

But was it worth going out of business to satisfy this prestige account? Here's what was involved. The electronic component was complicated to manufacture and required that finished subassemblies wait for long periods while other parts sat in the environmental chamber for two weeks. Rejects were high, and cash flow prevented the prompt meeting of the payroll on many occasions. The limitation of cash flow finally prevented payments for raw material for other customers' orders, and so there was no early collectible receivables. Needless to state, the 60-day customer's orders were a large portion of the company's total sales, and the profits involved were fairly marginal.

It was calculated that even if the profit percentage had been three times that charged to that customer, it would have been just as disastrous to the company. Profits can be made only by a company which is still breathing. And consider this: the brink-of-disaster state was based on a single-fact decision, namely, a sizable order, an important customer, and the request for 60-day terms. Yet the difference between the 30- and 60-day arrangement was the difference between a profitably operating company and one struggling for survival.

Managerial Control

Full data integration produces the most secure type of rapid and reliable control for general management. The controls are not perfect, for they have the human element as a vital term of the equation. They are accurate since the decision-making data are viewed in total perspective, and with the introduction of fact-conditioned forecasts, they can modify present decisions to the extent that they will affect future operations.

Most plants experience transient costs in their production. If these sharp variations occur with some predictable degree of frequency, they are no longer transients, but are part of the general characteristics of operation. Those that occur without any regularity are transient in interval and magnitude. Transients are produced by, say, a run of poor material, the employment of a group of trainees, the disposal of a machine, etc. It can be unfair for the upper managerial levels to act on these transients via weekly ratios. The effect of these transients, however, should be well understood by all managerial levels.

Upper management is more interested in general movements in the economy, leaving to its subordinate groups the investigation and remedying of the local events which caused the movements. For that reason ratios should be presented in the form of movements. This is

managerial control. For an appraisal of a given week, ratios can be consulted. For control in a given week, a family of ratio curves is examined to see what the total trend is and the areas of negative and positive effect.

Control by Ratio Movements

Exhibit 5-1 shows a tabulation of primary data for four successive periods, leading up to the primary data of Exhibit 3-1. These data are not for successive weeks. Each period represents one week's data, and they are taken over a period of about eight months. The first period shows no incentive and no control in force. Then as the productivity and coverage grows, so do the excesses. Some are in proportion, and some are not. Some are even great enough to overcome productivity gains. These we shall see in the movements of the curves.

Exhibit 5-2 shows the nonlabor factory expenses, administrative data, and others for the same four periods. These data lead up to the primary data of Exhibit 4-1.

Exhibits 5-3a to 5-3c show the ratio values for the elementary, advanced, and tertiary ratios, respectively, for the four periods. The fifth period is the last, or most recent, period, calculated in the previous two chapters.

The progression through the four periods shows a definite improvement pattern in most areas. Some of the improvements are not as great in one area as they are in others, and this can be seen from perusing the ratio values developed for the five periods. In general, there were not very large changes in the total payroll, although the sales level did rise appreciably. This was due to the *effective* use of a wage incentive plan which included supervisors and the indirect, supporting workers. Control was established throughout the entire company from the start of this third period, and so the waste and rejects were kept in proportion to sales and to production increases. The impact of the workers' desire to earn bonus money was measured in the down time and excess costs areas and found to be within economical limits.

Unrelated Data Mislead Management

Management cannot act on isolated facts which have no weighted economic meaning. For example, gross payroll, cost of customer rejects, machinery repair costs, direct labor clock hours, and productivity represent five different types of primary data. Examining their respective values for the five periods shows that all but the direct labor clock hours had changes in direction. How was management to judge whether the sharp rises in productivity were really economical? Were the direct labor hours producing economically? How much were the rejects from

EXHIBIT 5-1. FOUR-PERIOD PRIMARY PRODUCTION DATA, FROM PAYROLL ANALYSIS

Code	1st period	2d period	3d period	4th period
		In dollars		
1	25,852	25,787	26,912	22,981
2	25,852	25,787	26,379	22,757
3	. . . .	. . . .	4,270	4,625
4	7,650	7,300	7,300	6,900
5	9,790	10,505	11,570	11,525
6	3,010	2,830	2,390	1,990
7	263	282	169	122
8	333	315	157	130
9	144	153	135	108
10	332	298	280	210
11	153	115	115	124
12	1,140	1,140	1,140	1,140
13	1,240	1,240	960	420
14	1,770	1,794	1,750	1,020
15	1,460	1,128	1,830	730
16	2,900	2,670	3,040	2,030
17	1,716	1,716	1,716	1,716
18	1,297	1,297	1,297	1,297
19	304	304	304	304
20	16,062	15,282	15,282	11,341
21	729	1,100	330	110
22	. . . . .	. . . . .	473	109
23	. . . . .	. . . . .	60	115
		In hours		
24	13,150	13,065	13,764	11,716
25	13,150	13,065	13,480	11,610
26	800	1,200	2,400	2,600
27	1,200	1,800	2,140	2,540
28	4,300	4,100	4,100	3,880
29	5,500	5,900	6,240	6,420
30	1,700	1,600	1,350	1,125
31	140	150	90	65
32	180	170	85	70
33	80	85	75	60
34	190	170	160	120
35	80	60	60	65

EXHIBIT 5-1. (*Continued*)

Code	1st period	2d period	3d period	4th period
36	400	400	400	400
37	620	620	480	210
38	730	720	720	420
39	830	640	1,040	415
40	1,540	1,390	1,620	1,080
41	560	560	560	560
42	440	440	440	140
43	160	160	160	160
44	7,650	7,165	7,240	5,190
45	400	600	180	60
46			260	60
47			24	46

EXHIBIT 5-2. FOUR-PERIOD PRIMARY PRODUCTION DATA, FROM NONPAYROLL SOURCES

Code	1st period	2d period	3d period	4th period
a	72,000 sq ft	72,000 sq ft	72,000 sq ft	72,000 sq ft
b	$56,200	$61,700	$73,400	$92,000
c	$2,040	$1,860	$2,210	$1,460
d	$1,740	$1,510	$1,910	$1,130
e	$7,300	$7,200	$7,600	$5,240
f	$1,900	$1,900	$1,900	$1,900
g	$4,160	$4,160	$4,160	$4,160
h	$15,880	$15,880	$15,880	$15,880
j	2,420 hr	2,560 hr	2,800 hr	3,320 hr
k	$8,060	$8,060	$8,060	$8,060
l	5,000 hr	5,000 hr	5,000 hr	5,000 hr

customers worth in terms of their effect on profits? Were the machinery repair costs justified for the level of productivity?

None of these questions are really answered by the values themselves. What portion of the direct labor hours shown carried the productivity shown? In other words, what was the incentive coverage? Did machinery and repair costs exceed the depreciation expenses? Were these maintenance costs provoked by the incentive? Did this show whether machines were too uneconomical to own any longer? These are questions which have to be weighted and integrated so that management can

EXHIBIT 5-3A. MOVEMENT AND VOLATILITY OF ELEMENTARY PRODUCTION RATIOS

Ratio no.	Formula	Period				
		1st	2d	3d	4th	5th
I	$\frac{26}{27}$	0 667	0 667	1 121	1.032	1.175
II	$\frac{27 - 15 + 46}{27}$	0.667	0.667	1 037	0 993	1 12
III	$\frac{27}{29}$	0.218	0.305	0.343	0.395	0.433
IV	$\frac{27 - 45 + 46}{29}$	0 1152	0 204	0.356	0.396	0.484
V	$\frac{27 - 45 + 46}{25}$	0.0608	0.0918	0 164	0.219	0.286
VI	$\frac{45}{46}$	....	.. ...	0.692	1.00	0.319
VII	$\frac{11}{29 + 46}$	1.39	1.215	1.115	0.80	0.649
VIII	$\frac{20}{5}$	1.64	1.45	1.32	0 985	0 795
IX	$\frac{44}{24}$	0 582	0 549	0 526	0.443	0 391
X	$\frac{20}{1}$	0 621	0 593	0.567	0 494	0 446
XI	$\frac{45}{27}$	0.333	0 333	0.084	0.0236	0.056
XII	$\frac{6 + 7 + 8 + 9 + 10 + 11 + 15 + 21}{5}$	0 655	0 592	0.467	0.305	0 241
XIII	$\frac{6 + 7 + 8}{5}$	0 368	0 326	0.234	0 195	0.148
XIV	$\frac{9 + 10 + 11}{5}$	0 064	0 054	0 064	0 038	0.027
XV	$\frac{12}{5}$	0.117	0.108	0 098	0 099	0.087
XVI	$\frac{37}{29}$	0 113	0.105	0 077	0 033	0.036
XVII	$\frac{13}{5}$	0 127	0 118	0 083	0 036	0.0314
XVIII	$\frac{38}{29}$	0 133	0 122	0.115	0.065	0.048
XIX	$\frac{14}{5}$	0.181	0.171	0.151	0.089	0.0611
XX	$\frac{40}{29}$	0.28	0.236	0.258	0.173	0.142

EXHIBIT 5-3A. (*Continued*)

Ratio no.	Formula	Period				
		1st	2d	3d	4th	5th
XXI	$\frac{16}{5}$	0 396	0.254	0 263	0 176	0.136
XXII	$\frac{41}{25}$	0.0426	0.0428	0.0416	0 0482	0 0502
XXIII	$\frac{41}{29}$	0.102	0.095	0.09	0.087	0.0853
XXIV	$\frac{18}{5}$	0.133	0.124	0.112	0.113	0.101
XXV	$\frac{19}{5}$	0.03	0.029	0.0262	0.0264	0.0236
XXVI	$\frac{40 + 41 + 42 + 43}{29}$	0.491	0.433	0.445	0.349	0 319
XXVII	$\frac{16 + 17 + 18 + 19}{5}$	0.635	0.57	0.55	0.464	0 396
XXVIII	$\frac{(46 - 45) + 47}{29}$	.....	.....	0.0167	0.0072	0.0601
XXIX	$\frac{21 + 22 + 23}{5}$	0.0745	0.1045	0.0745	0.029	0.1048
XXX	$\frac{37}{26}$	0.775	0.516	0.20	0.0807	0.0602
XXXI	$\frac{38}{26}$	0 913	0.60	0.30	0 161	0 0965
XXXII	$\frac{22}{6}$	.....	.....	1.098	0.0548	0 533
XXXIII	$\frac{5}{1}$	0 379	0.408	0.43	0 502	0 554
XXXIV	$\frac{29 + 46}{24}$	0.418	0.452	0.472	0 552	0 605
XXXV	$\frac{6 + 7 + 8 + 9 + 10 + 11 + 13 + 14 + 15}{20}$	0.613	0.608	0.585	0.528	0.393
XXXVI	$\frac{6 + 7 + 8 + 9 + 10 + 11 + 13 + 14 + 15}{5}$	1.01	0.885	0.772	0.52	0 312
XXXVII	$\frac{22}{14 + 15}$	.. ...	.....	0.132	0.0623	0 675
XXXVIII	$\frac{14 + 15}{5}$	0.33	0.278	0.31	0.152	0 105
XXXIX	$\frac{7 + 10 + 14}{5}$	0.242	0.226	0.19	0.1175	0.0816
XL	$\frac{44}{24} \times \frac{29}{26}$	4.00	2.69	1.37	1.09	0.773
XLI	$\frac{40}{24}$	0.117	0.1065	0.118	0.0923	0.079

EXHIBIT 5-3A. (*Continued*)

Ratio	Formula	Period				
		1st	2d	3d	4th	5th
XLII	$\frac{29 + 4\,6}{44 + 45}$	0.683	0 761	0.877	1 235	1 49
XLIII	$\frac{27 - 45 + 46}{24}$	0.0608	0 0918	0 161	0 216	0 272
XLIV	$\frac{27 - 45 + 46}{44}$	0 1045	0 1675	0 307	0 49	0 694
XLV	$\frac{29 - 45 + 46}{24}$	0 388	0 406	0 459	0 547	0 59
XLVI	$\frac{29 - 45 + 46}{25}$	0.388	0 406	0 469	0.552	0.619
XLVII	$\frac{6 + 16}{5}$	0 604	0.523	0 470	0.348	0.270
XLVIII	$\frac{44 + 45}{24}$	0 612	0.597	0 542	0.448	0.405

control their economic effect. This is one of the most fertile areas for profit harvesting in industry today.

Interrelation of Primary Data

Let's get closer to managerial control by interrelating primary data. Exhibit 5-4 shows the relationship between maintenance and repair costs, productivity, and fixed expense recovery (see Chapter 11 for a definition of recovery). Here maintenance and repair costs are plotted with recovery against the same base of productivity. As productivity increases, so does the maintenance and repair. Recovery goes up quite rapidly and then levels off. In this company, increasing productivity accelerates recovery to the point where the maintenance excesses increase the amount to be recovered which cannot be overcome by added productivity. The light vertical line shows the most economical, or optimum-productivity, point. Boosting productivity beyond this point incurs needless added expenditures, including the maintenance and repair costs plus the bonus premium moneys. Pushing productivity also will hasten the date of capital replacement and will probably increase the level of inventory-in-process. Both these latter factors can have an untoward effect on the capital structure, as we shall see later in the book.

Naturally, there are many other factors to be considered in a situation

EXHIBIT 5-3B. MOVEMENT AND VOLATILITY OF ADVANCED PRODUCTION RATIOS

Ratio no.	Formula	Period				
		1st	2d	3d	4th	5th
A	$\frac{b}{1}$	2 17	2.39	2.73	4.00	**4.27**
B	$\frac{b}{25}$	4.27	4.72	5 45	7.92	8.81
C	$\frac{b}{5}$	5.74	5.88	6.35	7.98	**6.68**
D	$\frac{b}{29}$	10 20	10.45	11 80	14.30	**14.95**
E	$\frac{b}{a}$	0.78	0.86	1.02	1.28	**1.365**
F	$\frac{b}{h}$	3.53	3.88	4.63	5.80	6.20
G	$\frac{7 + 10 + 14 + c}{f}$	2.32	2.23	2.32	1.48	**1.15**
H	$\frac{d}{b}$	0 031	0.0245	0 026	0.0123	**0.00935**
I	$\frac{e + 15}{b}$	0 156	0.135	0.128	0.0649	**0.053**
J	$\frac{22}{14 + 15 + d}$	.....	.....	0.086	0.038	**0.401**
K	$\frac{22}{d + e}$	.....	.....	0 049	0.171	**0.163**

L	$\frac{d+e}{1}$	0.349	0.338	0.353	0.278	0.242
M	$\frac{22}{9+10+11+14+15+21+23+d+e}$	.....	.....	0.0364	0.0124	0.118
N	$\frac{g}{5}$	0.425	0 396	0.359	0.360	0.325
O	$\frac{g}{29}$	0.756	0.705	0.667	0.648	0.634
P	$\frac{g+h+(1-5)}{29}$	6.56	5.98	5.66	4.91	4.62
Q	$\frac{g+h+(1-5)}{5}$	3.68	3.36	3.06	2.74	2.47
R	$\frac{b}{g+h+(1-5)}$	1.55	1.75	2.08	2.92	3.24
S	$\frac{20}{b \times 1}$	0.000011	0 000009	0 000007	0.000005	0.000045
T	$\frac{5 \times b}{1}$	14,200	25,200	31,500	46,100	55,300
U	$\frac{h}{29}$	2.89	2.69	2.54	2.46	2.42
V	$\frac{f \times a}{j \times b}$	1.005	0.862	0.665	0.446	0.456
W	$\frac{h}{j}$	6.56	6.20	5.67	4.78	5.21
X	$\frac{c}{f}$	1.07	0.978	1.16	0.77	0.60

EXHIBIT 5-3B. (*Continued*)

Ratio no.	Formula	Period				
		1st	2d	3d	4th	5th
Y	$\frac{e + d}{j}$	3.73	3.40	3.40	1.93	1.83
Z	$\frac{h}{5}$	1.62	1.51	1.37	1.38	1.24
A′	$\frac{7 + 10 + 14 + c}{b}$	0.0785	0.0685	0.06	0 0305	0.0222
B′	$\frac{k}{j}$	3.33	3.15	2.88	2.43	2.64
C′	$\frac{f}{j}$	0.785	0.742	0.678	0.572	0.623
D′	$\frac{40}{j}$	0.636	0.543	0.578	0.325	0.307
E′	$\frac{j}{30 + 31 + 32 + 33 + 34 + 35 + 37 + 38 + 39 + 40}$	0.397	0.457	0.493	0.915	1.003
F′	$\frac{26}{g + h}$	0.04	0 06	0.12	0.13	0.167
G′	$\frac{29}{g + h}$	0.0275	0.0295	0.0312	0.0321	0.0328
H′	$\frac{j}{g + h}$	0.121	0.128	0.14	0.166	0.1525

EXHIBIT 5-3B. (*Continued*)

Ratio no.	Formula	Peroid				
		1st	2d	3d	4th	5th
I′	$\frac{6 + 16}{j}$	2.44	2 15	1 95	1.21	1.13
J′	$\frac{(6 + 7 + 8 + 9 + 10 + 11 + 15 + 16 + 21) \times 1}{5}$	24,600	21,800	19,750	13,100	8,730
K′	$\frac{g + h}{j}$	8.27	7.81	7.15	6.02	6.58
L′	$\frac{b}{27}$	46.8	34.3	34.3	36.2	34.6
M′	$\frac{7 + 10 + 14 + c}{j}$	1.82	1.65	1.57	0.845	0.718

EXHIBIT 5-3C. MOVEMENT AND VOLATILITY OF TERTIARY PRODUCTION RATIOS

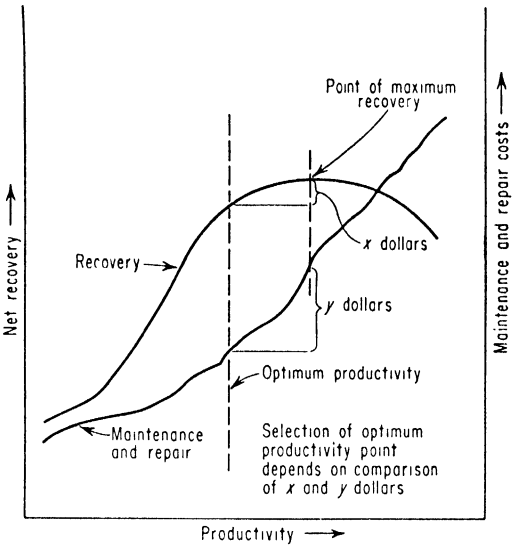
Ratio no.	Formula	Period				
		1st	2d	3d	4th	5th
AA	$\frac{\text{Ratio IV}}{\text{Ratio XII}}$	0 22	0 344	0.762	1.30	2 00
BB	$\frac{\text{Ratio IV}}{\text{Ratio XXI}}$	0.368	0 802	1.35	2.25	3.55
CC	Ratio IV × Ratio B	0.624	0 962	1.94	3.14	4 27
DD	Ratio V × Ratio B	0 258	0.434	0 895	1.73	2.52
EE	Ratio XXVII + Ratio N	1.06	0 966	0.809	0.824	0.721
FF	$\frac{3 - 21}{2}$ + Ratio M	.....	.....	0 1859	0.2114	0.385
GG	$\frac{(3 - 21)/2}{\text{Ratio XII}}$	0 0835	0.138	0 32	0.653	1.11
HH	$\frac{\text{Ratio IV}}{\text{Ratio XXXVIII}}$	0.442	0 734	1.15	2.60	4.61
II	Ratio D × Ratio XII	6.68	6.20	5.52	4.36	3 60
JJ	Ratios B × Y × XII	10 43	9 50	8.65	4.66	3.88
KK	$\frac{\text{Ratios XXVII + N + Z}}{\text{Ratio A}}$	1 23	1.03	0 835	0.55	0.459
LL	$\frac{\text{Ratios XXVII + N + Z}}{\text{j}}$	0.0011	0.0009	0.0008	0.00066	0.00064
MM	$\frac{\text{Ratio V}}{\text{Ratio XXI}}$	0 1535	0.362	0.624	1.24	2.10

EXHIBIT 5-3C. (*Continued*)

Ratio no.	Formula	Period				
		1st	2d	3d	4th	5th
NN	$\frac{24 \times \text{Ratio IV}}{40}$	1.248	1 916	3 02	4 29	6.12
OO	$\text{Ratio D} \times \left(\frac{j}{30+31+32+33+34+35+37+38+39+40}\right)$	4.05	4.79	5 82	13.10	15.00
PP	$\frac{\text{Tertiary Ratio EE}}{j}$	0 00044	0.00038	0 00029	0 00025	0.00024
QQ	$\text{Ratio IV} \times \frac{26}{g+h}$	0 00584	0.01224	0.0427	0.0514	0.0809
RR	$\text{Ratio IV} \times \frac{29}{g+h}$	0.004	0.006	0.0112	0.0127	0.0159
SS	$\text{Ratio IV} \times \frac{j}{g+h}$	0.0176	0 0262	0.0498	0.0657	0.0739
TT	$\text{Ratio V} \times \frac{j}{g+h}$	0 0073	0.0118	0.023	0.0364	0.0435
UU	Ratio B × Ratio E	3 33	4.06	5 55	10.10	12 05
VV	$\frac{\text{Ratio XLVIII} \times (d+e)}{\text{Ratio I}}$	8,290	7,800	4,600	2,760	1,925
WW	$\frac{\text{Ratio XLVIII} \times (30+31+32)}{\text{Ratio I}}$	1,855	1,720	737	546	368
XX	$\frac{\text{Ratio XLVIII}}{\text{Ratio I}} \times (d+e+6+7+8+9+10+11)$	10,450	9,800	5,480	3,420	2,700
YY	Ratio F × Ratio V	2.14	3.56	0.76	1.27	1.77

like this. Perhaps a revision in product mix will change the slope of the recovery curve. And the maintenance and repair costs, even though excessive, are still economical in comparison with the now accelerated recovery. Or perhaps the productivity applies to handwork operations, in which case the correlation to maintenance and repair is not valid. This would point invariably to an obvious poor condition of equipment, with the defects occurring at low speeds and at low levels of usage. To

EXHIBIT 5-4. INTERRELATION OF PRIMARY DATA



determine any of these matters, the appropriate ratios would have to be established to reflect the principal characteristics of the company.

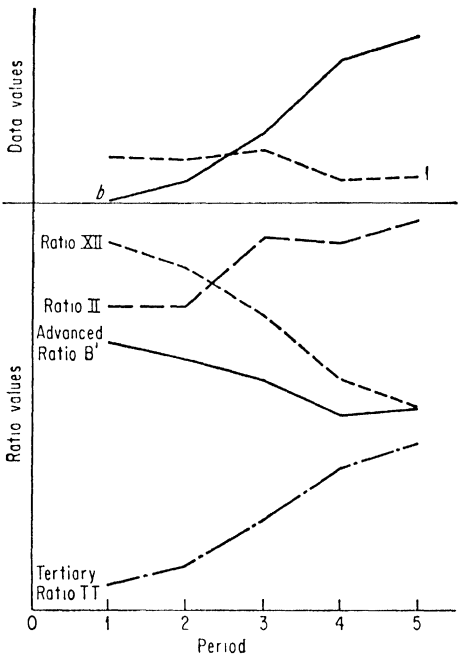
Movements of Primary Data with Ratios

Exhibit 5-5 shows the movements of various primary data and the elementary, advanced, and tertiary ratios for the five periods previously mentioned. While the results are all positive, the speed of changes differs widely. Notice that b (sales) rises at a different rate from Ratio II Net Productivity. That means that the two are not directly related; something else is causing the difference. The reasons can be manifold: the product mix could shift, the coverage increased thereby averaging the productivity down by the presence of new operators, etc. On the other hand, item 1 (total gross payroll) is decreasing with increases in sales, always a positive sign unless the added sales contained little labor (revised product mix) compared with the earlier segment of

sales. Therefore it is possible to see this opposite relationship even if productivity was decreasing.

With the aforementioned positive movements Ratio XII, Excess Cost, drops steadily, which is a positive direction for this ratio, and adds to the improvement of the plant's economy. Observe Ratio B′. Notice that while this ratio drops, which is positive movement for it, it does not drop as fast as Ratio XII. While the latter ratio is concerned with excess costs, the former is concerned with the velocity of expense recovery

EXHIBIT 5-5. MOVEMENTS OF PRIMARY DATA: ELEMENTARY, ADVANCED, AND TERTIARY RATIOS FOR FIVE PERIODS



and the two need not move at the same rate. In large fixed costs industries, Ratio B′ is usually of greatest concern because those companies are, in effect, selling machine time. The fact, however, that these two have different speeds does have significance. The further apart these curves are, the less the productive effort emphasizes machine work. However, this relationship can be distorted by rises in excesses, even in the nonmachine area.

Ratio TT is a tertiary ratio, which integrates all the data listed except sales. It is clear that by comparing this curve with that of item b (sales), there is an almost equal increase in economy with increases in sales. That does not mean that the profit on sales remains the same over

the five periods. That in itself would produce more profit dollars because of the higher sales level. It means, instead, that there is an increase in the economy; that is, as sales rise, there is also an increase of the profit percentage on sales, boosting profit dollars even further. This is a desirable situation up to a point, as we shall see in the section on the capital structure.

Company Progress by Ratio Control

However, from just the plant operating viewpoint, the five-period situation showed positive movement. The period shown started without any control. The first step the company took was the installation of a time and production reporting system. And then these data were transferred to a payroll analysis. As management let it be known that it was looking at the cards, there was an immediate psychological effect. When management saw the large amount of time spent in waiting for work, for setups, for orders, for materials, for repairs, for adjustments, etc., management got busy and set up a flying-squad pool to take care of these matters promptly.

Next management investigated the planning and scheduling to make sure that the long runs were not given preference out of their proper sequence. Then elementary ratios from the payroll analysis were developed to bring the equipment cost excesses into line. Time studies were started next, and a wage incentive plan discussed. At about the same time, by policing the waste and reject ratios, these excesses were reduced. Then followed reductions in the excessive level of indirect labor that had obtained previously, and the total payroll had a higher proportion of direct labor. Operations were placed on incentive as the production standards were developed, instead of waiting until the entire shop was covered.

Not all situations respond to this technique, however. To avoid possible resentment from workers not as yet covered by incentives, a plant-wide, or interim, form of incentive was developed. As the incentive coverage progressed, the interim plant-wide incentive affected fewer and fewer people. As the workers started to earn bonus, those indirect workers supporting them became a bit lax. This pointed up the need for immediate tie-in of the indirect workers, and then productivity was well on its way up. In addition, supervisory incentives were installed and foremen rewarded for maintaining the usual hidden and subtle expenses to within economical limits. They were in fact stimulated to observe and question cost areas to which heretofore they were indifferent. This further reduced rejects, waste, and unnecessary indirect labor.

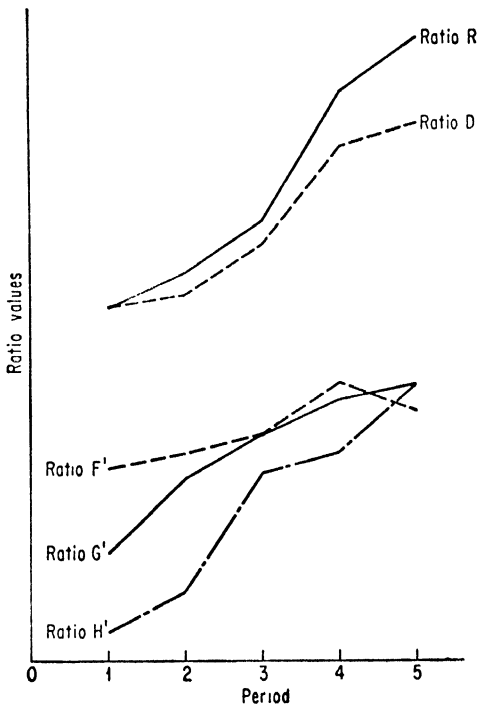
Tertiary ratios were installed following the above improvements, and

management was directed to profit-making areas. With machine-hour-rate cost estimating in effect, the product mix was redesigned to provide the greatest profits. From this the company determined and selectively sold its most profitable facilities. At a later point, after the interval covered by the five periods, the company's sales had soared to limits which actually threatened its financial safety. This was due to the expanding inventory level which had to be maintained to support the higher activity. It interfered with the company's working capital position, and the company had almost expanded beyond the safe limit for its size. It was in the "overtrading" area; i.e., its sales and inventory value was too great for its net worth. This aspect of control is discussed in the capital section.

Interrelation of Advanced Ratios

Exhibit 5-6 shows a somewhat different picture of the company over its five different but successive periods. Here we see Ratio R, showing the speed with which the sales absorb the overhead expenses as compared with the velocity with which the sales are returned per direct hour. In

EXHIBIT 5-6. INTERRELATION OF ADVANCED RATIOS

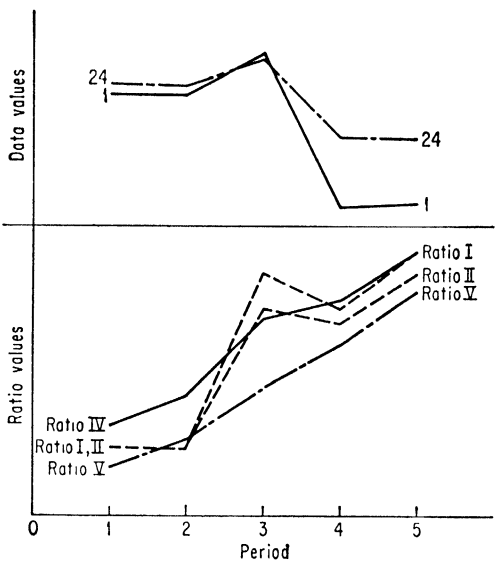


both of these curves there is a steadily increasing trend toward the positive. The curves of Ratios F′, G′, and H′ are different and depict another aspect of the company's characteristic movements and responsiveness to various stimuli. It is obvious that Ratio F′ moves faster than the other two. Examination of the ratio formulas will show that this is due to the presence of the earned hours, which is obtained from incentive stimulus. Ratio H′, on the other hand, is the slowest of the three, and its base is tied to the machinery running hours. This would seem to indicate that the presence of the incentive—with the present product mix—is a direct contribution to productive capacity liberated, which the company is able to sell.

Volatility of Primary Data

Exhibit 5-7 is an example of the difference between the movements of the primary, unrelated data and the elementary ratios which condense and weight the effect of the interrelated primary data. It is just

EXHIBIT 5-7. VOLATILITY OF PRIMARY DATA



this primary-data volatility which makes decision making difficult and unobjective. If a man were to judge his plant's economy on the basis of, say, the gross payroll, then he would consider the third period the worst. Nothing could be further from the truth. The third period is head and shoulders above the first two. Productivity, performance, and improvement index all rose. The rejects and waste rose, but so did the

sales; the running hours jumped up; and the productivity almost doubled with a 50 per cent increase in coverage.

Five-period Summary

All things do not run smoothly in the earliest stages of wage incentives. Everyone is tempted by money. Supervisors and foremen are no exception. Occasionally they also fall prey to short cuts for making more money for their people. That's one of the many reasons for using supervisory incentives. In the five-period observation of these four curves, the following conclusions were arrived at. After it was in effect a short time, the mechanical aspects of the incentive were economical. The maintenance expenses in comparison with the need in the productive effort were high at the start. As soon as the elementary ratios were issued and acted upon, their level tumbled, but then started to slow up as the men realized that fewer men were doing more work, now that the incentives stimulated faster work and greater machinery utilization.

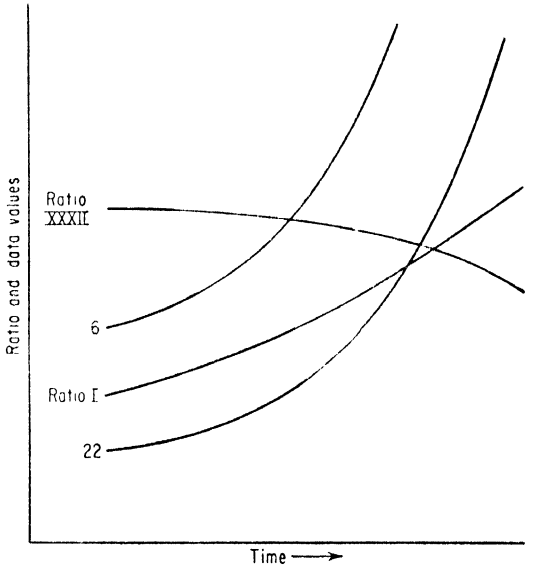
A change was noticed after the maintenance men were tied into the production incentive. This is shown by the reversal of Ratio XXVIII, once the indirect premium was earned. The rise in the indirect premium, in effect, controls the rise in the direct premium in those shops where the indirect labor effort closely services the productive workers.

One other interesting thing happened. Notice the reversal of direction of Ratio XXXII. The planning suffered in the early stages of the incentive. Orders were selected for their size (and hence the continuance and increase of premium bonus moneys), and the company suffered cancellations of orders. In addition, all emphasis was placed on the speed (at the start of any incentive plan this tendency is bound to occur unless anticipated and controlled) of production, and the planning of materials, die changeovers, etc. all suffered. As a result, the waiting time soared and Ratio XXXII plunged. After this was discovered and corrected, the ratio resumed its positive upward climb.

Effect of Favoring Long Production Runs

In Exhibit 5-8 is shown a more dramatic example of what the ratio data look like in companies where there is a tendency to favor the long runs out of sequence in the schedule. Invariably the productivity and premiums soar and Ratio XXXII steadily decreases and item 6 (miscellaneous waits) rises very fast. Even when companies receive many cancellations as a result of this continued practice, it sometimes takes quite a while for management to actually find the pattern. In medicine, any stimulant requires careful administration and watchfulness lest the patient suffer ill effects. In manufacturing, the same is exactly true of the use of incentives for any echelon.

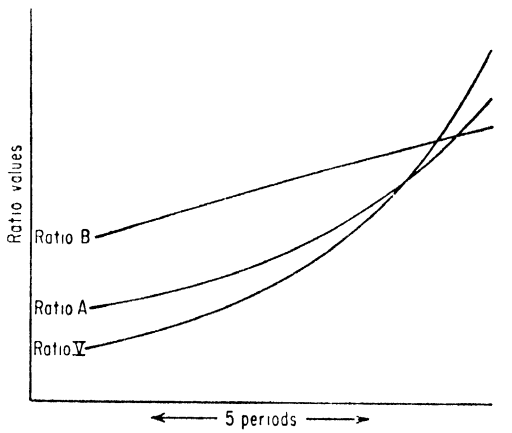
EXHIBIT 5-8. EFFECT OF FAVORING LONG PRODUCTION RUNS



Ratio XXXII = productivity planning = $\frac{22}{6}$

$= \frac{\text{direct incentive premium}}{\text{miscellaneous downtime waits}}$

EXHIBIT 5-9. REVISED PRODUCT MIX OR INCREASED LABOR EFFECTIVENESS?



Ratio A = $\frac{b}{1} = \frac{\text{shipments}}{\text{gross payroll dollars}}$

Ratio B = $\frac{b}{25} = \frac{\text{shipments}}{\text{base payroll hours}}$

Diagnosing Increase in Billing

Exhibit 5-9 diagnoses a condition occurring in the company during the five-period interval. Comparing the relative movements between Ratios A and B raises the question as to whether the two rates of speed shown were due to a revised product mix or an increased labor effectiveness. Either condition would give rise to the changes in the curves. When Ratio V is added, then there is no doubt that this condition was due to increased labor effectiveness. If Ratio V did not confirm this, i.e., if the curve headed downward, then the condition would be depicting a revised product mix. This is a very general appraisal, but if the changes are great enough, it acts as a rough clue to stimulate management to further investigation.

Ratio Movements for Diagnosis

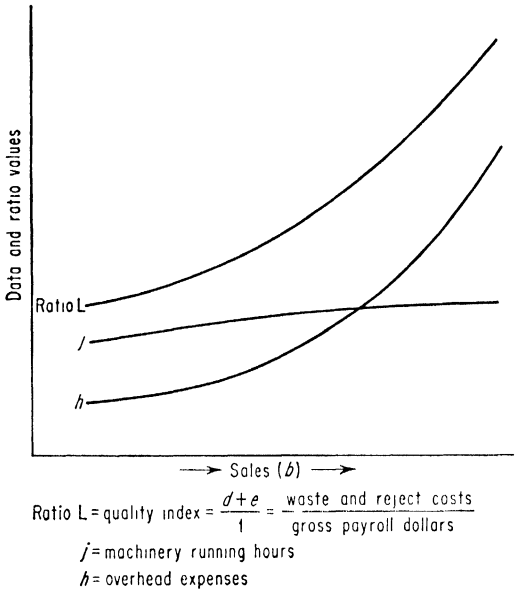
Not all ratios move in the same way with respect to each other in all plants. Each plant has its own special characteristics and peculiarities. In fact, it has a composite personality made up of the various people who direct or influence them. This would seem to reinforce the notion that there is one best way to manage a company, given a specific set of conditions and events.

The charts to be discussed now have no connection with the previous plant and its five periods. These are representations of the movements of certain ratios and how diagnoses were made from those movements. There are various ways of showing these charts. One can place a most critical ratio at the x axis and draw inferences from how other data and ratios gyrate around it. This is the case with Exhibits 5-10 and 5-11. The remainder of the charts use the x axis as an increase in time from left to right.

Sales versus Product Mix

Exhibit 5-10 shows that item h is moving faster than item j and indicates that increases in overhead are mostly due to the general and administrative expenses rather than in the factory. The accompanying rise in Ratio L is a possible indication that excess sales can't be handled at satisfactory quality levels. Notice that all the data rise, and they rise as sales rise, since sales is taking the place of time on the x axis. This type of chart appraises a characteristic of what may be expected to happen in a company of a certain product mix, with an increase in sales. The situation can be changed considerably by a change in product mix.

EXHIBIT 5-10. MOVEMENT OF DATA WITH RESPECT TO SALES INCREASE



Ratio L = quality index = $\frac{d+e}{1} = \frac{\text{waste and reject costs}}{\text{gross payroll dollars}}$

j = machinery running hours

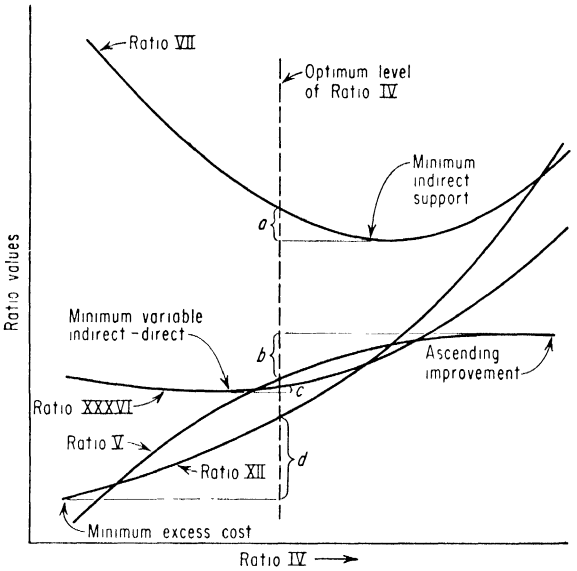
h = overhead expenses

Optimizing Excess Cost

Exhibit 5-11 uses Ratio IV, Performance, as a base and shows what could happen in a company with increases in performance. Ratio IV can increase and yet, depending on the proportions of the gross payroll and the internal changes in its proportions of direct labor, earned hours, and indirect labor, the other ratios will vary. In other words, various performance levels can be attained at a fixed level of gross payroll because of the variations within the gross payroll's content. It can consist of a little indirect labor or a lot; whatever percentage is direct labor can be varied by the amount of earned hours, etc. At a given advanced level of Ratio IV, Performance, Ratio VII starts to rise. This might be due to the foreman's decision to add indirect people to support the higher productivity. Ratio V rises quite sharply and then tapers off, possibly because of the presence of the added indirect labor, which of course acts to raise the total payroll. On the other hand, Ratio XXXVI goes up and down, which shows a changing down time and excess picture within the payroll. This is borne out by Ratio XII, which rises constantly. But notice that in the earlier periods of performance increases, the rising excess did not have a negative impact on Ratio XXXVI.

In that range of performance, the localized economy was strong enough to overcome those excesses. The light vertical line suggests the optimum level of Ratio IV. The reader must keep in mind that it is an

EXHIBIT 5-11. MOVEMENT OF ELEMENTARY RATIOS WITH RESPECT TO PERFORMANCE INCREASES



Optimum level of Ratio IV: $a+c+d=b$

optimum for just this company and its own set of specific characteristics. It might be pegged at an entirely different point for other companies, or even for the same company under different circumstances.

Determining Optimum Productivity

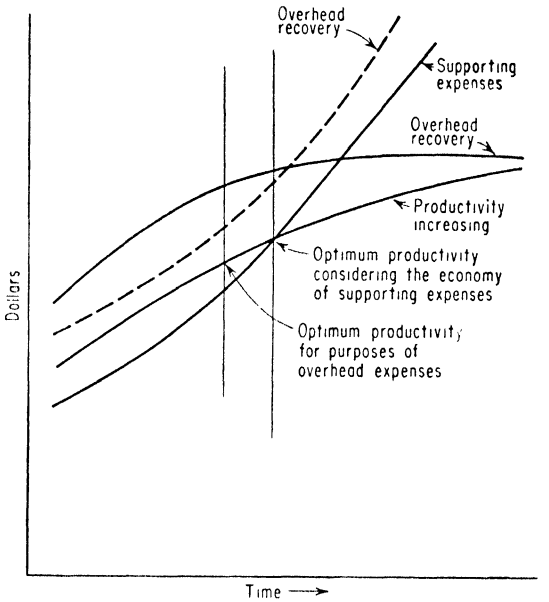
Exhibit 5-12 shows the typical relationship between productivity, supporting expenses, and overhead recovery. As we have said several times before, a point is reached in the climb of productivity where it becomes uneconomical; that is, above this point, the magnitude of the indirect labor used—materials handlers, setup men, maintenance services, additional inspectors, etc., plus the increase in waste and rejects—is sufficient to offset the gains of the higher productivity. This point should be determined in each locale so that management can counsel properly.

However, as productivity rises, if it is accomplished at operations carrying substantial levels of fixed expenses, then the climbing productivity is also accelerating fixed expense recovery (provided the sales department is able to sell the additional capacity thus liberated). Based on which operations are involved in the productivity increases and how these increases change at higher levels, the slope rise of the recovery curve is determined. This may or may not coincide with that

of the productivity. As Exhibit 5-12 shows, the optimum productivity for purposes of economical overhead recovery occurs before the optimum productivity as far as the supporting expenses are concerned. Again, this is not necessarily the same in all companies; it depicts a very specific local condition.

From this set of facts, it is obvious that the company is better off at the *lower* optimum productivity because, in going up to the *upper* optimum, it is incurring additional supporting expenses, *and* the con-

EXHIBIT 5-12. DETERMINING OPTIMUM PRODUCTIVITY: FOR EXPENSE ECONOMY? FOR OVERHEAD RECOVERY?



tinued production pressure only succeeds in piling up work-in-process inventory and possibly distorting the internal asset balance of the company. That is why capital considerations must be integrated into decision making. If continued productivity to the upper optimum increases the value of inventory by, say 20 per cent, then, based on the proportion of inventory in the total asset picture and the speed with which this is being converted into accounts receivable, it is possible not only to cause a serious drop in financial liquidity, but actually to cause additional expenses in the form of interest charges for the use of capital to finance the higher inventory. As we shall see later on, this also affects the working capital position of the company and changes the degree of ownership.

All the foregoing events occur in many instances just through an unbalanced drive for productivity. The *small* question in many cases is whether it is worth the additional supporting expenses to get slightly higher productivity since the recovery does not increase. In many situations, *the major consideration* is the effect on the capital structure or the effect it has on the sales function. As a matter of fact, there are many instances where the productivity must be reduced below either of the optimum points because of more serious effect elsewhere.

And, by the way, every time action like that becomes mandatory, it is clear indication that the company is organically unbalanced; that is, when the company was first started, or maybe afterwards, each function was permitted to develop and mature independently of the others. Thus the production is developed with a capacity that cannot possibly be supported by the financial function. Or maybe the capital structure is far too great for what is needed in production, and the investors' money becomes sluggish. Sales also plays a role in this type of determination because sometimes the productive efforts are frustrated when sales cannot sell what production is able to turn out. And so we have a triheaded biological structure which must be fully integrated and slowly adjusted and brought into proper balance.

Now let's get back to Exhibit 5-12 and see what the decision making should be if the recovery curve takes the slope of the dotted line. This is usually the case where the productivity occurs on operations which involve high fixed costs. Neglecting the financial aspect for the moment, this would call for an arithmetic comparison between the additional fixed expenses recovered versus the added supporting expenses. The economical point usually occurs well up on the productivity scale. As a matter of actual fact, the author has rarely seen the fixed expense recovery as amounting to less than the supporting expenses. In this kind of situation (again with due consideration for the capital and sales areas), with the new recovery curve as shown, soaring productivity is a direct contribution to profits. The light vertical dotted line shows where such a higher optimum would occur. Of course, there are some other production considerations which have to be watched as well, which might lower the new higher optimum level. This would be principally the rise in maintenance and repairs costs on equipment at the upper productivity limits.

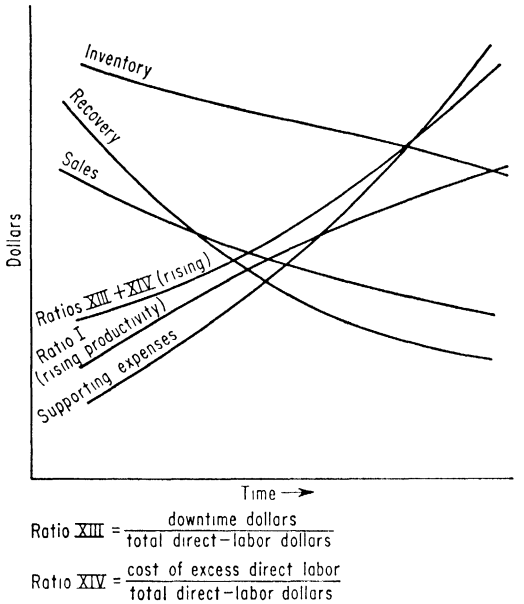
Spotting Dishonesty

There are precautions which must be taken with respect to productivity. Management must make certain that the productivity calculated is the true productivity. Earlier, collusion which sometimes occurs, the dishonesty of reporting excessive down time or daywork, was mentioned.

This artificially lowers the time spent on production standards and thereby falsely inflates the productivity. It also unfairly raises the amount of day-work payment, and the company not only does not really have the productivity reported, it has an excess nonproductive payment to make as well.

Exhibit 5-13 shows the effect of some of this and how it can be detected. It is somewhat exaggerated so as to allow the reader to note the variations in the movements. It sometimes does get so bad in companies where the management is principally sales-oriented and pays

EXHIBIT 5-13. DIAGNOSIS: COLLUSIVE DISHONESTY



$$\text{Ratio XIII} = \frac{\text{downtime dollars}}{\text{total direct-labor dollars}}$$

$$\text{Ratio XIV} = \frac{\text{cost of excess direct labor}}{\text{total direct-labor dollars}}$$

little attention to the factory managerial nuances. Usually the management runs around hollering at the sales department because of the sales drop-off, reinforced by feeling that the factory is productive and provides the potential whereas the sales department just sits with inventory, etc.

In this chart, the rise in artificial productivity is not supported by a drop in down time and excess time; instead these latter time elements rise. This just can't be; two things can't occupy the same space at the same time. And if in an 8-hour day, 5 hours is spent on incentives (where it should be reported as 7), then 3 hours (which should be 1 hour) is claimed as day work. If the day work is ostensibly spent on direct operations not covered by standards, this condition can sometimes be discovered by introducing Ratio III or IV.

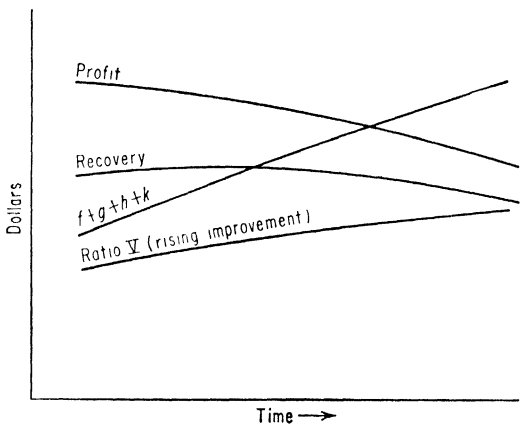
The second clue comes from a steady drop in overhead recovery. This occurs for two reasons: first, the productivity is really not as high as shown, which slows up the recovery; and secondly, the excess times are a charge to overhead, and this decelerates its recovery even more. Then again, sales are decreasing (relatively). If productivity is high and sales effort applied in a proper market, this has to result in higher sales. The final clue is the fact that the slope of the dropping inventory (which shows no tremendous manufacturing pressure) and the slope of sales are about the same, indicating that if there is a rise in productivity, it is not showing up in inventory or sales.

The reader should understand that this set of curves applies to a specific situation in a specific company. The reader should likewise be informed that variations in product mix, and consequent variations in the cost and usages of facilities, could change the picture considerably. This presentation serves to acquaint the reader with the logical technique behind the diagnosis of a situation, and it could be applied to other situations as well.

Impact of Improvement on Overhead Economy

Exhibit 5-14 depicts what happens when overhead expenses are added without first seeing whether they can be economically justified. In this case the decision to add and tolerate overhead expenses stemmed

EXHIBIT 5-14. DIAGNOSIS: INCREASE IN OVERHEAD NOT JUSTIFIED BY IMPROVEMENT INCREASES



$f + g + h + k$ = total company overhead expenses

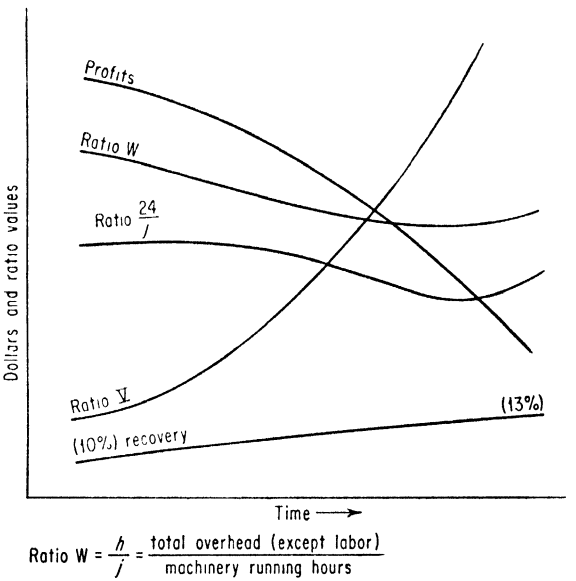
from a real improvement in Ratio V, Improvement Index. The mistake was in not considering and comparing the limits of such an addition compared with what the Ratio V was actually producing from its rise.

A simple comparison with recovery would have done it. Here the increase in overhead expenses is not justified by a rise in the improvement index; the profits drop. Even worse, the expense recovery drops because the performance in the shop (and perhaps the inability of the sales department to sell the added capacity) cannot overcome the added expenses fast enough. Of course, there are rationales for such an overhead increase, like better service to customers, expanded development needs, additional executive control. If this is so, all these acts should result in more profits, a healthier capital structure, or both. Otherwise the motives are immature and self-deceptive.

Evaluation of Productivity

Exhibit 5-15 shows a situation in which a high rise in Ratio V, Improvement Index, together with other factors showed up an unhealthy condition. With a fast increase in Ratio V (not necessarily up to a high ratio value), the profits dropped. Here was a shop which produced

EXHIBIT 5-15. DIAGNOSIS: PRODUCT MIX AND INCENTIVE COVERAGE FAVORING NONMACHINE OPERATIONS



$$\text{Ratio W} = \frac{h}{j} = \frac{\text{total overhead (except labor)}}{\text{machinery running hours}}$$

precision parts and which had a high level of yearly fixed expenses. The number of running hours of the equipment was low and remained within fairly narrow limits compared with the total gross payroll hours (ratio 24/j). Ratio W shows that as performance and productivity and coverage rose (improvement index), there was no appreciable increase

in hourly expense recovery. Plotting the recovery curve confirms this fact. With the spurt in Ratio V, the expense recovery which the company needs desperately to reach its break-even point improves from 10 to 13 per cent, leaving the unrecovered portion to eliminate profits.

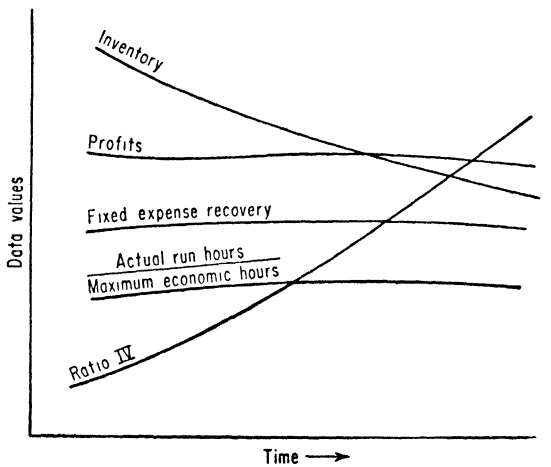
This could be the result of either an inadvertent product mix which favored the nonmachine operations, that is, those products which involved a small amount of machinery operations, or of the fact that the incentive coverage applied to the nonmachining or handwork operations. The latter turned out to be the case. It seemed that management made the mistake of feeling that since the machine operations were not operator-paced (automatic feed), the production standards should be placed only on the operator-paced jobs. As a result, the former operations slowed down, workers let the machines run out of material and stand idle, maintenance crews slowed down the repairs and adjustments, mechanics took much longer to perform their setups, etc.

Ironically, most of the company's investment existed in this type of equipment, and yet their activity, which is the key to the return on this investment, was low. This is why it has been stressed repeatedly that the ratios shown, such as Ratio V, be applied to individual departments as well as plant-wide.

Sales Not Supporting Production

Exhibit 5-16 shows a case where the level of profits, fixed expense recovery, and percentage of actual running hours to the maximum economical running hours all remain more or less the same. And this

EXHIBIT 5-16. DIAGNOSIS: SALES FAVOR NONMACHINE PRODUCTS; UNIT SELLING PRICES TOO LOW ON HAND PRODUCTS



circumstance is occurring with performance increasing steadily. What does this show? It indicates that the major sales segment is for non-machine products, and since performance is rising, it shows that the unit prices are too low on the hand products. Taking this apart bit by bit: the unchanged level of the fixed expense recovery and the running hours together with the increase in performance shows little activity on machine equipment, and therefore few sales on machine-involved products.

The fact that profits remained the same with increases in performance could be traced to any of the various reasons given in the other charts, but in this case it was due to the fact that the company's prices were not high enough; the cost-finding system in effect was producing costs below that of actual in most of the company's handwork product mix. Ironically, then, the incentive in use was academic and the premium moneys paid were a charge *against* profits. The entire situation was confirmed by a dropping inventory level, indicating a fast turnover in sales.

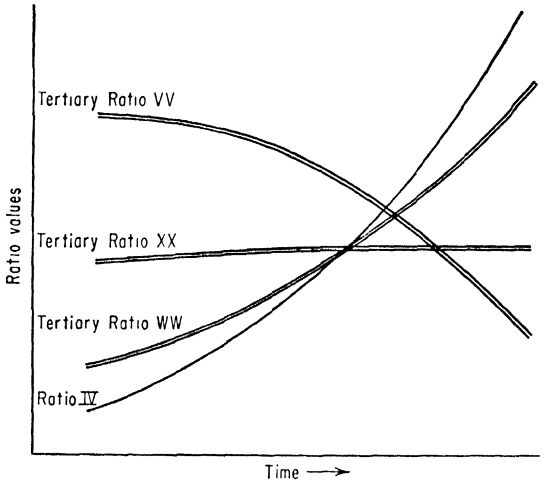
As in so many cases, the company did not use the proper method of allocating overhead expense to its products and the handwork products were undercosted and sold like hot cakes. The way of apportioning overhead to the machine products so overpriced them that the customer resistance kept the machines idle. This was a double dilemma: not only couldn't the company sell its machine-made products, it had to absorb the cost of its idleness (underrecovery), which kept the profits at a very low level.

Diagnosis: Poor Scheduling

Exhibit 5-17 involves a comparison between elementary and tertiary ratios. This example is drawn to show the different areas responsive to the various tertiary ratios. Remember that not all tertiary ratios are applicable in all companies. And the number that can be constructed from the data shown in previous exhibits is practically infinite. The ratios developed and presented in this book simply represent a portion of those used by the author for many years.

Notice that Ratio IV is rising. Tertiary Ratio VV indicates the positive relationship between the productivity increases and quality, but Tertiary Ratio WW shows that a negative reaction exists between productivity increases and down time. This points up that while workers are careful in production, the scheduling and production planning are poor. This condition acts to level off Tertiary Ratio XX, which integrates the effect of both and should be steadily falling as evidence of positive effect. Tertiary Ratio XX is handy for upper-management control, especially when confronted by boasts of superproductivity.

EXHIBIT 5-17. DIAGNOSIS: POOR SCHEDULING. COMPARISON BETWEEN ELEMENTARY AND TERTIARY RATIOS



$$\text{Tertiary Ratio VV} = \frac{\text{Ratio } \overline{\text{XLVIII}}\ (d+e)}{\text{Ratio I}}$$

$$\text{Tertiary Ratio WW} = \frac{\text{Ratio } \overline{\text{XLVIII}}\ (30+31+32)}{\text{Ratio I}}$$

$$\text{Tertiary Ratio XX} = \frac{\text{Ratio } \overline{\text{XLVIII}}\ (d+e+6+7+8+9+10+11)}{\text{Ratio I}}$$

Optimizing Productivity

Exhibit 5-18 shows a most interesting situation, one which pinpoints similar tendencies in many companies. Here is a case where the rise in productivity (Ratio I) is being matched by the negative effect of an almost equally fast moving Ratio G, showing that productivity increases are being matched by a corresponding drop in machinery economy. Yet Ratio j/l, which shows the percentage of machinery running hours to the maximum economic number, is low (40 per cent) and hardly changes during the entire productivity excursion. How can this be possible?

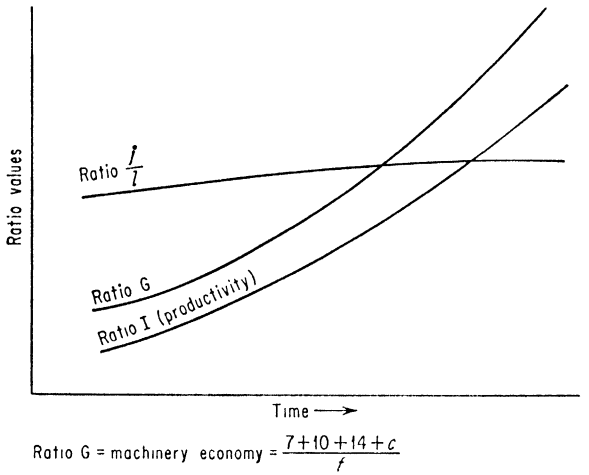
In this obvious anomaly, several things could be happening. It could be an indication that major repairs occur on a few machines and these could be done by certain types of workers who don't respect the company's property; or it could be due to sudden spurts in productivity when a particular type of work comes to the machines; or, as it was in this specific case, the workers only pushed the work when the so-called "gravy" jobs came along.

At this company, the production standards did not have much consistency. There were practically as many "loose" as "tight" standards, and the company maintained a very militant position on its subsidy

costs. Therefore the workers scrupulously avoided showing any substandard performance on their tickets. Whenever they got work which obviously carried a loose production standard, they cranked up the speeds on their equipment to get the highest possible number of earned hours to help counterbalance out their previous lack of earned hours when performing under tight standards.

Everyone lost here, especially the company. Repairs proceeded at a very high rate; replacements threatened their entire capital architecture; and the workers' morale was low; they received very little premium

EXHIBIT 5-18. EFFECT OF PRODUCTIVITY ON EQUIPMENT ECONOMY



Ratio G = machinery economy = $\frac{7+10+14+c}{f}$

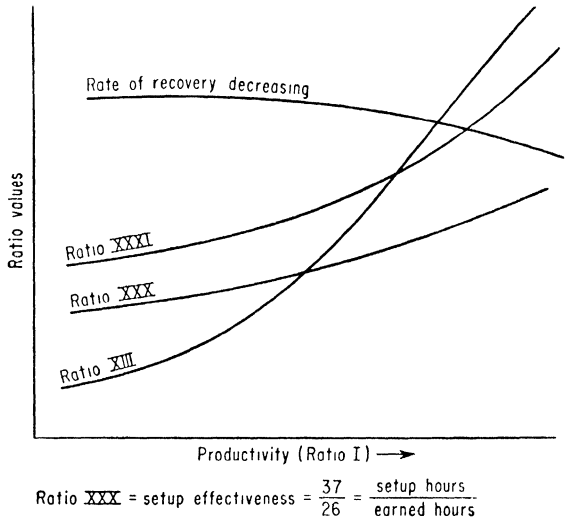
money. This condition was in existence for a few years, entirely overlooked by management. It was very easy to understand that most of management's time was spent in trying to hold its capital structure together. Its credit became limited at a certain point, and it was placed on a c.o.d. basis. And when an opportunity came along in connection with a large government contract, which involved some capital expansion, the company was unable to take it on. At that point management asked for help. Luckily, as expected from this type of management, there was a written historical record of production data which was well organized and clear. Exhibit 5-18 represents the "testing back" of their data as if the ratios and controls were in effect over these years. Had they used any sort of elementary ratio, this condition would have stood out like a sore thumb.

Costly Omissions

Exhibit 5-19 diagnoses a somewhat different situation. Here are the results that could be expected by not rewarding the setup and main-

tenance men in accordance with the gains made by the productive workers on incentives. In so many cases, the incentive covers only the direct workers and the materials handlers who have to deliver material faster, the setup men who have to perform their jobs faster, and the maintenance men who must do more repairs (as production workers increase their efforts in return for more pay) get no more pay. Not only is this inequitable, it's not good management—if morale is to be considered, one of the characteristics every worker brings to his job. Here, Ratios XIII, XXX, and XXXI are plotted with respect to an increasing

EXHIBIT 5-19. DIAGNOSIS: INDIRECT WORKERS NOT INCLUDED IN WAGE INCENTIVE PLAN



Ratio XXX = setup effectiveness = $\frac{37}{26} = \frac{\text{setup hours}}{\text{earned hours}}$

productivity on the x axis. It will be noticed that as productivity increases, the down time increases sharply. The reason for that was that even though the production workers needed setup men now even more than before—now that they were on incentive work—the setup men were not only slow in coming, they were slow to complete the setup job.

This situation reduced the number of running hours on which the workers could earn a bonus, and so their premium earnings dropped. Of more importance to the company was the fact that there were now fewer activity hours in which to recover the fixed level of expenses. Since it could not pass along a higher hourly rate to customers via its cost system (fixed level of expenses/fewer running hours) because of higher customer resistance, it had to absorb this underrecovery, which was a charge against profits. At the same time, with productivity in-

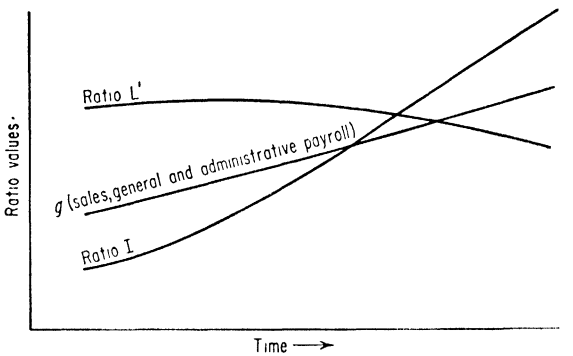
creases, there was a decrease in maintenance effectiveness, shown by the rising curve of Ratio XXXI. This was due to the fact that as the direct workers speeded up, there were bound to be breakages, bindings, etc., of some of the machine parts. This condition did not figure in Ratio XXXI because it is a fairly normal item within certain limits. What the ratio shows is the excess use of maintenance and repair labor; that is, the same repairs now took longer to do because these men were not made part of the incentive. The same is true of Ratio XXX, which shows the added length of the set-up operation.

Of all the delays caused by the drop in morale, the one involving *waiting* was the greatest. In other words, it was easier for the indirect men to keep the direct incentive workers waiting for them to make an appearance to take care of the workers' needs rather than lengthen the time taken to do the specific task, as this was far more obvious.

How Related Data Can Be Misleading

Exhibit 5-20 shows a situation somewhat similar to that shown in Exhibit 5-14. In this case, the increased productivity was not resulting in increased sales. This could be the result either of a lack of sales effort

EXHIBIT 5-20. DIAGNOSIS: LACK OF SALES EFFORT OR INCREASED PRODUCTIVITY ON INEXPENSIVE FACILITIES?



Ratio L' = billing − productivity return = $\frac{b}{27}$

$= \frac{\text{shipments}}{\text{direct clock hours}}$

or of the productivity on unimportant facilities. As if that were not bad enough, the management increased its administrative staff on the strength of the productivity increase.

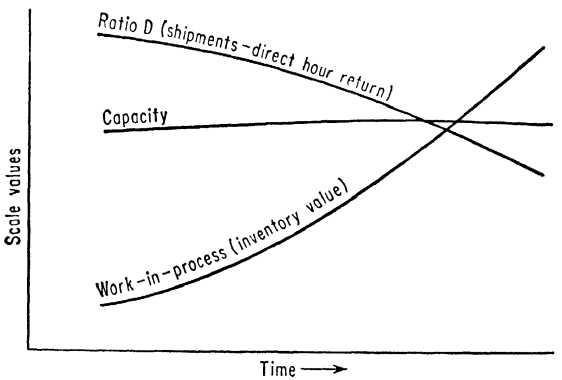
This situation is presented to show how even *related data* can be misleading unless carried further. The plant manager should want the

elementary type of ratios to pinpoint both the good and bad areas. But before higher managerial decisions are made, more data must be integrated and weighted. As a justification for adding to the administrative staff, which is a fairly fixed expense, there must be sufficient profitable volume to absorb this expense. Productivity is related to volume only if the coverage is high enough and if the productivity drives support the product mix being sold.

Product Mix Limits Capacity

Exhibit 5-21 diagnoses another interesting and deceptive situation. Ratio D is dropping, and this could be due to insufficient sales effort or to an excess level of direct labor for the sales capacity of the plant. If

EXHIBIT 5-21. DIAGNOSIS: PRODUCT MIX LIMITING CAPACITY OF PLANT



the plant is operating at, or close to, its maximum sales capacity, as shown in the chart, then continued manufacturing pressure adds payroll costs and swells the work-in-process. This ties up capital and space, as well as increasing the risk element in the inventory and weakening the capital structure. Capacity in terms of output can be increased by the proper use of wage incentives. Capacity in terms of dollar sales can be increased by a revision of the product mix.

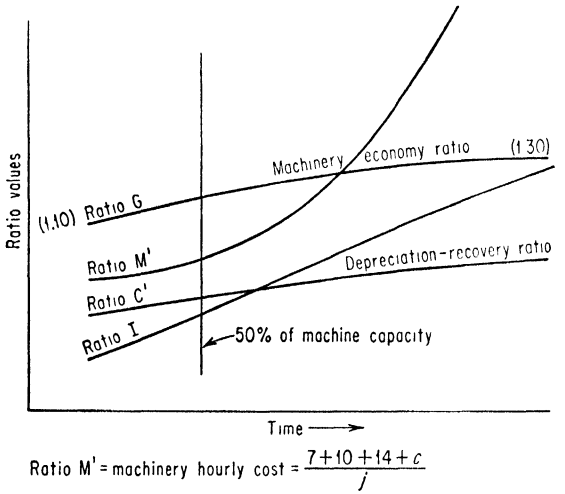
Both incentives and a proper product mix place the company in a favorable position, provided the impact of financing these conditions is not too great for the company. The cure for the condition shown in Exhibit 5-21 was to select a different product mix, in which the material content in the sales dollar was lower and the direct labor higher, consistent with the needs of the overhead contents of the revised mix to fulfill the needs of expense recovery. Sales pressure was also increased, so that the average level of inventory was reduced even further.

When to Discard Equipment

Exhibit 5-22 solves, in this instance, the ambivalence of management toward discarding equipment. Ratio C′ shows that the fixed depreciation expense is directly affected by the running hours. However, regardless of the running hours in the period, large surges of down time and repairs begin when only 50 per cent of the capacity of the machine is reached. This is shown by Ratio M′. Ratio G rises also, confirming this negative condition.

Where the total of these expenses exceeds the depreciation of the machine (neglecting for the moment the method of depreciation in

EXHIBIT 5-22. DIAGNOSIS: TIME TO DISCARD EQUIPMENT



Ratio M' = machinery hourly cost = $\frac{7+10+14+c}{j}$

effect), it means that possibly the ownership of a new machine, considering depreciation and maintenance expenses, would be less than the present combined level. At this point management should think about getting rid of the machine. What is not shown in this chart, but what must be considered, is the impact on the capital structure of a new purchase. Also, the sales aspect should be interwoven, which might temper the capital-affecting position.

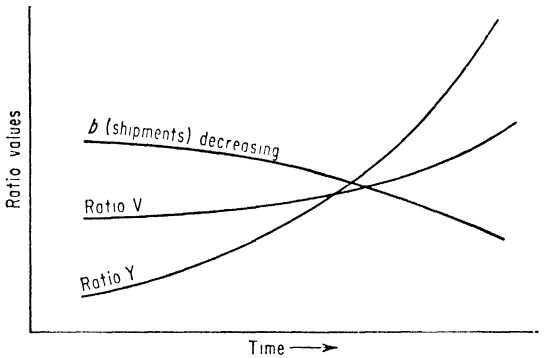
Economic Chaos

Exhibit 5-23 shows that waste and rejects are being produced from machine rather than from handwork operations. Decreasing sales shows that estimates are not recovering expenses and the machine utilization is also decreasing. Since Ratio V is rising, showing a lower machinery utilization, and the waste and reject velocity is increasing, as shown by

a more rapid increase in Ratio Y, indicating an increasingly greater amount of rejects with the running hours, it is simple to draw this conclusion. However, since item b is decreasing, the lower sales and higher running hours are incompatible unless accompanied by a drop in the price level.

Here is what happened in this case. The company arbitrarily dropped its prices in almost direct proportion to the increase in machine activity. In doing so it did not consider the high residual level of fixed

EXHIBIT 5-23. DIAGNOSIS: WASTE AND REJECTS PRODUCED FROM MACHINE OPERATIONS; COST ESTIMATES NOT RECOVERING EXPENSES; ECONOMY OF MACHINERY UTILIZATION DECREASING



Ratio V = machinery utilization = $\frac{f \times a}{j \times b}$

Ratio Y = waste and reject velocity = $\frac{e+d}{j}$

expenses, which did not vary with sales and which must be fully absorbed before applying a variable pricing policy based on variations in activity.

Impact of Performance

Exhibit 5-24 shows a very significant relationship. Here, with a rising performance, the company is experiencing large surges in outside machinery repair costs. And while the inside repair labor costs are also rising, these are rising with running hours. For one thing, it shows that the repairs center more on parts breakdown and replacement than on minor repairs, which the inside maintenance crew can take care of. Of equal importance is the fact that the rise in productivity is taking place on machine operations and the handwork ones are either "uncovered" or the standards are tight and discourage any attempt to boost output. This could also be evidence of abuse of equipment.

EXHIBIT 5-24. DIAGNOSIS: EFFECT OF PRODUCTIVITY ON PARTS BREAKDOWN

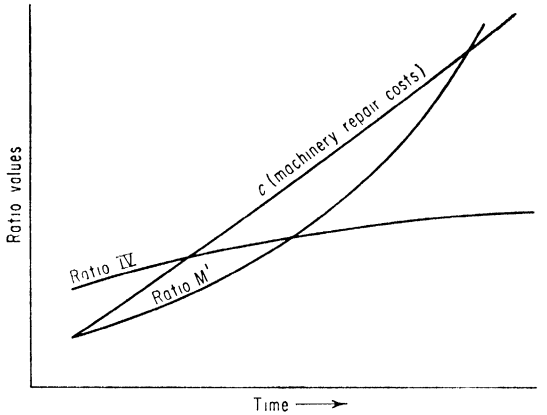
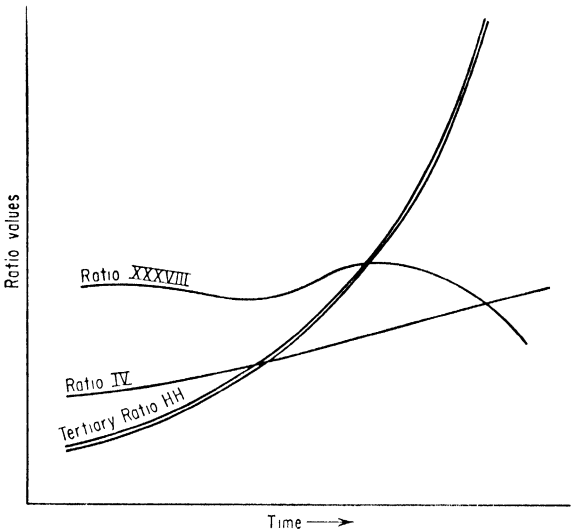


EXHIBIT 5-25. IMPACT OF LABOR UTILIZATION ON EXCESS COSTS



Ratio XXXVIII = avoidable content

$$= \frac{14+15}{5} = \frac{\text{maintenance, repairs, salvage, reprocess costs}}{\text{total direct-labor cost}}$$

$$\text{Tertiary Ratio HH} = \frac{\text{Ratio IV}}{\text{Ratio XXXVIII}}$$

Tertiary-ratio Evaluation

Exhibit 5-25 shows the impact of the utilization of direct labor on maintenance, repairs, salvage, and rework operations. It also shows how the tertiary ratio relates to the elementary components within that ratio. In this chart Ratio IV, Performance, is moving ahead, but with a vary-

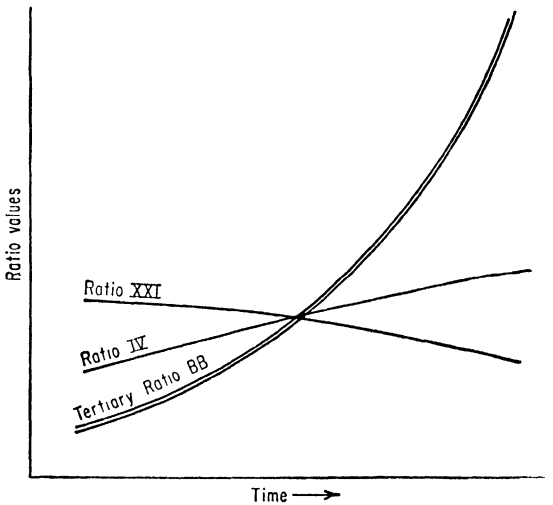
ing response from Ratio XXXVIII. What happened in this case was that as productivity and performance rose, items 14 and 15 decreased slightly with respect to total direct labor cost, and then rose sharply during a period in which the costs of items 14 and 15 were high. It then was brought under control and continued to decrease.

This was the case in the example of the company whose data were considered and analyzed over the five periods. Referring back to Exhibits 5-1 and 5-3a to 5-3c, values can be seen for each of the elements and ratios. However, the interest in the upper managerial levels is one of trend effect. This can be seen by the curve of Tertiary Ratio HH, which is the type of ratio employed in companies that wish to control the tendency for higher productivity to severely affect the quality of the work.

Indirect Incentives

Exhibit 5-26 shows how a tertiary ratio can heighten the problem, to bring it forcibly to the attention of those in authority who can act on it swiftly. Tertiary Ratio BB is composed of Ratios IV and XXI. In this

EXHIBIT 5-26. EFFECT OF SUPERVISORY AND INDIRECT INCENTIVE TIE-IN



$$\text{Ratio XXI} = \text{service cost} = \frac{16}{5}$$

$$\text{Tertiary Ratio BB} = \text{performance} - \text{service index} = \frac{\text{Ratio IV}}{\text{Ratio XXI}}$$

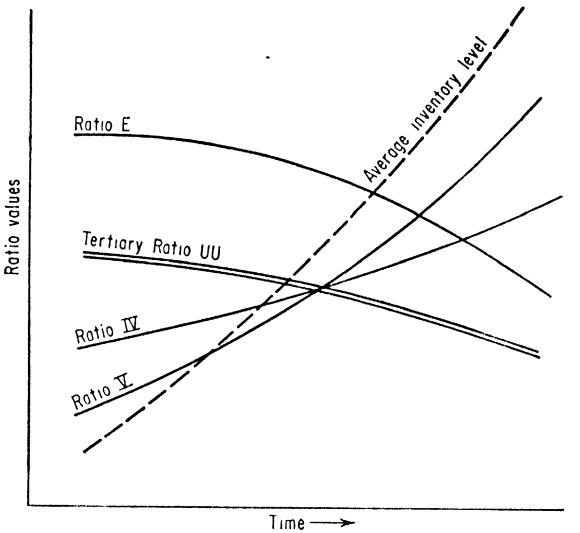
set of curves, performance is rising, and there is a drop in the employment of materials handlers and other service workers usually supporting the direct workers. The sharp reactive positive increase of the curve

of Tertiary Ratio BB is the result. This is an actual case and is typical where supervisory incentives are in effect and where the indirect workers are tied into the production incentive.

Actual versus "Guesstimated" Costs

Exhibit 5-27 represents the "testing back" of a condition which management called an impossible inconsistency. And so it was. If manage-

EXHIBIT 5-27. DIAGNOSIS: INCONSISTENCY CAUSED BY TRADITIONAL COST ESTIMATING



Ratio E = shipments − manufacturing space = $\frac{\text{shipments}}{\text{manufacturing occupancy}}$

Tertiary Ratio UU = (Ratio B) Ratio E

ment had had the tertiary ratios watching, this condition would have been spotted earlier.

The complaint was simple enough: the productivity, performance, and improvement indices all rose. But the billings steadily decreased, even after being adjusted for period overlap. One clue was the very fast-rising inventory level. On the strength of that last curve, there was a hint of the real trouble. To confirm tentative findings, the products were analyzed and tested for their ability to recover expenses. What was found was the practice of allocating overhead on the basis of direct labor; that is, the overhead for each product was allocated to each product on the basis of 150 per cent of the direct labor irrespective of the actual overhead used. What was dropping was the billings level, but not the products sold. Some of them were so undercosted that they

were moving off the manufacturer's shelves like jet rockets. Some gathered dust; but the sales department felt very chipper. The capital state steadily atrophied.

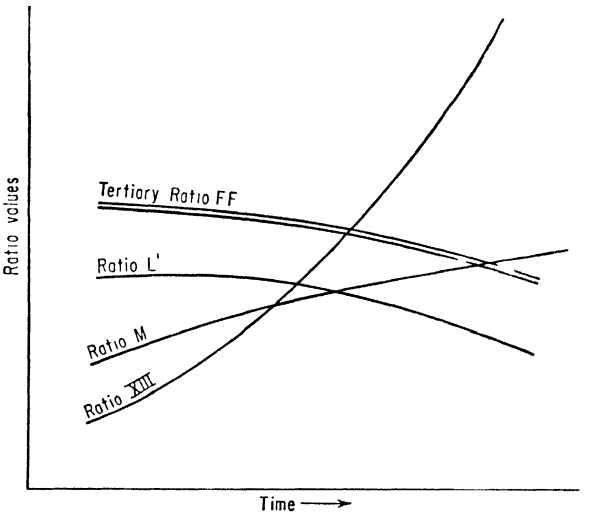
At the bottom of it all was improper estimating, as the test showed The estimating function is interjected between production and sales, and sometimes, as in this case, the estimating can wildly distort the costs. If the company had had the Tertiary Ratio UU in effect, this condition would have been corrected earlier.

Later, toward the end of this book, it will be shown how steady production pressure without sufficient cash flow from sales expands the inventory to levels which can threaten the financial stability. That is precisely what happened in this case.

Collusion Spotting

Exhibit 5-28 gives another example of the benefits of the tertiary ratio. Here is a relationship between the incentive premiums earned and the excesses provoked. The rise in Ratio M shows that the excesses

EXHIBIT 5-28. DIAGNOSIS: COLLUSION SPOTTED BY TERTIARY RATIO



Ratio M = incentive quality

Ratio L' = billing - productivity return

Tertiary Ratio FF = $\frac{3-21}{2}$ + Ratio M

have not risen as fast as the incentive premium, which is good as far as it goes. However, if Ratio XIII rises sharply, indicating an accompanying increase in down time and day-work allowances, collusion may be present. This is further confirmed by Ratio L′, which is falling, show-

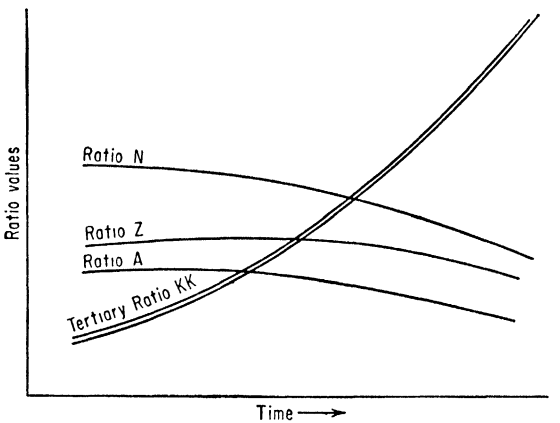
ing that the productivity is really not related to an increase in sales. Applying Tertiary Ratio FF confirms the entire situation. Notice that FF is not falling rapidly. This is an indication that the productivity gains are not far behind the excess losses.

A situation like this, since it is so subtle, i.e., since the abuses are not too obvious, is difficult to determine by the naked eye unless one's eyes and mind operate like a data processor. The slowness of the Tertiary Ratio FF drop is insidious, and those experienced with this type of collusion will usually take care to keep their dishonesty within prudent limits.

Uneconomical Labor Increase

Exhibit 5-29 is another multirelationship involving the tertiary ratio. Here is the case where more materials handlers were added because of an increase in the direct labor manning. Ratio N decreased, which was

EXHIBIT 5-29. DIAGNOSIS: DIRECT LABOR INCREASE UNECONOMICAL



Ratio N = administrative – usage = $\frac{g}{5}$

Ratio Z = nonlabor expense usage = $\frac{h}{5}$

Tertiary Ratio KK = overhead cost – recovery index

$$= \frac{\text{Ratios } \overline{\text{XXVII}} + N + Z}{\text{Ratio A}}$$

positive, and showed that there was no increase in administrative expenses for the higher direct labor; Ratio Z likewise decreased over the same period, but not as fast, since there were some increases in item h to support the direct labor increase.

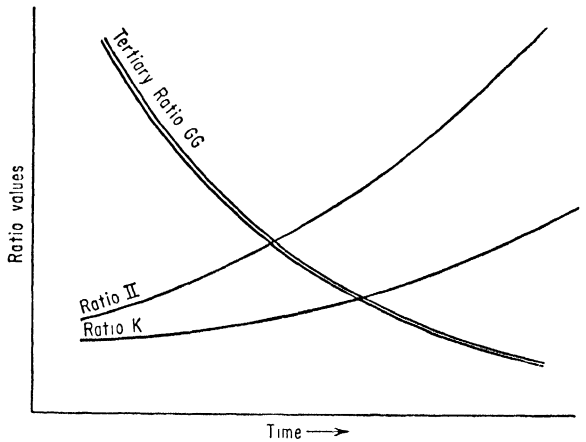
These latter two movements were positive, but the fly in the ointment was the drop in the economy of direct labor; that is, while the labor load was increased, the performance of the higher direct total

was poor. During this period there was no appreciable change in product mix and Ratio A reflected a lower return on the total payroll. So while the increase in direct labor was economical as far as the use of overhead was concerned, it was less productive in the sales area, which dwarfed the positive aspects of the utilization of overhead. Tertiary Ratio KK shows the impact of this net circumstance.

Uneconomical Productivity Increase

Exhibit 5-30 shows a typical reaction to the impact of stimulated productivity. Here Tertiary Ratio GG integrates the effect of the net productivity with that of the premium earnings and the excesses pro-

EXHIBIT 5-30. DIAGNOSIS: UNECONOMICAL INCREASE IN PRODUCTIVITY



Tertiary Ratio GG = payroll-excess index

$$= \frac{3-21}{2} \div \text{Ratio XII}$$

duced. The movement of GG shows an uneconomical acceleration of excesses with productivity, as well as an inconsistency of bonus-earning opportunity as shown by the increase of item 21 (subsidy). The rise in Ratio K is used as a test to show that the excesses are in time rather than in materials. The rapid drop shows the integrated effect of all these negative events.

PROBLEMS

1. Explain fully the differences between ratio evaluation and ratio control.
2. List seven areas that each of the following ratios or events can affect and explain why:
   a. Fixed-expense activity
   b. Ratio II

c. Ratio XVII
d. Ratio XXVIII
e. Item 46
f. Item 30
g. A new machinery purchase

3. Assume five-period data for any three widely differing ratios of your own choosing. Define each period and plot the movements of the ratios. Explain each ratio and explain its use.
4. After completing Problem 3, construct one tertiary ratio from the same three ratios that will give a reasonable indication of the state of economy over that period.
5. What are the pitfalls or the special qualifications of the tertiary ratio developed in Problem 4? Are there events which can occur to mislead the user of your ratio? What are these circumstances?
6. What is meant by ratio volatility?
7. Show (by use of your own data) in the form of ratio movements (curves):
   a. How to find excess-cost-provoking operations
   b. How to spot claims for excess time work claimed by incentive operators
   c. How to detect dishonest piece counts in productivity scores
   d. How to spot a trend toward sluggish production flow
   e. How to spot ineffective indirect support
   f. How to detect the effects of tooling and maintenance economy
   g. How to evaluate supervisory competency
8. Using the five-period data given in the text and with Ratio G as the x axis, plot the movements of ratios that critically evaluate the elements of machine economy. Name the ratios plotted and discuss the rationale of your conclusions.
9. Refer to Exhibit 5-18 and the corresponding text matter:
   a. Construct a tertiary ratio which would have shown up the condition earlier.
   b. Define each term of the tertiary ratio and its role in the ratio.
   c. How would you alter the tertiary ratio to show whether the condition is caused by few or many:
      1. Machines
      2. Workers
10. Do the same for Exhibit 5-19 as for Problems 9*a* and *b*.
11. Develop a tertiary ratio for the condition depicted in Exhibit 5-21 and explain.

CHAPTER 6 *Introduction to Evaluation and Control of Sales Function*

In manufacturing, there must be contact between the production effort and those who buy and use the items manufactured. This contacting activity must be of such magnitude and quality as to permit the regular disposal of the finished products manufactured, enabling the manufacturer to make a reasonable profit, to prosper, to grow, and to develop new and better products.

This contacting activity is, of course, known as *selling*. The selling act adds its own qualities to that of the product. By those qualities it can accelerate or impede the flow of sales. Some salesmen are very easily received by most buyers; some have personality clashes with prospects or customers; some sales take place best when the personalities of the salesman and buyer blend harmoniously.

Economic Selling

The selling function can be run at various economic levels, like any other manufacturing function. As such it can be evaluated as a separate entity charged with making a profit from the expenses it incurs.

The sales-management function can contribute or detract from the over-all profitability and health of the company.

Here, as in the production area, managing is usually done on a one-fact basis. Salesmen are evaluated based on the amount of gross sales booked or on some other piece of unrelated data. The sales manager in turn is evaluated at the upper managerial level by the total gross sales booked, expenses incurred, etc. These unweighted data are not a proper measure of what the department *could do* in the way of maximum value to the company.

Selling, to be fully effective, must sell the products of the company in a way that enhances and preserves the profit-making potential created

after their manufacture. Sales activity must not only be keyed to the market, but to the most profitable products, to the most profitable production centers, or to those production centers that can recover a large magnitude of fixed expenses.

Selling, to be fully productive, must provide sales management with an objective basis for evaluating, policing, and directing the efforts of their men.

Uncontrolled Sales Effort

Lack of proper control over salesmen results in a draining off of profits and deprivation of proper growth in the period when such control was lacking. The author has performed studies in departments where some salesmen serviced one or two "big" accounts for which they were handsomely remunerated. In these cases, the "salesmen" worked about 5 per cent of the time and were on the golf links the rest. This is fine for the salesman. But the company had the benefit of only a fractional "body" occupying the place of a whole, complete salesman. Not only was this demoralizing for the rest of the force, it was an inefficient use of the manager's time. Actually, everyone knew that these salesmen were not being "managed" or directed. This did not help the stature of the sales manager, and yet he had to go through the motions. Granted, these "big" accounts were of value to the company and could not be jeopardized.

A lack of control also creates the feeling that the salesman and not the company "owns" the account. To avoid this situation it is a good practice to transfer an account from one salesman to the next, once the first man sells an order to the account.

Some companies inadvertently introduce discontrolling elements. Undoubtedly, the best form of incentive for salesmen is the straight commission. When this is enhanced by a profit-margin tie-in, so much the better. But sometimes a little of this incentive stimulus has to be surrendered in order to get control and make the salesmen responsive to managerial direction. In one company the maximum-incentive practice resulted in an inability of the sales manager to control his older men. The men would not approach new customers, nor would they push new products, nor would they go into any area other than the ones which afforded them the maximum income. The maxim by which these men sold was *the greatest commission for the least time and effort.* The most commission dollars for the least sales minutes was their personal yardstick of performance. Needless to say, some of the expensive production centers remained idle, at great expense, and the profit-making items lay on the shelves.

Sales MC

The basic requirements for sales MC are:

1. A proper managerial framework must be present by which men are responsive to direction
2. Individual sales activity must be reported at regular intervals
3. Activity data must be interrelated for proper evaluation

Is a salesman a good salesman because he can sell what he likes, in the areas he likes, to the people he is comfortable with? Or is he good when he is like the professional hunter who kills the game he is paid to kill whether it is day or night, hot or cold, deer or lion?

In the MC of sales, we are interested:

1. That sales management have realistic targets which support the company's total needs
2. That upper management and sales management have the tools for evaluating the sales department's implementation of these targets
3. That the sales manager have the means for evaluating the performances of his salesman as to productivity, effectiveness, economy, and responsiveness to the direction of his personal management by which the targets are hit

Control Ratios

As was shown in the preceding chapters, acting on primary facts and events is fallacious, for we are unable properly to assess their meaning individually. However, when primary data are compared with other facts which they control, influence, or affect, then we have a balanced measure.

A salesman cannot be judged by the number of contacts he makes per week, or even by the number of orders he sold, because while the sold contacts may be low, the amount of dollars sold may be high, resulting in high sold dollars per contact, which may or may not be desirable. In some cases, the company may want or need a wide dispersion of contact effort and, because of the economic-lot problem in the shop, may wish a somewhat lower-order quantity.

Similarly, we should not necessarily accept as positive a high number of contacts per week. This contact activity can result in either a high or low volume of orders. If it is a large number of low-dollar orders, the company is involved in a multitransaction cost which may not be desirable; perhaps the high contact volume resulting in a small number of high-dollar orders is better.

Taking any of these isolated facts in themselves is not a proper

measure of a salesman's performance or responsiveness to direction. Integrating them is.

Some companies report the number of sales a man makes, together with the number of quotations he gives. Again, this is no measure of the man. What should be known is the quotation acceptance or mortality. What is the ratio between cumulative sales and cumulative quotations? The degree of lag in both, together with the number of quotations it took to accomplish, considering the expenses incurred in generating them, is a more realistic measure of performance.

Required Primary Data

Primary data—the events of the day, the unrelated facts—are the meat of the ratios, and they must be collected in some organized fashion. In the case of production MC, a payroll analysis was required from which a summary was constructed. Then facts from other areas were added which were deemed related to the payroll-analysis summary. From these two sources came the ratios.

In the factory payroll analysis, the activity of each individual was distributed to the functions he performed. The same should be done weekly for each salesman to show how many contacts he made, what resulted from these contacts, and the nature of the results. A suggested form is shown in the salesmen's activity summary of Exhibit 6-1.

Exhibit 6-1 is a summary of daily contact reports and is tabulated weekly. The author realizes full well the limitations of salesmen when it comes to writing long reports and is sympathetic to that viewpoint because *salesmen should sell* and the office should do all the necessary clerical work. However, the compactness of the form should in no way limit the vital minimum amount of information that the salesman must report. While holding no brief for a specific form, a check list or tabulation is preferable to an essay report. In one company a thin-card, scored-hole card system was installed, allowing the salesman to punch out the information with his pencil. Then it was summarized by tabulating equipment.

Several cost items were left out of this tabulation of primary data so that the application of the ratio concept might better emerge. Among these are advertising expense, sales office, clerical and administrative expense, and other sales expenses like promotional costs, manuals, and training programs.

The Cost to Contact-sell

This is one of the most deceptive areas in the entire industrial costing picture. So many selling costs are hidden. One manufacturer was appalled when he learned that the 4 per cent rate on the commission

Exhibit 6-1. Salesman's Weekly Sales Activity Summary Sheet

Sales Activity Summary

Salesman_____ Territory_____ Week ended_____

Product code	Total contacts / Contact cost: No. by phone / $	No. by letter / $	No. by visit / $	Type of contact and status: Prospects: Dead	Possib.	Hot	Sold	Existing cust.	Amount sold: Type of account: New: No.	$	Existing: No.	$	Amount quoted: Type of account: New: No.	$	Existing: No.	$	Expenses: Auto. exp.	Mileage	Lodging	Entertainment: Prospect	Customer
Existing products																					
ab																					
ac																					
bc																					
cd																					
Total existing products																					
New products																					
WW																					
YY																					
ZZ																					
Total new products																					
Total all products																					

schedule was, in fact, closer to 12 per cent. This increase was brought about by allocating the following supportive services to the selling function:

1. The salaries of straight-salaried trainees who dug up qualified leads and who otherwise paved the way for the experienced "closer"
2. The salaries of the sales manager and clerks in the sales office
3. The sales office and expense, other than salaries
4. The cost of sales promotion, salaries, and expenses
5. Advertising costs
6. Entertainment and traveling expenses not applied against commissions
7. Sales demonstration kits
8. Direct-mailing costs
9. Sales manuals
10. Training kits and programs

As if that didn't hurt enough, the total contact expense, just the cost of knocking on a prospect's door, was calculated to be over $70 each when all the above cost factors were added. On the average, the number of contacts required to make the sale, plus the sales level of the average sale, pegged the *selling cost* in the sales dollar higher than the *direct labor cost* in the sales dollar. The ironic part of this story, and unfortunately sometimes typical of management, was that all labored tirelessly and incessantly to reduce the direct labor cost—a necessary and commendable endeavor—paying little or no attention to the evaluation, control, or reduction of the larger segment of total cost—selling costs.

The same irony sometimes underlies product costing, where management will devote almost infinite attention to cost-reduction techniques in the factory without concerning itself about the method or consistency by which those costs, reduced or not, are mirrored on the cost sheet and charged to the customer. Is it any wonder that these cost reductions sometimes never see the light of day in the marketplace? And doesn't that explain why an efficient factory can lose money?

Management must control its economy and protect every potential cent of profit by considering each of its operating functions as separate profit-making entities. It must then demand profitability from each and must not be trapped by accepting an over-all profit movement wherein one profit-making function compensates for the losses in another. Even in the case of the office-management function, it can be made profitable and held accountable for losses.

Just as a selling quota is unrealistic because salesmen have no control over the market, so it is hard to set standards of all types of selling performances. Contacts per week, made in certain territories for certain

products to certain types of customers, can be standardized and enforced. But sales expense per sales dollar cannot be considered a standard since the salesman does not have complete control over it. The prospective customer may order a hamburger or a steak; the salesman may have to travel deeper into his territory to get orders due to previous saturation. What *can be* discerned is a trend, a proportion—the right and fairness of the sales manager in counseling his men on an objective basis.

In applying the MC technique, all these major items should be included. Ratios involving some of these expenses can be constructed to show the economy of the movement of the expense involved. For example, promotional expenses might be related both to existing product sales and to new products; advertising can be related to several factors in the attempt to find a correlation: to sales dollars (changeable at various levels of sales to account for the "loading" quality of the initial advertising effect); to profits; to return on investment (when advertising expense or a portion of it is regarded as a capital investment).

The number of important ratios that can be developed from these primary data runs into the hundreds. These ratios are valuable, and they validly mirror certain happenings and conditions. They evaluate performances of one form or another that sales management has to know about before making decisions. Not all ratios are suitable for all companies—perhaps not even for two companies in the same industry. The ratio must take into account the characteristics of the particular company, together with the areas in which it needs control.

Contact, Productivity, Activity

It will be noticed that ratios are constructed by using somewhat similar terms. Some ratios contain dollar figures, and others the number of accounts or orders; some contain both. Both are essential for proper evaluation. For example, a weekly sales dollar figure can be obtained from one or twenty sales orders and from one to twenty selling-contact calls. A singleness of evaluation is misleading, since a satisfactory level of sales dollars produced might come from two old contacts, both of whom placed orders. This might have involved 10 per cent of the salesman's time and is a matter for the sales manager to control. Similarly, another salesman may have made a satisfactory number of calls from which he got a respectable amount of orders, but the total of these orders might have been so low as to cause a high internal transaction cost. It may be the immature salesman's way of obtaining managerial approval.

Contacts are made by a personal visit, by telephone, and by letter. Contact method is a valid type of primary data to include in the

ratios. In the composition of the ratios, the latter two contact methods are not considered, in the interests of simplicity, so as not to becloud the concepts. Data for these two and for the lodging segment of expense are also not shown on the sales analysis sheet of Exhibit 6-1.

Also omitted from the ratios are the three evaluations of the contact: hot, possibility, or dead.

The following chapters show how ratios are constructed and how they are used.

PROBLEMS

1. What are the advantages of measured control of sales effort?
2. How can "gross-sales" managing mislead the sales manager in his control of sales economy?
3. Explain "sales profits" as opposed to "production profits."
4. What are the disadvantages of remunerating salesmen by a fixed salary only? What is one major advantage?
5. What are the disadvantages of remunerating salesmen by straight commission only? What is one major advantage?
6. Would you want your salesmen to feel that they were in business for themselves, having complete control over their pay check? Explain.
7. Define an effective salesman.
8. Discuss the problem of the relationship of the priority of management's time to the degree of reducibility of expense elements in manufacturing; to the degree of growth and profit potentiality.
9. Discuss how salesman activity can be evaluated. Name the controllable elements.
10. Develop a sales compensation plan which rewards salesmen in proportion to their contribution to the company's competitive position and profits.

CHAPTER 7 *Elementary Ratios for Evaluating Sales Effort*

In constructing ratios that are meaningful, we must collect primary data in a way which will make this simple. In the last chapter, Exhibit 6-1 showed a suggested form of collecting these data. Exhibit 7-1 shows how those data are tabulated and code-numbered preparatory to the construction of ratios. The data are for one week's effort of each salesman in the sales department.

The data involve facts concerning new and existing customers and new and existing products, for sales, quotations, contacts, and expenses. Elementary ratios show the interrelationship of these facts and events so that a man can be more effectively directed and his efforts and results compared with other men in the department.

Elementary Sales Ratios

Ratios are simple to develop and are very meaningful. For example, if it is desired to find out the percentage of new accounts brought in by a particular man in comparison with the total orders he sold, you would simply construct the fraction of *new sold accounts* over *total sold accounts*. Referring to Exhibit 7-1, we see that the code designations listed alongside of the appropriate terms would yield the fraction $(8 + 9)/23$. For Mr. Greene, the substituted value would be $\frac{4}{17}$, meaning that 23.5 per cent of all the accounts he sold was for brand-new accounts. To see how Mr. Greene stacks up with the others in his department regarding the number of new accounts he sold, a fraction of *new sold accounts* over *departmental total sold accounts* would be developed. This would produce the fraction (using the code numbers and letters) $(8 + 9)/w$ or $\frac{4}{45}$, meaning that of the total number of accounts sold in the department, Mr. Green was responsible for 8.9 per cent.

As we go deeper into the ratio material it will be shown how the

Exhibit 7-1. Primary Sales Data (Man)

Code	Sales effort	Salesman				Department code	Dept. total
		Jones	Smith	Brown	Greene		
	Customer product activity						
1	Total contacts	*27*	*27*	*56*	*42*	a	*152*
2	To existing customers	27	21	14	29	b	91
3	Sold new products ...	0	1	4	4	c	9
4	Sold existing products	5	7	4	9	d	25
5	Quoted new products	0	0	1	1	e	2
6	Quoted existing products	7	6	2	7	f	22
7	To new customers	0	6	42	13	g	61
8	Sold new products	0	0	2	1	h	3
9	Sold existing products	0	1	4	3	i	8
10	Quoted new products	0	0	7	1	j	8
11	Quoted existing products	0	0	8	6	k	14
	Volume contact activity						
12	Total amount sold and quoted.	*$1,800*	*$4,370*	*$1,925*	*$12,850*	l	*$20,945*
13	To existing customers	1,800	4,270	1,080	9,000	m	16,150
14	Sold new products ...	0	200	310	1,940	n	2,450
15	Sold existing products	1,050	2,930	460	3,800	o	8,240
16	Quoted new products	0	0	90	900	p	990
17	Quoted existing products	750	1,140	220	2,360	q	4,470
18	To new customers	0	100	815	3,850	r	4,795
19	Sold new products	0	0	100	920	s	1,020
20	Sold existing products	0	100	170	970	t	1,240
21	Quoted new products	0	0	250	90	u	340
22	Quoted existing products	0	0	325	1,870	v	2,195
	Summary activity						
23	Total customers sold ...	5	9	14	17	w	45
24	Total customers quoted	7	6	18	15	x	46
25	Total amount sold.	$1,050	$3,230	$1,040	$7,630	y	$12,950
26	Total amount quoted	750	1,140	885	5,220	z	7,995
27	Total new-product contacts	*0*	*3*	*24*	*10*	aa	*37*
28	To existing customers	0	2	6	7	bb	15
29	To new customers	0	1	18	3	cc	22
30	Total existing-product contacts	*27*	*24*	*32*	*32*	dd	*115*
31	To existing customers	27	19	8	22	ee	76
32	To new customers	0	5	24	10	ff	39
	Expense summary						
33	Total man expense	*$165.20*	*$224.00*	*$178.60*	*$147.70*	gg	*$715.50*
34	Salary..	80 00	80 00	80 00	80 00	hh	320.00
35	Automobile..	36 00	72 40	36 00	17.60	ii	162.00
36	Total entertainment..	*49.20*	*71.60*	*62.60*	*50.10*	jj	*233.50*
37	New customers.....	0	50.40	29.90	19.40	kk	99.70
38	Existing customers..	49.20	21.20	32.70	30.70	ll	133.80

above type of ratio can be expanded to show the percentage of Mr. Greene's new sold accounts to the department's total of the *new* accounts sold. It can be varied to show the activities of the new and existing product lines to new customers. And the denominator can be varied, depending on the nature of the desired evaluation. The various segments of expenses can likewise be introduced in considering the economy of those expenditures. And the element of territories constitutes still another factor that can be treated in these ratios.

What Are We Evaluating? Basically we are measuring the above-mentioned variations for:

Order productivity, which shows effort in terms of orders sold
Sales productivity, which shows effort in terms of dollars sold
Contact activity, which shows effort in terms of contacts made
Quotation productivity, which shows effort in terms of dollar value of quotations
Quotation activity, which shows effort in terms of quotes resulting from contacts
Quotation attempts, which shows effort in terms of orders quoted
Quotation performance, which shows effort in terms of quotational level in total sales

There are considerable differences in how one type of elementary sales ratio can be constructed. As in the production area, a ratio should be set up to reflect a local or grass-roots condition and must be well defined. Often management wants a check on who is selling what to whom. It may wish to check new-product activity, but only as it affects existing customers; or it may wish to keep its eye on the activity of obtaining new accounts by virtue of the sales of its new products. Let's take this latter motive and see how the ratio can be established. The first step is to name the area we are evaluating. Let's take *new-customer, new-product productivity.* Referring to Exhibit 7-1, we find that for sold new products to new customers the coded symbol is 8 and for its respective dollar value it is 19. This gives us two numerators to use in separate ratios; but this is a small part of the task of setting up the proper ratio.

What do we wish to measure?

Exhibit 7-2 tabulates the number of practical variations for measuring *new-customer, new-product productivity.* Note that all the formulas for each of the twelve variations have either symbol 8 or 19 as the numerator, depending on whether orders sold or dollars sold is desired. And all twelve formulas have twelve different denominators. Obviously, each formula evaluates new customer, new product productivity, in a

EXHIBIT 7-2. BASIC VARIATIONS IN AN ELEMENTARY SALES RATIO
Ratio: New-customer, new-product productivity

To show above productivity as a per cent of:	Formula	Percentage value				
		Salesman				Dept
		Jones	Smith	Brown	Greene	
(*a*) Total customers sold per man	$\frac{8}{23}$	0	0	14.3	5.9	6.7
(*b*) Total customers sold by department	$\frac{8}{w}$	0	0	4.4	2.2	
(*c*) Total dollar sales of each man	$\frac{19}{25}$	0	0	9.6	12.1	7.9
(*d*) Total department's sales	$\frac{19}{y}$	0	0	0 8	7.1	
(*e*) Total new customers sold per man	$\frac{8}{8+9}$	0	0	33 3	25.0	27.3
(*f*) Total new customers sold by department	$\frac{8}{h+i}$	0	0	18.2	9.1	
(*g*) Total new-customer dollar sales per man	$\frac{19}{19+20}$	0	0	37 0	48.6	45.1
(*h*) Total department's new-customer dollar sales	$\frac{19}{s+t}$	0	0	4.4	40.7	
(*i*) Total new-product accounts sold per man	$\frac{8}{3+8}$	0	0	33.3	20.0	25.0
(*j*) Total new-product accounts sold by department	$\frac{8}{c+h}$	0	0	16 7	8.3	
(*k*) Total new-product sales of each man	$\frac{19}{14+19}$	0	0	21 4	32.2	29.4
(*l*) Total new-product sales of department	$\frac{19}{n+s}$	0	0	2 9	26.5	

different way. Here, briefly, is what each ratio evaluates in relation to this productivity:

Line (*a*): As a percentage of *all* customers sold by the man, irrespective of the type of product. This evaluates the individual's efforts on behalf of the desired area of productivity in comparison with his *total efforts* without any relation to other men or to the department. Line *a* does this in terms of orders sold, and line *c* by sales dollars.

Line (*b*): As a percentage of all the customers sold by the depart-

ment, irrespective of the type of product. This evaluates to what extent the individual's efforts contributed to the total departmental score on behalf of the desired area of productivity. This ratio permits a man-to-man comparison. Line *b* does this in terms of orders sold, and line *d* by sales dollars.

Line (*e*): As a percentage of all the *new* customers sold by the man, regardless of the type of product. This is narrower than line *a* since it compares the desired area of productivity with the man's total *new* customers sold rather than all the customers he sold and is a refinement over line *a*. Line *e* is rated in orders sold, and line *g* by sales dollars.

Line (*f*): As a percentage of all the *new* customers sold by the department, irrespective of the type of product. This is similar but more refined than line *b*, because the base of comparison is the department's total *new* customers rather than the total of all sold by the department. Like line *b*, this ratio is used for man-to-man comparison and is rated in orders sold; line *h* measures in sales dollars.

Line (*g*): As a percentage of all the *new-product* accounts sold by the man, regardless of type of customer. This is like line *e*, except that the efforts are compared against new products instead of new customers. Line *i* appraises in orders sold, line *k* in dollar sales.

Line (*h*): As a percentage of all the *new-product* accounts sold by the department, irrespective of the type of customer sold. This ratio is like line *f*, but constructed to show the comparison against new products instead of new customers. This ratio, like lines *b* and *f*, evaluates men on a comparative basis and is rated in orders sold; line *l* does it by sales dollars.

Number of Variations. Exhibit 7-2 shows variations in formulas for the measurement of productivity only. When inquiry into contacting activity and the various appraisals of quotation effort is desired, the number of formulas is considerable. And these formulas would apply to the *one* desired area: *new customer, new product.*

Of course, each area requires its own set of formulas as inquiry is made into different products and different customers, namely, new customer, existing product; existing customer, new product; etc.

For more incisive evaluation, the elements of expenses and territories are added, which calls for ratios to reflect the selling efforts with due consideration for these factors.

Since the ratios which can be developed from the primary data listed in Exhibit 7-1 are practically limitless, space does not permit listing all of them. Instead, ratios typical and representative of most of the variations are listed and discussed. These were constructed for actual use by the author in various companies and situations. They give a

EXHIBIT 7-3. ELEMENTARY SALES RATIOS (MAN EFFORT)

Ratio no.	Ratio title	Formula	Ratio value of salesman:			
			Jones	Smith	Brown	Greene
SI	New-customer and product-order productivity*	$\frac{8}{23}$	0	0	0 143	0 059
SII	New-customer and product-sales productivity*	$\frac{19}{25}$	0	0	0.096	0.121
SIII	New-customer and product-contact activity*	$\frac{29}{1}$	0	0 037	0 321	0.072
SIV	Sales-contact yield*	$\frac{25}{1}$	38 9	120	18 6	181
SV	New-customer sales productivity *	$\frac{19 + 20}{25}$	0	0 031	0 26	0 248
SVI	New-product sales productivity*	$\frac{14 + 19}{25}$	0	0.062	0 394	0 375
SVII	New-accounts direction	$\frac{10 + 11}{1}$	0	0	0 268	0.167
SVIII	Existing-customer, new-product sales productivity	$\frac{14}{25}$	0	0 062	0 298	0 254
SIX	New-customer, existing-product sales productivity	$\frac{20}{25}$	0	0.031	0 163	0 127
SX	Existing-customer, new-product order productivity*	$\frac{3}{23}$	0	0 111	0 285	0.235
SXI	Existing-customer, existing-product quotation productivity*	$\frac{17}{26}$	1.0	1.0	0 248	0.452

SXII	New-customer, new-product quotation productivity	$\frac{21}{26}$	0	0	0.368	0.358
SXIII	Quotation activity*	$\frac{24}{1}$	0 26	0.22	0 32	0 36
SXIV	New-customer order attempts*	$\frac{10+11}{24}$	0	0	0 835	0.465
SXV	New-customer sales attempts	$\frac{21+22}{26}$	0	0	0.65	0.376
SXVI	Existing-customer order attempts	$\frac{5+6}{24}$	1 0	1 0	0 167	0.532
SXVII	Existing-customer sales attempts	$\frac{16+17}{26}$	1 0	1 0	0.35	0 625
SXVIII	Quotation performance*	$\frac{26}{25}$	0 715	0.353	0 85	0 685
SXIX	New business attempts*	$\frac{21+22}{25}$	0	0	0.553	0.257
SXX	Contact-order productivity*	$\frac{23+24}{1}$	0 445	0 555	0.571	0.761
SXXI	Total dollar productivity	$\frac{12}{1}$	0 086	0.209	0.092	0.615
SXXII	Average account sale*	$\frac{25}{23}$	210	359	74	448
SXXIII	Average quotation*	$\frac{26}{24}$	107	190	49	348
SXXIV	Average new-customer quotation	$\frac{21+22}{10+11}$	0	0	3.83	280

EXHIBIT 7-3. (*Continued*)

Ratio no.	Ratio title	Formula	Ratio value of salesman:			
			Jones	Smith	Brown	Greene
SXXV	New-customer trend*	$\frac{19 + 20}{26}$	0	0 088	0.305	0.362
SXXVI	New-customer and product-order performance	$\frac{8}{8 + 9}$	0	0	0.333	0 25
SXXVII	Existing-customer, new-product order performance	$\frac{3}{3 + 4}$	0	0 125	0.500	0.308
SXXVIII	New-product contact activity*	$\frac{27}{1}$	0	0 111	0.43	0.238
SXXIX	New-customer contact activity	$\frac{7}{1}$	0	0.222	0.75	0.309
SXXX	New-product quotation activity*	$\frac{5 + 10}{27}$	0	0	0.333	0.20
SXXXI	New-customer quotation activity	$\frac{10 + 11}{29 + 32}$	0	0	0.357	0.538
SXXXII	New-product attempts*	$\frac{5 + 10}{24}$	0	0	0.445	0.133
SXXXIII	New product–quotation attempt balance*	$\frac{10}{5}$	0	0	7	1
SXXXIV	New-product contact productivity*	$\frac{3 + 5 + 8 + 10}{1}$	0	0 037	0.25	0.167
SXXXV	New-product dollar productivity	$\frac{16 + 14 + 19 + 21}{25}$	0	0 062	0.721	0.505

SXXXVI	Average potential sale*	$\frac{12}{23}$	360	485	137 5	755
SXXXVII	Average departmental potential sale*	$\frac{12}{w}$	40	97 2	42.5	285
SXXXVIII	Productivity-return index*	$\frac{12}{23 + 24}$	150	291	60.1	402
SXXXIX	Expense productivity*	$\frac{25}{33}$	6.35	14 4	5.84	51.6
SXL	Expense-contact cost*	$\frac{33}{1}$	6.12	8.3	3.19	3.52
SXLI	Entertainment economy*	$\frac{25}{36}$	21.4	45 1	16.6	152
SXLII	New-account entertainment economy*	$\frac{19 + 20}{37}$	0	1.98	9 03	97.4
SXLIII	Existing-account entertainment economy	$\frac{14 + 15}{38}$	21.4	148	23 6	187
SXLIV	Expense return trend*	$\frac{12}{33}$	10.9	19 5	10 7	87
SXLV	New-account order entertainment expense*	$\frac{37}{8 + 9}$	0	50 40	4.99	4.85

* Described in text.

Exhibit 7-4. Elementary Sales Ratios (Man Comparison)

Ratio no.	Ratio title	Formula	Ratio value of salesman:			
			Jones	Smith	Brown	Greene
SXLVI	Sales productivity*	$\frac{25}{y}$	0 08	0 25	0 08	0 59
SXLVII	Productivity potential index*	$\frac{12}{1}$	0 086	0 209	0 092	0 615
SXLVIII	Sales performance*	$\frac{23}{w}$	0 11	0 20	0 31	0 38
SXLIX	Quotation performance*	$\frac{24}{x}$	0 15	0 13	0 39	0 33
SL	New-customer and product-order productivity*	$\frac{8}{w}$	0	0	0 0445	0 0223
SLI	New-customer and product-sales productivity	$\frac{20}{y}$	0	0	0 0077	0 071
SLII	New-product sales productivity	$\frac{14 + 19}{y}$	0	0 0154	0 0316	0.221
SLIII	New-product quotation activity	$\frac{5 + 10}{aa}$	0	0	0 216	0 054
SLIV	New-product dollar productivity	$\frac{14 + 16 + 19 + 21}{n + p + s + u}$	0	0 042	0.156	0 804
SLV	Contact order productivity	$\frac{23 + 24}{a}$	0 079	0 099	0 21	0 21
SLVI	Average account sale	$\frac{25}{w}$	23 2	71 8	23 1	169 5
SLVII	New-customer trend	$\frac{19 + 20}{z}$	0	0 125	0 0338	0 236
SLVIII	Productivity-return index	$\frac{12}{w + x}$	19.8	48	21 2	141
SLIX	New-account quotation activity*	$\frac{10 + 11}{a}$	0	0	0 10	0 046
SLX	New-customer contact activity*	$\frac{7}{a}$	0	0 039	0 376	0 034

* Described in text

valid cross section of the data as applied to the control of the sales department.

DESCRIPTION OF REPRESENTATIVE ELEMENTARY SALES RATIOS

Exhibit 7-3 presents a list of selected ratios constructed from the primary data of Exhibit 7-1. These are of the individual-man type, which evaluate areas in terms of the man's efforts. Exhibit 7-4 lists some selected ratios which allow man-to-man comparisons. Exhibit 7-5 lists departmental ratios and are convenient for use by upper management.

All these exhibits contain ratios which are sharp and pinpointed as well as those which are used for broader measurements. The reader should understand that not all ratios are necessarily used by all companies. Sales MC generally starts off with a few broad ones and gradually refines into the more incisive types. Then again, the nature of the ratios shifts as new demands are placed on the sales department. The ratios must reflect what is important to reflect, and they must do so reliably.

INDIVIDUAL MAN-EFFORT RATIO DESCRIPTIONS

RATIO SI: NEW CUSTOMER AND PRODUCT ORDER PRODUCTIVITY

$$\frac{\text{New sold customers for new products}}{\text{Total customers sold}} = \frac{8}{23}$$

This ratio shows the number of new customers that new products were sold to in comparison with the total number of all customers sold. It shows what portion of the total number of orders sold by the man was for new products to new customers. This ratio is used by the sales manager as a confirming check on the directions given to each of his men. The higher management levels are more interested in this ratio's counterpart, which shows the efforts of the department as whole without reference to the efforts of the individual men. In that case, Ratio SI′ of Exhibit 7-5 is used. This exhibit gives the value for the department together with the formula and shows that of the total number of accounts sold in the period, those for new products to new customers amounted to 6.7 per cent of the total.

Top management wants to know the direction of this figure, especially if funds have been invested in the development of new products. And of course, new accounts are the life blood of any business. The sales manager, on the other hand, uses Ratio SI to tell him how much of the individual man's productivity was devoted to this area.

EXHIBIT 7-5. ELEMENTARY SALES RATIOS (DEPARTMENTAL)

Ratio no.	Ratio title	Formula	Ratio value computed for period
SI′	New-customer and product-order productivity	$\frac{h}{w}$	$\frac{3}{45} = 0\ 067$
SII′	New-customer and product-sales productivity	$\frac{s}{y}$	$\frac{1,020}{12,950} = 0\ 079$
SIII′	New-customer and product-contact activity	$\frac{cc}{a}$	$\frac{22}{152} = 0\ 132$
SIV′	Sales contact yield	$\frac{y}{a}$	$\frac{12,950}{152} = 85\ 2$
SV′	New-customer sales productivity	$\frac{s + t}{y}$	$\frac{2,260}{12,950} = 0\ 175$
SVI′	New-product sales productivity	$\frac{n + s}{y}$	$\frac{3,470}{12,950} = 0\ 268$
SX′	Existing-customer, new-product order productivity	$\frac{c}{w}$	$\frac{9}{45} = 0\ 20$
SXIII′	Quotation activity	$\frac{x}{a}$	$\frac{46}{152} = 0\ 30$
SXIV′	New-customer order attempts	$\frac{j + k}{x}$	$\frac{22}{46} = 0\ 478$
SXIX′	New business attempts	$\frac{u + v}{y}$	$\frac{2,535}{12,950} = 0.196$
SXXII′	Average account sale	$\frac{y}{w}$	$\frac{12,950}{45} = 288$
SXXV′	New-customer trend	$\frac{s + t}{z}$	$\frac{2,260}{7,995} = 0\ 282$
SXXXV′	New-product dollar productivity	$\frac{n + p + s + u}{y}$	$\frac{4,800}{12,950} = 0\ 371$
SXXXVI′	Average potential sale	$\frac{l}{w}$	$\frac{20,915}{45} = 465$
SXXXVIII′	Productivity return index	$\frac{1}{w + x}$	$\frac{20,915}{91} = 230$
SXXXIX′	Expense productivity	$\frac{y}{w}$	$\frac{12,950}{715.50} = 18.1$
SXLI′	Entertainment economy	$\frac{y}{jj}$	$\frac{12,950}{233.50} = 55\ 6$

The effect of these efforts on the sales dollars is another matter: men can sell many accounts for a small number of dollars, or they can sell a few accounts many dollars of product, or they can sell few accounts few dollars, or many accounts many dollars, and, in fact, any shade of variance in between. Thus the evaluation of Ratio SI must be supplemented by the addition of the sold dollar volume. This is provided by Ratio SII, which is the dollar equivalent to Ratio SI.

RATIO SII: NEW CUSTOMER AND PRODUCT SALES PRODUCTIVITY

$$\frac{\text{New customer sales for new products}}{\text{Total amount sold}} = \frac{19}{25}$$

Ratio SII shows what portion of the total sales dollars sold was for new products to new customers. Again, this ratio is of the most interest to the sales manager. Top management would refer to Ratio SII′ for a department-wide appraisal. At this point, the reader might speculate on how both Ratios SI and SII might be joined to form a tertiary ratio so that the effect of the number of contacts as well as the level of volume can be integrated. This is shown in Chapter 9.

Proper use of both of these ratios (and of course the many other pairs like them which explore other facets of sales effectiveness) can reveal the presence of certain salesman traits and characteristics which give the sales manager a clue to his counseling and directing efforts. Refer to Exhibit 7-3 for the individual salesman performances. Notice that Greene is behind Brown in order productivity (Ratio SI) but ahead of him in sales productivity (Ratio SII). That might mean that Brown was insecure about the new product or overcareful in soliciting a new account by not pressing for larger orders. Brown surely had to see many people in order to sell. This is confirmed in Ratio SIII.

RATIO SIII: NEW CUSTOMER AND PRODUCT CONTACT ACTIVITY

$$\frac{\text{New customers contacted for new products}}{\text{Total contacts made}} = \frac{29}{1}$$

This ratio shows the percentage of the total number of contacts that were made to new customers for the purpose of selling them new products. Obviously, if contact effort is increased where required, then the return should be higher. We reasoned that Brown must have seen more people than Greene since he sold more accounts than Greene. This fact is surely borne out in this ratio, as can be verified by checking with the values in Exhibit 7-3. High contact activity is fine, but management should expect to see the fruition of these contacts in the form of higher sales and more accounts sold. Brown seems to be a hit-and-run salesman, at least in so far as new-customer, new-product efforts are concerned. Is he this way throughout his entire selling? Refer to Ratio SIV and see.

RATIO SIV: SALES CONTACT YIELD

$$\frac{\text{Amount sold}}{\text{Total contacts made}} = \frac{25}{1}$$

This ratio compares the total amount of dollar sales with the number of total contacts made in the same period. It provides a broad evaluation and gives average sales return per contact. It is not a strict average of the contact return since naturally some contacts resulted in no sales. Reference to the values listed on Exhibit 7-3 indicated that this appraisal showed Brown to be a hit-and-run seller. It shows also that Brown has the lowest sales dollar return per gross contact of all the salesmen. The fact that he shows up higher than Jones and Smith in the new-product, new-customer area is certainly a positive indicator. It should provide clues as to how to work with this man. Evidently he is not afraid either of seeing new customers or of pushing new products, and this should be capitalized on. However, he surely needs counseling in how to make a contact and how to make it productive.

In one company, the author recommended that a Brown type of salesman be used for his ability to open up accounts rapidly, even though the accounts were not productive at first. This step was taken in defense of a rapidly expanding competitive situation which existed at the time, one which demanded the opening of as many accounts as possible in the shortest possible time. Of course, this was then followed up by the type of salesman who made few but solid contacts, from which the company could expect a gradually increasing volume of sales.

Top management is always interested in the departmental equivalent of this ratio, namely, Ratio SIV′, which shows how quickly the average return per contact moves. Invariably, and except for some special motive as described above, this ratio does report on the effectiveness of sales direction and management. If men are directed into the proper areas with the product most accepted in those areas; if they are counseled how often to see which customers; if they are taught how to develop a new customer, etc.; then this ratio value will rise, yielding a higher number of sales dollars per contact.

Instead of examining a narrow facet like new products to new customers, let's see how able Brown is when it comes to new customers, irrespective of the product, and when it comes to new products, irrespective of the customer. These involve Ratios SV and SVI, respectively.

RATIO SV: NEW-CUSTOMER SALES PRODUCTIVITY

$$\frac{\text{New customer sales}}{\text{Total amount sold}} = \frac{19 + 20}{25}$$

This ratio measures what portion of the total sales was sold to new customers. Here, by reference to the actual ratio values of Exhibit 7-3, we see that Brown is the leader in this area. He is best in obtaining new

business regardless of how poorly he uses his contacting effectiveness. Invariably, this ratio is of intense interest to top management. Top management would also be most interested in Ratio SV′, which is the departmental equivalent. It shows that in this period there was 17.5 per cent of new-account business. In this company, such a figure was extraordinarily high but did not continue throughout the year. The company was satisfied with an average of 7 per cent of new sales in its annual sales volume. Nevertheless, the major contributor here was Brown. This is again borne out by Ratio SVII, which shows the direction that the new-account possibilities are taking. And Brown leads here (see Exhibit 7-3); he made the highest percentage of quotations for the number of contacts seen.

As we go further into this analysis, Brown seems to be emerging as a man who is functional only with new faces for the first time. He makes a strong impression on his contacts, but not for long. He seems to be bored with people after selling them the same product for any length of time, and so he makes his hits and runs mostly with them. All this personality evaluation developed later, but these ratios could have pointed the way earlier for faster managerial action and control.

RATIO SVI: NEW-PRODUCT SALES PRODUCTIVITY

$$\frac{\text{New product sales}}{\text{Total amount sold}} = \frac{14 + 19}{25}$$

This ratio measures what portion of the total sales was for new products. Again, we see that Brown is the leader. And the departmental equivalent of this ratio is Ratio SVI′ which shows that 26.8 per cent of the total sales was for new products. Again, this is of importance where the company has the task of recovering by its selling efforts the money it invested in developing new products.

There are many shades of interest with ratios which show differences in product and customer variances. In many situations it is desired to find out whether existing or new customers are quicker to accept a new product. In other situations it is desired to learn whether it is easier to sell existing or new products to new customers. As to the first, it calls for a comparison between Ratio SII and Ratio SVIII. As to the second, Ratio SII must be compared with Ratio SIX. By reference to the ratio values it is easily seen that the results from selling new products to existing customers are twice as successful as selling existing products to new customers. The problem for sales management, based on these data, is obtaining new customers. Note that this relationship is almost directly related to Ratios SV′ and SVI′.

RATIO SX: EXISTING-CUSTOMER, NEW-PRODUCT ORDER PRODUCTIVITY

$$\frac{\text{Existing customers sold for new products}}{\text{Total customers sold}} = \frac{3}{23}$$

This ratio is very much like Ratio SI and shows what portion of the total orders sold was to existing customers for new products. This is a variation of the basic order productivity and can be varied by the type of customer and type of product. Similarly, a departmental ratio can be constructed for top management. This is Ratio SX′ in Exhibit 7-5. In the same way, ratios similar to Ratio SII can be constructed to show the dollar effect and from there can proceed to an integrated ratio combining both the number of accounts and the number of sales dollars. For this ratio (SX), its dollar equivalent is Ratio SVIII.

RATIO SXI: EXISTING-CUSTOMER, EXISTING-PRODUCT QUOTATION PRODUCTIVITY

$$\frac{\text{Existing customer quotations for existing product}}{\text{Total amount quoted}} = \frac{17}{26}$$

This ratio measures what portion of the total dollar value of quotations was devoted to existing accounts for existing products. Somehow this ratio evaluates one of the easiest segments of the sales effort since there are no challenges of new products or new customers. Reference to Exhibit 7-3 shows Jones and Smith leading as expected. Brown is the lowest. A glance at Ratio SXII, which relates the new-product, new-customer quotation value to the total value of quotations given, shows that Jones and Smith are zero and Brown leads. The fact that Brown performs best in the new-customer, new-product area—for orders or for quotations—shows the reliability of his quotations; that is, his quotations experience a low mortality rate. More on quotation mortality later.

RATIO SXIII: QUOTATION ACTIVITY

$$\frac{\text{Number of customers quoted}}{\text{Total contacts made}} = \frac{24}{1}$$

This ratio shows what portion of the total number of contacts made resulted in quotations. It is referred to as an "activity" rather than productivity ratio since we are not able to predict just what accounts will be sold as a result of the quotations and what the dollar volume will be. Obviously, this can vary considerably. However, if one knew from past history just what success a man had with his quotations, then a rough prediction could be made. (See Ratio SJ, Quotation Acceptance, of

Chapter 9.) Again, the value of this ratio is important only when confirmed by other ratio movements. A high value could be the result of few contacts as well as a large number of quotations; a low value, the result of a large number of contacts or a small number of quotations. The variations are infinite.

However, it does show the salesman's effort to quote as many qualified contacts as possible. If he quotes indiscriminately, this makes more clerical work for the sales office, for the estimators, schedulers, etc., and this can boost the "transaction cost" to unreasonable limits. Salesmen must learn to quote selectively and must also follow up quotations once they are submitted. Many times quotations are not converted into sales because of the follow-up which the customer expected and which the salesman did not provide. Consulting Ratio SK, Quotation Mortality, of Chapter 9, tells the story: Brown's high contact activity, which was nevertheless undirected, showed up after six months as a mortality rate of 78 per cent compared with the solid and unspectacular work of Smith, who had a quotation mortality rate of only 29 per cent.

RATIO SXIV: NEW-CUSTOMER ORDER ATTEMPTS

$$\frac{\text{New customers quoted}}{\text{Total customers quoted}} = \frac{10 + 11}{24}$$

This ratio measures what percentage of the total number of quotations was given on behalf of new accounts. Here is the starting point of every sale—the quotation. And if it is management's wish to have a high percentage of new-account sales, its beginnings must originate in this ratio. The dollar-value equivalent of this ratio is Ratio SXV. In both ratios, Brown achieves a high value. This becomes meaningful only when compared with the mortality ratios previously mentioned. Of course, upper management is interested in the departmental value of this ratio and consults Ratio SXIV′. Comparing that ratio with the departmental value for Ratio SXV, one sees that the dollar value of the ratio is below that of the quantity of accounts quoted. This indicates that more emphasis is being placed on the number of accounts quoted than on the size of the quotation.

The size of the quote controls the potential sales dollars, and so there should be an optimum relationship between the number of accounts quoted and their size. This consideration generally is more important for Ratios SXVI and SXVII, which deal with existing-account quotations. When a company is making a drive for new business (new accounts, new customers), generally the number of accounts quoted and opened has the edge over the dollar size of such quotations, at the beginning, anyway.

RATIO SXVIII: QUOTATION PERFORMANCE

$$\frac{\text{Amount quoted}}{\text{Amount sold}} = \frac{26}{25}$$

This ratio compares the amounts quoted with the amounts sold. This type of ratio casts an advance shadow. It hints at what the total sales *might be.* Of course, it depends on the maintenance of a level of sales and the experience given by the quotation acceptance and mortality ratios previously mentioned. The thesis is that the more people contacted, the more people sold. And if the people are *quoted,* the chances are enhanced.

A company has a surprisingly large investment cost wrapped up in a quotation. Maximum investment protection of the quote is obtained when a proper follow-up is made and the reasons for a rejected quotation determined. Quotation mortality can be caused by reasons of price, poorly selected prospect, and poor follow-up, and these can exist in varying proportions.

Case histories show a definite correlation between sales and quotation follow-up. Not all follow-up is really necessary. Often it is necessary simply because it is expected by the customer. And this emotional factor must be recognized for maximum sales success. Not all follow-up has to be done in person; some can be done by telephone and letter as well as by a personal visit. If it is desired to evaluate in this area for just new quotations, then Ratio SXIX can be used.

RATIO SXIX: NEW BUSINESS ATTEMPTS

$$\frac{\text{New customers quotations}}{\text{Total amount sold}} = \frac{21 + 22}{25}$$

This ratio is similar to the foregoing one, with the exception that it compares the amount of the new-account quotations with the total amount of sales. Obviously, the previous Ratio SXVIII can remain fixed when there is a considerable variation in the new-account-quotation segment. That is why this ratio is needed. It enables management to observe both the magnitude of the sales and the extent to which emphasis is placed on new business. Again, the quote precedes the sale, and regardless of the existing level of actual new-account sales, if this one is not kept at a proper level, the new-account sales will drop off. Quite naturally, the upper managerial levels are mightily interested in the departmental Ratio SXIX′ as an indicator of things to come for new business.

RATIO SXX: CONTACT-ORDER PRODUCTIVITY

$$\frac{\text{No. of customers sold} + \text{No. of customers quoted}}{\text{Total contacts made}} = \frac{23 + 24}{1}$$

This ratio shows the percentage of the total gross contacts that resulted in accounts sold and quoted. It shows how active the salesman was; it doesn't show the dollar productivity, of course, until the sales value has been added. The dollar equivalent of this ratio is Ratio SXXI, which automatically provides a man-to-man comparison. It should be mentioned that even though the dollar value of the contact-order productivity may be low, the salesman still performs a valuable service for the company in spreading the name and reputation of the company and its products. This is sometimes referred to as missionary work, and it should not be dismissed lightly. There is a level of missionary work in all contacting. Management must know and control in order to get a balance between this effort and dollar selling.

RATIO SXXII: AVERAGE ACCOUNT SALE

$$\frac{\text{Total amount sold}}{\text{Total customers sold}} = \frac{25}{23}$$

This ratio shows the amount of the average sale. It appraises the man so that the sales manager can see who is responsible for the existing sales level. It is a general tool for top management in its equivalent departmental form as Ratio SXXII′. Mostly, this ratio is used for sales department budgeting of expenses.

RATIO SXXIII: AVERAGE QUOTATION

$$\frac{\text{Amount quoted}}{\text{Total number of customers quoted}} = \frac{26}{24}$$

This ratio shows the amount of the average quotation. It is an excellent diagnostic tool when used in conjunction with Ratio SXXII. Stable salesmen should have a dependable relationship between their sales and quotations. When this ratio runs consistently high and the previous ratio runs low, it is immediate indication that the salesman is experiencing a high degree of quotation mortality. Both this ratio and the one previous should be expanded to show information for new and existing products and customers. This is done by using Ratio SXXIV and by creating some new ones to suit the purpose. For example, to get the average new-product sale requires that the new product sales be divided by the total of the new product accounts sold, which is calculated from

the formula $(14 + 19)/(3 + 8)$. To get the average new-product quote, the new product quotations is divided by the total new product accounts quoted, or $(16 + 21)/(5 + 10)$. To do the same, respectively, for new customer sales, the formulas are $(19 + 20)/(8 + 9)$ and $(21 + 22)/(10 + 11)$. The last one listed is Ratio SXXIV. In a similar manner, ratios are developed for existing customers and existing products.

RATIO SXXV: NEW CUSTOMER TRENDS

$$\frac{\text{New customer sales}}{\text{Total amount quoted}} = \frac{19 + 20}{26}$$

This ratio shows the relationship between the new-account sales and the total value of the quotations made. As this ratio value increases it shows that emphasis is being placed on obtaining new business. A drop may not necessarily indicate that new-account sales are off; it may be that the level of quotations has risen. Therefore the purpose of this ratio is twofold: it shows the results of the efforts to obtain new business, and it also indicates the balance between the quotations and sales situations. If there is a shift in the proportion of quotes to new and existing customers, this circumstance will show up rapidly in this ratio. As quotation efforts are placed on existing business, it is usual for the denominator to rise and for the numerator to drop. This double negative reaction (as far as obtaining new accounts is concerned) shows rapid drops in the ratio value and provides management with a clue for trouble-shooting. To determine this same type of trend for new products rather than for new customers, a ratio of total new product sales divided by total amount quoted would be constructed. This formula is $(14 + 19)/26$.

On a departmental level, consulting the equivalent Ratio SXXV′, it shows that on a total level, the trend is more toward new products rather than new customers. This confirms earlier findings. However, these ratios tell upper management the story concisely. The sales manager, however, has to find out which men have to be boosted in order to improve his department's situation. The individual ratio values show that Greene's trend toward new accounts is only slightly higher than Brown's. However, if Brown's quotation mortality rate continues at the same rate (see Chapter 9), then Greene can be appraised as being almost five times more responsible for bringing in new business than Brown.

In Ratio SI and in Ratio SII, its dollar equivalent, we found the proportions between the new-customer, new-product accounts and dollars sold and the total amount and number of accounts sold. This

provided an incisive evaluation of the activity of new products sold to only accounts by comparing that activity with the total of the department. However, in some companies where there are higher activity levels of new customers and new products, the ratios have to be altered to provide even finer assessments. This is done by a revision in the denominator so as to appraise within a finer area. The only change is that the former group of ratios compares the customer and product data with either the new customers or the existing customers instead of all the customers. To make this clearer, let us restate the formula for Ratio SI with that of Ratio SXXVI beneath it:

$$\text{Ratio SI:} \quad \frac{\text{New sold customers for new products}}{\text{Total customers sold}} = \frac{8}{23}$$

$$\text{Ratio SXXVI:} \quad \frac{\text{New sold customers for new products}}{\text{Total new customers sold}} = \frac{8}{8+9}$$

Similarly

$$\text{Ratio SX:} \quad \frac{\text{Existing customers sold for new products}}{\text{Total customers sold}} = \frac{3}{23}$$

$$\text{Ratio SXXVII:} \quad \frac{\text{Existing sold customers for new products}}{\text{Total existing customers sold}} = \frac{3}{3+4}$$

RATIO SXXVIII: NEW-PRODUCT CONTACT ACTIVITY

$$\frac{\text{New product contacts}}{\text{Total contacts made}} = \frac{27}{1}$$

This ratio shows what proportion of total contacts was made on behalf of new products. To find out the same information for new accounts, Ratio SXXIX is provided. By consulting this ratio the sales manager can direct the efforts of his men. Managing "after the facts" results in complaints about low-level new-product (or new-account) sales. If management on the spot sees to it that there is sufficient contacting activity, it partially ensures that new-product or new-account sales won't drop. This ratio also is helpful in determining over-all contact effectiveness by comparing with the sales and quotations produced as a result of such contact activity. This is best done by tertiary ratios computed over longer periods of time because of the time lag between a contact and a sale.

RATIO SXXX: NEW-PRODUCT QUOTATION ACTIVITY

$$\frac{\text{Number of new product quotations}}{\text{Total new product contacts}} = \frac{5+10}{27}$$

This ratio shows what portion of the contacts that were made on behalf of new products was quoted. It is similar in structure to Ratio

SXIII, which makes a like comparison for all products. (A ratio for showing the *new* customer quotation activity is given in Ratio SXXXI.) Ratio SXXX is valuable for uncovering characteristic salesmen's interests as divided between new and existing products. It is natural that some men feel more at home with what they have been selling regularly. On the other hand, as we have seen previously, there are men who function best with new items and in new situations. To discover the extent of these tendencies, this ratio should be compared with the ratio of the total number of existing product quotations made to the total number of existing product contacts, $(6 + 11)/30$. This shows us immediately that Brown leads in new products by quoting the highest percentage of his new-product contacts, whereas Greene leads in the existing products by his quoting of the highest percentage of his existing-product contacts.

In the evaluation of men it would be interesting to see the effectiveness of their new and existing *customer* contacts as far as quotation activity is concerned, to see how it compares with their new and existing *product* contacts. This is easily done by using Ratio SXXXI and a ratio constructed for existing-customer quotation activity. This would be $(5 + 6)/(28 + 31)$. The comparison shows Smith the leader in existing customer quotational activity and Brown the lowest. And in new customer activity, it shows that Greene is the leader, with Brown second. In the former case, Brown's lowest quotation performance is not as much an indication of a lack of effectiveness as it is a lack of motivation or interest in existing-customer activity. This is shown by his total existing-customer contacts (denominator) being at the lowest level.

A comparison between Ratio SXXX and Ratio SXXXI shows a difference between new-product and new-customer quotational activity. Brown leads in the former, and Greene leads in the latter.

The same types of comparisons can be made using ratios of dollar equivalence, which show the results of the quotational activity; then, to measure over-all man effectiveness, tertiary ratios can be constructed.

The foregoing discussion (starting with Ratio SXXX) compared the new- and existing-product quotes or new- and existing-customer quotes with the total contacts made for new or existing products or quotes. It measured an effectiveness localized within a total limited activity. How these efforts stacked up to total over-all man activity was not considered. This measure is provided by the following ratios.

RATIO SXXXII: NEW PRODUCT ATTEMPTS

$$\frac{\text{Number of new product quotations}}{\text{Total number of customers quoted}} = \frac{5 + 10}{24}$$

This ratio measures the percentage of total number of quotations given on behalf of new products. It is the product equivalent of Ratio SXIV, which made a like measurement for new-account attempts. Whereas Ratio SXXX showed the new-product quotational yield from the new-product contacts made, Ratio SXXXII showed the extent of the new-product quotations in the total quotational picture. It is one thing for high performance in Ratio SXXX, but if the value for Ratio SXXXII is low, then the high SXXX is academic. This will be true if the total new-product contacts are low. (Of course, the same effect is true of new-*customer* quotational evaluations.) Therefore ratios like SXXX and SXXXI are used to measure the salesman's personal characteristics rather than his output.

From glancing at the values for these types of ratios and their departmental values, it seems clear that the departmental emphasis is on new products rather than new customers, from the quotational viewpoint, at least. And perhaps this is in support of management's objectives; that is, it may very well be that the company's need to recover new-product-development expenditures is far greater than the urgency to acquire new customers. Then again, it may not be the case, which would mean that the sales department is not functioning in harmony with the economic needs of the company. But quotation activity need not be the same as the order or the sales productivity; it surely has some influence over the final amount sold, but it is not a determinant of those sales. Therefore, to see whether the sales results emphasize the new product over the new customer, Ratios SV and SVI should be consulted. This comparison shows likewise that new-product sales exceed new-customer sales.

Often, even in situations which require the introduction of new customers, a higher performance for new products is tolerable. This might be a perfectly acceptable condition, especially at the early stages in the marketing of new products. However, if the company generally does not acquire many new accounts, it may be a clue that salesmen are not properly prepared in comparison with their competition. Perhaps they need more sales-office support in the way of catalogues, promotional materials, a more dignified way of making appointments, etc. It may also be that sales training is lax, and it may require a review of sales manuals. One astute sales manager spot-checked the attire of his men. He also corrected their tendency to depend on just the law of averages for their sales.

RATIO SXXXIII: NEW PRODUCT–QUOTATION ATTEMPT BALANCE

$$\frac{\text{New product quotes to new customers}}{\text{New product quotes to existing customers}} = \frac{10}{5}$$

This ratio evaluates the balancing of the effort between new and existing customers for new-product quotations. In it we do not make comparisons against total gross contacts, total contacts for new or existing products or customers, the total gross quotations made, or the total quotations made for new or existing products or customers. The departmental value for this ratio in the period under tabulation is shown to be 4, which means that new products are being quoted to new customers four times more than new products are being quoted to existing customers. Again, this may or may not be compatible with the over-all aims of the company. It may not provide enough activity by which the sales-promotion effort can judge the effectiveness of the product or of its programs. A high value shows that the sales department is depriving management of the opportunity of getting reactions to its new products from its present customers. Often this provides an even better evaluation than the reactions from new customers. This ratio should be frequently consulted by the sales manager to see which men are unbalancing the effort. And certainly, the departmental ratio is of considerable interest to upper management in its coordination of the contact-selling and sales-promotion functions.

RATIO SXXXIV: NEW PRODUCT CONTACT PRODUCTIVITY

$$\frac{\text{New products sold and quoted}}{\text{Total contacts made}} = \frac{3 + 5 + 8 + 10}{1}$$

This ratio shows what portion of the contacts made resulted in both orders and quotations. This type of ratio relates new-product attempts, trends, and productivity by showing the order or quotation transaction per contact. In doing so it gives an indication of over-all contacting efficiency. In a similar manner, many other ratios can be constructed to show the amount of dollars involved in the above per gross contact. Of more interest is Ratio SXXXV, which is the dollar equivalent of Ratio SXXXIV, showing all the activity of new products in the total sales picture.

RATIO SXXXVI: AVERAGE POTENTIAL SALE

$$\frac{\text{Amount sold and quoted}}{\text{Total accounts sold}} = \frac{12}{23}$$

This ratio compares the total value of the sales and quotations made with the number of accounts sold, giving an average dollar value per sold account. The value of this ratio is useful in determining whether or not emphasis on quotations is interfering with the closing of the sales. This circumstance would show up as a high value in the ratio by the inflation of the quotation dollars in the numerator and the drop in

the denominator. Other factors can contribute to a high value, such as high sales dollars, low quotation dollars, and the small number of accounts involved in the sales. This would likewise be a negative indicator because of the smallness of the quotations, which shows a poor future trend toward sales, and because of the few accounts involved in the sales.

A low value need not necessarily be positive, for this can occur because of a low sales dollar level, obviously. However, in this type of ratio, there are satisfactory ranges which can be established based on the type of product, the market being served, and the needs which the company has in other areas of economic effect.

RATIO SXXXVII: AVERAGE DEPARTMENTAL POTENTIAL SALE

$$\frac{\text{Amount sold and quoted}}{\text{Department total number of accounts sold}} = \frac{12}{w}$$

This ratio is the same as the one preceding, with the difference that the denominator uses the departmental total number of accounts sold instead of the individual-man total of accounts sold. It really shows the contributory effects of the efforts of each man. Comparing its value with that of the preceding ratio shows that Brown is on the bottom with Jones next in Ratio SXXXVI, and the reverse is true for the two men in Ratio SXXXVII. So while Brown skipped all over the place, Jones performed more solidly with an average of 360 over Brown's 137.5. But because of Brown's slightly higher dollar level, exceeding Jones by $125, the former made a slightly greater contribution to the department's performance, Jones being at point 40 and Brown at 42.5.

RATIO SXXXVIII: PRODUCTIVITY RETURN INDEX

$$\frac{\text{Amount sold and quoted}}{\text{Total number of accounts sold and quoted}} = \frac{12}{23 + 24}$$

This ratio compares the dollar value of the sales and quotations with the number of accounts sold and quoted in order to obtain an average sold-quoted amount per account sold and quoted. Obviously, it is a composite ratio of the average account sale and the average quotation. It is the proof-of-the-pudding index for any immediate period being evaluated. There is no tempering of the value to account for past successes like quotation acceptance or mortality. This type of ratio can be expanded to account for new and existing products and customers, but is shown here in total form. A glance at the ratio values shows that in spite of all his gyrations and flamboyance, Brown emerges as the lowest, with Jones next highest, beating him by 2½ times. Greene leads with a score almost seven times better than Brown.

Expense Economy

The ratios listed on Exhibit 7-3 and those described to this point deal with the man and his activity, his effectiveness, and his personal characteristics and give some indication of his responsiveness to sales management's direction as regards different classes of products and customers. We have measured his drives and willingness to sell, quote, or otherwise circulate the company's name and reputation. But we have not as yet measured the *cost* of his doing any or all these things.

We have not equated his activity to expenses.

Actually, each of the ratios mentioned so far could accommodate the factor of expenses and so lend economic tempering to a man's over-all performance. And performance must include the cost factor, otherwise the effort to attain objectives might get prohibitively great. This integration of activity with expenses must be known in order that management might be induced to pursue the optimum economic course.

Often management will decide to invest a considerable sum in the expenses of landing a particularly important account. This is more or less standard practice for many companies. And often the expenses of landing the account are far out of proportion to the amount of the first sale. This may make sense if the intention is to get the account on the books in the hope that successive sales will rapidly amortize the initial sales expense. Sometimes the expense is invested just to land the one big order, where that order is large enough easily to take care of the invested expenses. The author does not include this type of expense investment in the ratios. Only those that are the object of constant and routine repetitive practice should be under close control. They are the expenses which the salesman normally incurs or is tempted to incur in the routine performance of his duties.

The thesis here is that the level of routine expense incurred by the individual salesman should have some bearing on, or correlation to, the importance of the contact. This importance is measured in sales levels; desirability of customer; desirability of market and territory; product acceptance and propagation; and the relationship of the product sales to the economic needs of the company. Very often salesmen will be found to be entertaining prospects regularly from whom no sales were made over a long period and from whom no sales are likely to come.

Salesmen have been known to use levels of entertainment expense in excess of the sales they normally obtain. Some invest much expense with a customer who is located beyond the company's economic radius of delivery, that type of account being practical only if little or no expense is invested to obtain it. Then there are salesmen who limit their

sales by being too conservative, and by neglecting to entertain those prospects who have the greatest potential for them.

Management must face quite realistically that the entertainment of customers and prospects can be optimized to the sales levels required. Entertainment expense is an efficient catalytic agent in the buyer-seller arena. This is standard practice, and those who build up prejudice against this type of expense are unrealistic. Generally, a prospect or a customer *will not ask* the salesman to take him to lunch or dinner or to a play or night club. That is something a good salesman feels the need for doing, intuitively. However, before the salesman acts, and if he acts, the degree of the proposed expenditure should be equated against the possible good it will do for the company. The end-goal criterion is: will it accomplish what the company needs to have accomplished?

Ratio control in this area alerts the salesman to the fact that the sales manager is not only keeping a close watch but a careful correlation of his expenses to his performances. We must be realistic and face the fact that there are cases where salesmen report expenses they did not actually incur. This padding of the expense account shows up quickly when the simple ratios are used. After all, the expenses are not designed to serve as partial subsidy for sales compensation. They are allowed and should be incurred only if *productive.*

However, judgment of the salesman is the largest control factor in the entire expense picture. If he lacks judgment and is somewhat dishonest as well, the sales expense costs will climb rapidly.

Many companies simply equate sales with expenses and accept the average level of expenses per sales dollar as their yardstick. This is tantamount to managing on the basis of a profit-and-loss statement. Waiting for an average of historical data postpones managerial action until after the facts. Smart management knows that all averages contain peaks and valleys, and it must be prepared to take advantage of a positive opportunity at the time it is occurring and must be alerted to negative conditions when they appear.

While a salesman's yearly expense average might show 10 per cent in the sales dollar, ratio analysis might show that within that 10 per cent there were excursions from 2 to 22 per cent. What caused the 2 per cent? What are the elements that contributed to that low level? Can the circumstances be duplicated on a regular basis so that the over-all yearly average is reduced? What caused the 22 per cent? Has management overlooked a condition which caused this? Will it gain from eliminating or shifting a territory, or by replacing a man, or by rotating men and accounts, or by dropping a product?

The ratios described below deal with the relationship of activity,

performance, and productivity to the expense level. They are only a few of the large number that could be developed to fit a specific need. The following text describes some of those listed in Exhibit 7-3.

RATIO SXXXIX: EXPENSE PRODUCTIVITY

$$\frac{\text{Sales}}{\text{Total expenses}} = \frac{25}{33}$$

This basic ratio compares the number of sales which each dollar of expenses can produce. Or, looking at it from a different viewpoint, it shows the number of cents of expenses that each dollar of sales requires. Obviously, this ratio shows an average condition for each man; the upper managerial levels have more interest in the departmental value for budgeting purposes. For this, they will refer to Ratio SXXIX′ of Exhibit 7-5. Ratio SXXXIX shows the comparative judgment of the individual salesmen, and since it is a lumping of all the circumstances which occurred in the production of sales at different times and under different conditions, no diagnosis can be made as to how justifiably the individual situational expenses were spent. It is valuable as a check on trend even though it might not be as fair as more penetrating ratios.

For example, the use of this sole ratio would show that Jones was *not* at the bottom in getting a sales return on his expenses. But should that be the sole criterion? Perhaps a greater sense of freedom in expenses might have helped him in closing more business. Brown shows frugality, and he has a low sales performance as well. Is there a connection between the two facts? Will the expense cost per contact confirm any of these insights?

RATIO SXL: EXPENSE-CONTACT COST

$$\frac{\text{Total expenses}}{\text{Total contacts made}} = \frac{33}{1}$$

This ratio is simply a relationship between the total expenses and the total number of contacts made. It shows the average expense cost per gross contact. Without recourse to other ratios, this one alone may be misleading. For example, Brown appears to be the best performer in this ratio, but only for the reason that he jumped around so much, thereby logging a good deal more contacts than the others. The fact that he had such a low level of expenses, which of course made the cost per contact very low, showed how little time he spent with each contact. When he did take one of his contacts to lunch, there was not any sort of level of sales or customer interest justifying this move, as will be seen later. The positive aspect of Brown's expense record is that he is

able to move around considerably at a relatively low expense. This one fact is invaluable in counseling other men and in establishing what activities can be done with little expense money.

Needless to state, the sales manager must use care with this type of procedure lest it backfire on him, as in the case of Brown's poor performance. However, with Greene's outstanding sales effectiveness, his contact expense level is only slightly higher than Brown's. This makes management's caution much less vulnerable to criticism.

RATIO SXLI: ENTERTAINMENT ECONOMY

$$\frac{\text{Total sales}}{\text{Total entertainment expenses}} = \frac{25}{36}$$

This ratio shows the average number of sales produced from each dollar of entertainment expenses. Stated another way, it shows the number of average entertainment cents spent for each dollar of sales. This is not to say that those entertainment cents are *required* to produce a dollar of sales; no one knows this for sure in this average. However, when the movement of this ratio follows definite trends, there is every reason to believe that the manner in which entertainment expenses are disbursed accounts for a major part of the trend.

This segment of sales expense is the least traceable and the hardest to get the men to account for. It can't be checked, like the practice of spot-checking the men's automobile expense records by reading their cars' speedometers. It has the largest degree of variability and also, because of direct contact with prospects, has the greatest leverage for producing sales of any other controllable expense.

Ratios which incorporate entertainment expenses (and these can be many) should be constructed to show whether there is sufficient or too much money being spent for the entertainment of prospects and customers. Just as too little entertainment may limit sales, thereby rendering the contact cost uneconomical, so an excess of entertainment expense not justified by a proper level of sales is uneconomical. The disbursement of entertainment expenses must be an optimum, not a minimum. In this case, a minimum is as bad as a maximum. There is an optimum point of expense above which no additional sales will be produced. In other words, the effect of a $10 entertainment expense may be exactly the same as a $50 entertainment expense, but infinitely greater than if there were no entertainment activity at all.

In the actual ratio values for this period (see Exhibit 7-3) it is apparent that Brown used very poor judgment, entertaining the *wrong type of customers or prospects* or *doing it in the wrong way.* Used properly, that same level of expenses might have brought in double his

sales level. Greene, with almost the lowest level of entertainment expenses, brought in a sales level of over nine times that of Brown. That doesn't mean that Greene necessarily used the optimum amount of judgment in incurring entertainment expenses. Greene's high sales level may be due to his maturity and excellence as a salesman, without any particular reference to how he entertained customers or prospects. But there are some contacts who look for the token lunch or dinner; there are those who expect to be entertained, believing that the salesman's company has made this kind of allowance to him. Like it or not, companies have to recognize some part of these facts if they are interested in selling to companies employing that type of individual. In Greene's case it is highly possible that an increase of 20 per cent in the judicious use of entertainment expenses could have resulted in a 40 per cent increase in sales.

Sales management might wish to make some distinctions between the entertainment of prospects and customers, between selling new and existing products and all the variations in between, as shown for the nonexpense ratios previously mentioned. Management generally is prepared to tolerate a higher level of this type of expense for new customers and for new products—and surely for the narrow area of new products to new customers. Ratios are easily constructed that show the economy in these areas. Sometimes the amount of total expense in this kind of promotion begins to make the entire effort questionable. Sometimes, it is more than justified. Management's task is to watch the trends to see that the expense levels do not become uneconomical.

One of the usual ratios to be set up deals with the entertainment of new accounts or recent prospects sold and now on the company's books.

RATIO SXLII: NEW-ACCOUNT ENTERTAINMENT ECONOMY

$$\frac{\text{New account sales}}{\text{New-account entertainment expense}} = \frac{19 + 20}{37}$$

This ratio shows the amount of new customer sales obtained for every dollar of entertainment expense. Here we see a very poor performance by Smith and one not much better by Brown. Greene emerges the winner again, but there still should be doubt as to whether he spent enough on his new business. The chances are that even if the $19.40 he spent on the entertainment of new customers (see Exhibit 7-1) had been $5, his sales level would probably not have been affected.

Referring back to Exhibit 7-1, we see that of the thirteen contacts he made to new customers, he sold four and quoted seven and with two he had no luck at all. Perhaps in these latter two, a luncheon invitation would have eased some of the resistance, if there was any. Perhaps, of

the seven he quoted, one or more would have approved his order on the spot had the transaction been accomplished under less formal circumstances. A glance at Ratio SXLIII, which is the equivalent of the above but constructed for existing customers, shows that Greene spends twice as much in entertainment to obtain the existing customer sales dollar as he does to get the new-customer sales dollar. This may or may not be in keeping with the goals of upper management, depending on where they need the emphasis, i.e., in new product or new customer or neither.

It is possible that there is some element of disdain in Greene's attitude as far as new customers are concerned. His higher entertainment expenses for existing customers may imply an element of appreciation, which may not necessarily be the way his company wants him to feel about his selling.

The full results of expense disbursement is not received immediately. A part of it is always invested in the immediate or future quotation, and so there should be a measure of the levels of total expenses to support the quotational as well as the sales effort.

RATIO SXLIV: EXPENSE RETURN TREND

$$\frac{\text{Amount sold and quoted}}{\text{Total expense}} = \frac{12}{33}$$

This ratio shows how much sales and quotation dollars were obtained for every dollar of total expenses. While the expense level may be considered high in a given period in comparison with the immediate sales, it may be judged as acceptable after the level of quotations is considered. Of course, the natural follow-up to this evaluation is the extent of the past quotation mortality. If the mortality has been low, then there is every reason to accept a high quotational level as a reasonable substitute for sales in the appraisal of the expense level. Obviously, this type of ratio can be expanded for new and existing products and accounts, as described earlier.

RATIO SXLV: NEW-ACCOUNT ORDER ENTERTAINMENT EXPENSE

$$\frac{\text{New-account entertainment expense}}{\text{Total new accounts sold}} = \frac{37}{8 + 9}$$

This ratio shows the average amount of entertainment expense spent for every new account sold. It is useful in confirming other ratios. For example, Smith's performance on Ratio SXLII shows a very low level of sales returned per dollar of entertainment expense disbursed. The reason as shown in this ratio lists $50.40 for the one new account that he sold, whereas the average for the other men is under the $5 mark. And

again, this type of ratio can be applied to the over-all performance of the man, or to new products, etc.

In all these ratios, the departmental equivalents, shown in Exhibit 7-5, can be developed so that upper management can observe the trends in the particular areas of greatest interest to them. As we shall see later, these departmental ratios are used for other determinations as well. It should also be borne in mind that any of the ratios can be modified to include the expense consideration.

MAN-COMPARISON RATIO DESCRIPTIONS (EXHIBIT 7-4)

RATIO SXLVI: SALES PRODUCTIVITY

$$\frac{\text{Total sales per man}}{\text{Departmental total sales}} = \frac{25}{y}$$

This ratio shows what portion of the total departmental sales was sold by each man. The value of the ratio gives the percentage for each man. Thus Greene was responsible for 59 per cent of the department's total sales. The ratio is useful in making comparisons with other areas of performance. This type of ratio can be modified for different product and customers and expenses similar to the man-effort ratios.

RATIO SXLVII: PRODUCTIVITY POTENTIAL INDEX

$$\frac{\text{Total sales and quotations per man}}{\text{Dept. total amt. of sales and quotations}} = \frac{12}{l}$$

This ratio shows what percentage of the department's total of sales plus quotations was obtained by each man. Here Brown rates a bit higher than Jones; in the previous ratio they were both equal. This shows that Jones does not do much quoting. Greene is still the leader, being responsible for 61.5 per cent of the department's total. In a like manner, this ratio can be expanded to provide variances of evaluation for customers and products.

RATIO SXLVIII: SALES PERFORMANCE

$$\frac{\text{Total no. accounts sold per man}}{\text{Departmental total accounts sold}} = \frac{23}{w}$$

This ratio shows what percentage of the department's total accounts sold was brought in by each man. Greene is the leader again, with Brown following close behind. This ratio requires additional data in order to fully validate the above values. While it shows that Brown sold 31 per cent of the department's sold accounts, that percentage

loses importance when compared with Brown's percentage in Ratio SXLVI, which shows that he was responsible for bringing in only 8 per cent of the department's total sales. This ratio, just as we pointed out for the man-effort ratios, is valuable in showing the salesman's ability to open a large number of accounts even though they may not be productive immediately.

RATIO SXLIX: QUOTATION PERFORMANCE

$$\frac{\text{Total accounts quoted per man}}{\text{Departmental total accounts quoted}} = \frac{24}{x}$$

This ratio shows what percentage of the department's total accounts quoted was quoted by each man. Here Brown is the leader, but this is positive only if he experiences a high quotation acceptance.

RATIO SL: NEW-CUSTOMER AND PRODUCT-ORDER PRODUCTIVITY

$$\frac{\text{New sold customers for new products}}{\text{Departmental total customers sold}} = \frac{8}{w}$$

This ratio is the same as Ratio SI of the man-effort type except that the new sold accounts for new products are taken as a percentage of the departmental total instead of the man's total sold accounts. Similarly, Ratio SLI is the man-comparison equivalent of the man-effort Ratio SII. In a like manner, Ratio SLII is equivalent to Ratio SVI; Ratio SLIII is equivalent to Ratio SXXX; Ratio SLIV is equivalent to Ratio SXXXV; Ratio SLV is equivalent to Ratio SXX; Ratio SLVI is equivalent to Ratio SXXII; Ratio SLVII is equivalent to Ratio SXXV; and Ratio SLVIII is equivalent to Ratio SXXXVIII.

RATIO SLIX: NEW-ACCOUNT QUOTATION ACTIVITY

$$\frac{\text{New accounts quoted}}{\text{Departmental total contacts}} = \frac{10 + 11}{a}$$

This ratio shows what portion of the total of the entire departmental contacts each man converted into quotes. It is the departmental equivalent of the man-effort Ratio SVII listed in Exhibit 7-3. The values show that Brown was more than twice as effective as Greene in this area, but the real proof of the pudding is the results of his contact effectiveness. Obviously, this is a function of the sales levels attained via the quotational acceptances and is consistent with the level of expenses necessary to attain the results.

RATIO SLX: NEW-CUSTOMER CONTACT ACTIVITY

$$\frac{\text{New accounts contacted}}{\text{Departmental total contacts}} = \frac{7}{a}$$

This ratio shows the proportion of the department's total number of accounts contacted that was devoted to new customer contacts. It shows the effort being put forth to obtain new customers and is the departmental equivalent of man-effort Ratio SXXIX. Here Brown again leads, but how this effort affects the over-all sales picture is a matter we have discussed several times before. Top management is particularly interested in the departmental equivalent of this ratio, for as this ratio value increases, so does the prospect of obtaining new business.

Again, it is worthwhile mentioning that the element of expenses in total, or in its various categories, can be appended to any of the ratios to give expense effect to the values. This may be helpful in appraising a local situation, but is not necessarily the soundest way to control the trends. We shall see how it works later on.

Even if management does not carry these ratios beyond the elementary form, it will still derive a degree of evaluation and control superior to what it gets from consulting unweighted data. This information is easy to prepare and can be kept cumulatively for each man and by upper management for the department as a whole.

For larger companies, the author especially recommends this procedure as ideally suited for tabulating and data-processing equipment. In some applications, the author was consulted on systems whereby ratios were created by "addressing" the processing equipment. Cumulative records were stored on memory systems, and limits set on other ratio values, which triggered management to action when exceeded. Because of all the variations that normally take place in larger corporations, properly designed data processing will provide the rapid decisions in all areas as well, for the total integration of data for company-wide decision making.

The smaller companies can derive great benefits from the simple and advanced ratios for evaluation and control by simple computation.

PROBLEMS

1. Show how a sales-activity statistic can be given performance meaning.
2. Show how the statistic can be given economic meaning.
3. Explain the differences between sales productivity, activity, attempts, performances, trends.
4. Following the pattern of Exhibit 7-2, construct a table of basic variations for an elementary sales ratio to evaluate new-customer, existing-product productivity. Show all formulas and values for the four men and department.
5. In Exhibit 7-2, which variation would you use to determine the salesman responsible for selling most of the department's new accounts, the company's new items?

6. Construct a ratio to show the balance between the sales to new customers for existing products and sales to existing customers for new products.
7. Explain the uses of the following elementary sales ratios and the activities affecting their values and discuss under what circumstances (negative and positive) they may rise or fall:
   a. Ratios SVII, SIX
   b. Ratios SXV, SXVI
   c. Ratios SXXI, SXXIV
   d. Ratios SXXVII, SLIII
   e. Ratios SLIV, SLVII
8. Give expense meaning to the following elementary sales ratios (by constructing a new ratio for each):
   a. Ratio SV
   b. Ratio SVII
   c. Ratio SVIII
   d. Ratio SXIV
   e. Ratio SXIX
   f. Ratio SXXVII

CHAPTER 8 *Elementary Sales Ratios for Evaluating Product Activity*

The previous chapter dealt with means of analyzing and appraising how effective the individual salesmen were in their contacting activity, the resulting productivity, and the economic levels attained in the performance of those functions. From this analysis, also, the total department's performance could be assessed. The factors upon which these evaluations were made included the type of customer, whether he was an existing one or a new one; the type of product, whether it was part of the existing product line or a new one recently developed; and the amount of expenses incurred and their nature.

With these indices sales management could determine the weak and strong points of the men and thus give management a target for counseling and strengthening. They pointed out the major "man" characteristics so that intelligent management could capitalize on them to the advantage of the company. They provided sales management with a balanced evaluation, which could then be used as a yardstick to determine whether the men were actually implementing the expressed aims and directives of sales management. Finally, they provided upper management with trend figures so necessary to the planning, as well as a check on the effectiveness of the sales management.

Product Evaluation

The previous chapter provided guides by which the efforts of the men could be directed to the right territories, customers, etc., and in addition showed how well they were doing. It did not, however, show how well the individual products were doing; how much it cost to promote and sell them; which customers and territories responded most favorably; etc.

The previous chapter evaluated man performance; this chapter assesses product performance without reference to individual men.

This chapter sets up ratios which show what effect the sales efforts

have on the sales of specific products. Such an analysis is an essential part of managerial control, for it shows the trends for the acceptance of various products by types of customers, territories, etc. It also shows the relative selling costs of different products.

These are vital economic considerations. When a new product has been developed, a sum of money has been spent. Management is interested in seeing that its investment is made economical by sales of that item large enough to amortize that developmental expense. This is another way of saying that management seeks to justify its judgment in having made the decision to develop the new product.

Intelligent management should have constant control over the factors that can ensure a favorable result. There is little point in analyzing the economic history of a new product one year after it was given to the sales group. Among other things, this study will show that x amount was spent for development, to which was added y amount for sales expenses. This will be compared with the actual sales and the amount of economic gain contributed by the sales. If there was an over-all gain, management will be satisfied. But if there was a loss, what can be done about it now and what is to be done in the future?

Obviously, nothing can be done about the past year's record—that's ancient history, like all managing after the facts. And if insufficient data were accumulated during the first year, how can a plan for the following year's activity be designed?

Protect Investment in Product

As we have said repeatedly throughout this book, managing must be done during the facts, while the facts and events are being born. We have also said that sales come from quotations and contacts: the more contacts properly made, the more sales must result. Therefore an investment in a new product must be enhanced and protected by requiring a certain type and a certain level in the magnitude of the sales effort. In this type of evaluation, we are interested only in the effort put forth by the department on behalf of certain products. Which of the men contribute most to specific product activity is a subject to be referred to Chapter 7.

It is obvious that management is more interested in the sales success of a product which costs them $50,000 to develop than in one in which they have invested $1,000 of developmental money. Trends toward these successes rest with the amount of contact effort put forth for these products, and this must be under constant policing. So again, one-fact management is inadequate: the total sales level attained may still not be consonant with the needs of management, and development expense recovery surely is one of those needs.

But this is not all. Suppose the cost of contacting and selling on behalf of high-development-cost products is likewise high (of course, this should have been evaluated as part of a market survey in the early stages of the product's development), management would surely want to know this in order to make decisions and control the effort. Simple ratios incorporating the elements of expenses would give the needed trend information. In some cases, management decides to write off the developmental expense as a loss and gives up the idea of selling a particular new product when it discovers that the contacting, promotional, and selling expenses are uneconomically high. These can so burden the product's selling price as to price the company out of its markets.

Naturally, there are many more considerations that enter here before a decision like this can be made. A principal factor is the value of the lost expense recovery caused by the removal of the product. Nevertheless, this expense element must be watched and optimized lest it create large loss elements in the gross income of the company.

Product Expense Recovery

Product-activity assessment is by no means confined to new products. Again, in evaluating sales performance on total sales, management may be doing itself a gross disservice. In a company making more than one product, there can exist within the same gross sales level an infinite sales-product mix and an infinite production utilization-product mix. The sales-product mix refers to the fact that a given gross sales level can be composed of different individual product sales. Where each product has a different profit margin, the profit contributions from each are variable, and so the final gross profit margin on the gross sales is subject to this product mix.

The other side of the coin is that the varying sales of each product comprising this same gross sales level cause variations in the level of production-equipment utilization, and this in turn varies the amount of fixed-expense recovery made by the company. Thus a given gross sales level can have a wide effect on the amount of fixed-expense recovery gained by the company, because of the nature of the product mix and the magnitude of the sales volume of each product in the mix.

Thus it is essential that management prepare target data or other data by which it can inform the sales manager of the needs for expense recovery in production. This is a major step in the integration of sales and production, discussed in Chapter 10. Once the data are available, the sales manager must include as part of his managing the effort to obtain a specified product mix. It is accomplished by the use of these same ratios, which show the contact, quotational, and sales productivity *by product.*

Primary Data Required

Since ratios will be set up to evaluate product activity rather than man activity, the data reported and summarized for each man will now have to be compiled in a different form. Exhibit 6-1 showed the form in which the activity data were summarized. Then Exhibit 7-1 showed how *man* data were extracted from this form. Exhibit 8-1 shows how *product* data are extracted from this same form. Exhibit 8-2 shows the primary data which were taken from this product summary analysis,

EXHIBIT 8-1. WEEKLY PRODUCT SUMMARY ANALYSIS

Product Summary Analysis

Territory_____ Week ended_____

Product	Man	Contacts			Amount sold				Amount quoted				Expenses			
					Type of account								Auto		Entertain.	
		Total	Prospects	Customers	New		Exist.		New		Exist.		$	Miles	Prosp.	Cust.
					No.	$	No.	$	No.	$	No.	$				
	Jones															
a	Smith															
b	Brown															
	Greene															
Total																
	Jones															
a	Smith															
c	Brown															
	Greene															
Total																
Total																
	Jones															
Z	Smith															
Z	Brown															
	Greene															
Total																

Exhibit 8-2. Primary Sales Data (Product)

Code	Activity	Product							Department
		ab	*ac*	*bc*	*cd*	*WW*	*YY*	*ZZ*	
58	Total contacts	*36*	*27*	*21*	*31*	*11*	*14*	*12*	*152*
39	To new customers	10	11	9	9	5	8	9	61
40	To existing customers	26	16	12	22	6	6	3	91
41	Total customers sold and quoted.	*24*	*18*	*7*	*20*	*11*	*9*	*2*	*91*
42	Sold new customers	2	2	1	3	2	0	1	11
43	Sold existing customers.	12	7	1	5	5	4	0	34
44	Quoted new customers	4	5	1	4	3	4	1	22
45	Quoted existing customers	6	4	4	8	1	1	0	24
46	Total amount sold and quoted.	*$5,895*	*$4,280*	*$760*	*$5,210*	*$3,070*	*$1,600*	*$130*	*$20,945*
47	Sold new customers	480	360	40	360	980	0	40	2,260
48	Sold existing customers.	3,100	2,360	80	2,700	1,080	1,370	0	10,690
49	Quoted new customers	940	685	120	450	110	140	90	2,535
50	Quoted existing customers.	1,375	875	520	1,700	900	90	0	5,460
51	Total field cost.	*140.10*	*152.20*	*89.80*	*161.60*	*44.20*	*54.80*	*72.80*	*715.50*
52	Total automobile expense	27.20	39.20	32.80	36.00	3.60	4.00	19.20	162.00
53	Total entertainment expense.	36.90	51.00	23.00	55.60	18.60	26.80	21.60	233.50
54	For new customers	20 20	4.00	6.50	31.60	12.40	3.40	21.60	99.70
55	For existing customers	16 70	47.00	16.50	24.00	6.20	23.40	0	133.80
56	Total automobile and entertainment	64.10	90 20	55 80	91.60	22.20	30.80	40 80	395 50
57	Salary	76.00	62.00	34.00	70.00	22.00	24.00	32 00	320.00

which uses the same data as originally accumulated in Exhibit 6-1; that is, the primary data appearing on Exhibits 7-1 and 8-2 are exactly the same but in different forms. Exhibit 8-3 shows a list of some ratios developed from the primary data of Exhibit 8-2.

Notice that the form of the ratios is the same as those listed in Chapter 7. Those listed in Exhibit 8-3 are of the same type as those listed on Exhibits 7-3 to 7-5. Some new ratios are also added. For example, Ratio SPIV of Exhibit 8-3 is the same as Ratio SIV; Ratio SPXXII, the same as Ratio SXXII; Ratio SPXXXIX, the same as Ratio SXXXIX; Ratio SPXL, the same as Ratio SXL. Obviously, the only difference between the ratios of Exhibit 8-3 and that of Exhibit 7-3 is whether the values apply to products or men, respectively. Consequently, explanations which apply to the ratios of Chapter 7 for man effort and man comparison apply here to products with equal force, and these explanations do not have to be repeated in this chapter. Those that have not been mentioned previously (Ratios SPLXI to SPLXXIII) are left for the reader to ponder.

Exhibit 8-3 is a selection of typical ratios as applied to the seven products, together with the values applying to the products. The list of ratios is by no means limited to what is shown in this exhibit. Hundreds of product ratios can be developed to suit specific needs.

Impact of Product Activity

Since descriptions of individual ratios are unnecessary, let's turn our attention to the inferences that can be drawn from the differences in the product activity values.

Ratio SPIV shows that new product *WW* gets more sales per contact, with products *cd* and *YY* following in that order. Ratio SPXXII shows that product *cd* has a higher dollar value per sale, with products *YY* and *ac* following in order; product *WW* is in fourth place. Ratio SPLXI shows that there were no sales of new product *YY* to new customers, and product *WW* leads with product *ab* close behind. Obviously, these three ratios tell us that new product *ZZ* requires many contacts before an order is landed or that the return per contact is low. Ratio SPXXII tells us that both assumptions are correct.

Obviously, product *ZZ* is one to watch. If there is quite a sum invested in its development, then the salesmen should be directed to spend more contact effort on its behalf, and then sales management should police these ratios to see that this directive is followed.

Let's look at some of the expense-type ratios. Ratio SPXXXIX shows that new product *WW* has the most favorable value; that is, it took less expense cents to produce a dollar's worth of product *WW* sales. This is followed by products *ab* and *YY*. New product *ZZ* was again

EXHIBIT 8-3. ELEMENTARY SALES RATIOS (PRODUCT)

Number of ratio and title	Formula	Ratio value of product							Department
		ab	*ac*	*bc*	*cd*	*WW*	*YY*	*ZZ*	
SPIV: sales-contact yield	$\frac{47 + 48}{58}$	99 5	101	5.7	98.8	187	97	3.3	85.2
SPXXII: average account sales	$\frac{47 + 48}{42 + 43}$	256	302	60	382	294	342	40	288
SPXXIX: new customer contact activity	$\frac{39}{58}$	0.278	0.407	0.428	0.29	0.455	0.57	0.75	0.40
SPXXXIX: expense productivity	$\frac{47 + 48}{51}$	25.6	17.9	1.34	18 9	44.7	25	0.55	18.1
SPXL: expense contact cost	$\frac{51}{58}$	3.9	5.65	4 27	5 21	4 01	3.91	6.06	4.70
SPXLI: entertainment economy	$\frac{47 + 48}{53}$	97	53.4	5 2	55	111	51	1.85	55.6
SPXLII: new account entertainment economy	$\frac{47}{54}$	23.8	90	6.15	11 4	79	0	1.85	22.7
SPXLIII: existing account entertainment economy	$\frac{48}{55}$	186	50 2	4 85	113	174	58.6	.....	79.8
SPXLV: new account order entertainment expense	$\frac{54}{42}$	10.10	2 00	6.50	10.53	6 20	.....	21.60	9 05
SPXLVI: sales productivity	$\frac{47 + 48}{y}$	0 276	0.21	0 009	0.236	0 159	1.06	0 003	

SPLXI: average new account sale	$\frac{47}{42}$	240	180	40	120	490	0	40	206
SPLXII: new customer sales productivity	$\frac{47}{y}$	0.037	0.028	0 003	0.028	0.076	.....	0 003	
SPLXIII: average account expense	$\frac{51}{42 + 43}$	10	16.9	44.9	20 2	6.33	13.7	72 8	15.9
SPLXIV: average order contacts	$\frac{58}{42 + 43}$	2.57	3.0	10 5	3.9	1.57	4.66	12	3.47
SPLXV: average order potential contacts	$\frac{58}{41}$	1.5	1.5	3	1.57	1	1.55	6	1.67
SPLXVI: average new-order contacts	$\frac{39}{42}$	5	5.5	9	3	2.5	.....	9	5.55
SPLXVII: new sales contact yield	$\frac{47}{58}$	13.3	13.3	1.9	11.6	89	.....	3.33	14.9
SPLXVIII: entertainment order expense	$\frac{53}{42 + 43}$	2.64	5.66	11 50	6.95	2 66	6.70	21 60	5 20
SPLXIX: nonsalary expense productivity	$\frac{47 + 48}{56}$	55.8	30 2	2 15	33.4	92 8	45 5	1 0	32.5
SPLXX: nonsalary contact cost	$\frac{56}{58}$	1.78	3.32	2 66	2.95	2.05	2 2	3.4	2.6
SPLXXI: nonsalary order expense	$\frac{47 + 48}{52}$	131.5	6.95	3.66	85.00	572	343	2.08	80
SPLXXII: automobile expense economy	$\frac{56}{47 + 48}$	0.018	0.033	0.465	0.030	0.011	0.023	1.02	0.0305
SPLXXIII: sales dollar expense	$\frac{51}{47 + 48}$	0.039	0.056	0.748	0.053	0.021	0.04	1.82	0.055

the poorest performer, requiring the most expenses to produce a dolla of sales. This circumstance is borne out by Ratios SPXL and SPLXIII

An interesting comparison is one made between Ratio SPXLII anc Ratio SPXLIII. This shows the difference between the productivity o the entertainment expense on new or existing customers for each of the seven products. Ratio SPXLII shows that product *ac* rated highest. This was due to the fact that most of the men spent little on entertainmen when promoting this product because it was an existing one—one which had received wide customer acceptance over the years—and s they felt it was not necessary to spend moneys on it. Product *WW* seems to have responded to the entertainment expense; not so produc *ZZ;* and it is probable that the amount spent on product *ab* was un necessary. Nevertheless, these values showed what was actually in curred in this period.

On the other hand, product *ab* responded best when the entertain ment and sales were made to existing customers. This was followed b products *WW, cd,* and *YY.* In this case product *ac* rated in fifth place The ranking of the seven products for both these ratios shows a con siderable interchange, which means that separate expense policies fo the sale of the various products should be established for new and fo existing customers. Of course, this is to be done only if there is a con stant pattern similar to that shown by these ratios.

Contact Costs

Exhibit 8-4 is a listing of four major cost ratios, their formulas, anc their values. Using the same data as originally presented in Chapter 7

EXHIBIT 8-4. PRODUCT COST RATIOS

Ratio no.	Cost of:	Formula	Ratio value, dollars
SCA	Selling each new-product order	$= \frac{51(WW \text{ to } ZZ)}{42 + 43(WW \text{ to } ZZ)}$	$= \frac{171.80}{12} = 14.34$
SCB	Selling each existing-product order	$= \frac{51(ab \text{ to } cd)}{42 + 43(ab \text{ to } ZZ)}$	$= \frac{543.70}{33} = 16.47$
SCC	Selling each new-product dollar	$= \frac{51(WW \text{ to } ZZ)}{47 + 48(NW \text{ to } ZZ)}$	$= \frac{171.80}{3470} = 0.0495$
SCD	Selling each existing-product dollar	$= \frac{51(ab \text{ to } cd)}{47 + 48(ab \text{ to } cd)}$	$= \frac{543.70}{9480} = 0.0572$

it shows that on the average it costs less to sell a new-product orde and a new-product dollar than it does an existing-product order anc dollar.

Product-performance Summary

Product ZZ appears to be a poor performer as far as the sales department is concerned. It gets the lowest level of sales per contact; it has the lowest average order value; and it requires the most expenses per sales dollar—all this from the aspect of the isolated sales-function evaluation. However, from the aspect of the benefits that the smallest amount of these sales has for production, all the above sales unfunctionality may be unimportant. In the broad company-wide picture, it might be good business to tolerate the excess sales efforts and costs to achieve a net gain for the company. "Excess" is, after all, a relative, not an absolute, term. What is excess in the isolated situation of sales by comparison with other product scores may be a positive aspect when considered in a larger economic framework.

On the other hand, product *bc* is almost as poor a *sales* performer, but as we shall see later on, the effect of product *bc* on the total economy is almost the reverse of that of product ZZ.

Product *WW*, which is herein receiving *sales* praise, likewise has an entirely different effect on the total economy of the company, as will be shown in a later chapter.

One might ask why we use these ratios at all until we have some further insight into the economy of the other areas of the company. The answer is that the ratios or controls provide us with an objective measure. If sales management is told to push product ZZ (irrespective of its poor *sales* economy) because it benefits the company, the indices that reveal the doings of product ZZ are watched for movement. Management of the indices does not imply making them all go up or down, but simply going to limits prescribed by self or others for the accomplishment of specific goals. Similarly, as we shall see later, sales management will be told to back off on the activity of product *WW*. The indices are the barometers.

PROBLEMS

1. What is the purpose of segregating sales effort "by product" as well as "by man"?
2. An electrical-devices manufacturing company employs 450 people in the multiproduct manufacturing of "standard catalogue" items. It employs its own sales force of twelve and has five standard "lines." Outline a card-tabulating system for rapid collation and reporting of sales-effort data by man, products, territories, and customers.
3. Define product expense recovery. How does this recovery affect the economy of the company?
4. What is the difference between the products' expense recovery and the production facilities' expense recovery?

5. Prepare the equivalent of Exhibit 7-2 "by product" instead of "by man." What are the advantages of doing this?
6. How are the products' developmental expenses recovered? What are the ratios that measure this?
7. Explain the purpose of the following ratios:
   a. SPLXI, SPLXII, SPLXIII
   b. SPLXIV, SPLXV, SPLXVI
   c. SPLXVII, SPLXVIII, SPLXIX
   d. SPLXX, SPLXXI, SPLXXII, SPLXXIII

CHAPTER 9 *Advanced Evaluation and Control of the Sales Function*

The previous two chapters in the sales section dealt with the development of elementary ratios for evaluating man effort and product activity. These ratios showed values for one short period and are useful to the sales manager in localizing difficulties and in checking on the men's conformity to directives from the sales manager respecting type of product, customer, territory, expense level, and nature. By means of the ratio, especially if the values follow a trend, he can appraise the characteristics of his men, their habits, patience, persistence, motivations for certain types of sales work, drives, etc. However, there are some matters which cannot really be evaluated in a short period. These factors influence the manager's predictions concerning the longer-range performances of his men.

Advanced Ratios: First Group

Single-period evaluations of men based on the elementary ratios cannot possibly appraise expected quotational performance; that is, the immediate-period ratio value gives the amount of quotation per contact but can in no way state what percentage of these quotational dollars will come to fruition. To do this one would need a crystal ball to see the future or one must necessarily use what the quotational acceptance or mortality has been in the past to modify present-period performance. Therefore, in this first group of advanced ratios, historical quotational information is presented.

Another vital factor in the management of sales is the question of customers' potential and how the men are functioning with respect to it. Selling can be hit-and-miss, with maximization being the prime motive, or it can be designed to provide the company with the best stability possible in its sales structure. Invariably, this greater stability is accompanied by higher sales at less effort and expense.

The thesis behind the introduction of the consideration of customers' potential as a sales-evaluation factor rests with the assumption that, in the average company, it is less desirable to sell $5 million per year to 4 customers that buy $4.7 million and 40 customers that buy the other $300,000 than to sell the same $5 million to 44 customers that all buy more or less the same amount, even though the latter costs more in contact expenses.

Customers' Potential

This is probably one of the most used terms in the entire field of marketing and sales promotion. The measurement of potential is not objective since it is based on personal opinion, regardless of how scientific the forms or the questioners are that collect the data. In these chapters we are interested in the potential of the customer, that is, how much of the company's type of product he buys in total. We are interested in the territorial potential, i.e., the amount of the company's type of product that can be consumed in a given geographic area. We are also concerned with the market potential, that is, the trend or tendency for the public to interest themselves in, and ultimately to buy, the type of product made by the company.

Knowing this potential (the determinants of which are outside the scope of this book), the sales department can then set targets for obtaining as large a share of it as it can economically digest, at minimum acquisition cost, but consistent with the economic needs of its production facilities. The control of sales effort, then, is policing to see that potential is considered together with the other factors being measured.

We have mentioned in passing that by simply rotating customers and salesmen, the same contact effort gets a larger share of customers' potential. This is due in large measure to the compatibility of the customer's personality with that of the salesman assigned. Sales management should have some evaluation of this condition, indeed to know where and when the condition exists.

The first step that must be taken in this direction is a measure of the buying potential of each customer. While this is not a text in market research or marketing practices, the author feels impelled to pass along some ideas which he has used in helping the sales department determine customers' potential. The primary tool in this investigation is the salesman assigned to the account. From him comes some indication of what prospects his customer has for the coming year. The customer may provide hints as to plans for new drives, new products, a better year than last, penetrating new markets, etc.

An effective way is to elicit from the customer his own sales forecast. If not given directly, perhaps it can be obtained by inquiring

about what percentage over last year's volume he expects to reach. Then by reference to credit-reporting services, an income and expense statement helps arrive at an approximate answer. From that point on, one would have to know the breakdown of the customer's profit-and-loss statement in order to determine that percentage disbursed for the company's product. Once that was obtained, the customer's expected yearly disbursements for the type of product the company makes would not be too difficult to approximate.

The missing link is the cost of material in the customer's sales dollar. Very often trade associations will cooperate by supplying a typical P&L statement for their industry, and this would be a close enough guide. The Federal Trade Commission and the Department of Commerce are also excellent sources for typical expense breakdowns. On occasion the studies issued by the Internal Revenue Service showing corporation income tax returns will provide the information.

Geographic and Industry Potential

To obtain potential concerning a given territory, to ascertain whether or not it is economically justified to penetrate with a sales force, the trade-association-sponsored market surveys are helpful. If, say, a *dairy* trade association has available a market study on the ice-cream-eating trends of the people of Kansas, no doubt a figure somewhere near the figures of the study will come to fruition with Kansas dairy firms, sugar distributors, refrigerator manufacturers, and folding-carton companies in or near Kansas. Often such studies can be obtained free, on loan, or for a nominal printing charge.

Industry potential is quite another thing. A company in an industry should get a share of the over-all market in proportion to its size, ability, and location. If its share is out of proportion, then controls should be set up comparing its performance with the industry in general to ensure that it is coming close to the goal. This area of forecasting is probably the most difficult because of the lack of objective factors. Each of the reasons contributing to the deviation of the company from a norm in its industry cannot be given objective weight. Customers' tastes, needs, etc., are always changing; the location factor becomes a fluid variable; competition has volatile effect; etc. Management can only hope to develop as a goal a realistic level of the industry and then attempt to obtain or exceed it within economical operating limits.

Many public indices or economic indicators are available, such as national income and product, business sales and inventories, construction, factory payrolls, freight-car loadings, consumer prices, and purchasing power. These are contained in regular government publications. A cement company, for example, can possibly key its activity to con-

struction contracts awarded; and the agricultural-machinery manufacturer can peg his future activity to farm prices, always an indicator of farmer prosperity.

Be all this as it may, the first figure necessary is the potential of each customer for the company's type of product; that is, we want to know how much of the company's type of product customers buy per year in total and what percentage of that the company may properly expect to receive. We then want to evaluate and control the sales efforts accordingly.

Seller-Buyer Compatibility

Whether these potential studies are made or not, management must determine whether it has the right man for its customer. Just as a change in the product mix will increase profits within the same sales level, so a rotation of the same number of sales "bodies" between men and accounts can well boost the sales level of the company. In the author's experience, the best-organized sales department, complete with modern tabulating equipment, plenty of sales clerical support, as well as a fine line of products, did not ensure the optimum level of sales or mix of sales.

In one situation the company (we'll call it Black Mfg. Co.) was suffering for lack of sales in a particular product that was responsible for keeping two of their most expensive facilities busy. There were two customers in the immediate vicinity whose potential for buying these products was eight times greater than Black Mfg. Co. needed for full expense recovery on their two expensive production centers. There were three or four other customers also within Black's economical radius of delivery, but these were giving almost full potential to the company. The two local customers were giving Black a mere pittance—a tiny fraction of their potential. And as was discovered later, one of these two companies gave most of its potential to a competitor of Black's located well out of the immediate area. As a matter of fact, Black never considered this plant a competitor because of its distant location from the client's radius of service. In any case, the local company's buying practices appeared strange.

Had the ratios been in effect earlier, the condition would have been investigated sooner. It so happened that in the "testing back" of the ratios to see what their effect would have been if they had been developed and installed earlier, this great variance between customer potential and sales acquired from him was revealed.

It seems that the salesman defeated that company's purchasing agent for office in the Junior Chamber of Commerce a few years back. Changing the salesman assigned solved the problem.

In another case, the rejection was on the part of a *salesman,* a short individual, who just could not bring himself to make a thorough presentation to a certain customer who employed a tall purchasing agent.

Record Customer's Data

Both the historical quotational data and the figures concerning the customer's potential should be recorded in a form which allows ready and simple access.

The performances of quotational success, together with the acquisition of the customer's potential, are combined with the *cumulative* values of the elementary ratios of Chapter 7 to give the first group of the advanced ratios. The primary data used for these ratios are shown in tabular form in Exhibit 9-1. The ratios constructed from these data are shown for the individual men and for the department in Exhibit 9-2.

The primary data of Exhibit 9-1 show statistics for the current month: items numbered 61, 63, 64, and 66 to 68 and, for the year to date (six-month period), items 60, 62, 65, and 69 to 74. Item 59 refers to the customer's yearly potential, and item 60 is a percentage of that figure based on the elapsed time in the year. In this case it's six months, and therefore 50 per cent.

Some of these factors may need clarification:

Contacts refers to a communication by visit (in this case) irrespective of companies contacted. Two visits in the month to one company is counted as two contacts.

Cumulative sales this year means all the sales booked by the salesman in the six-month period.

The same is true of quotations.

Companies contacted means the number of *different* companies.

Companies sold and quoted means the number of *different* companies.

Total number of companies sold this year means number of *different* companies.

Thus there can be many contacts or many sold orders and few companies sold. This is evidence of the few-account type of salesman. Likewise there can be few sold orders and few companies sold. Obviously, the number of orders sold must always be more than the number of different companies sold.

Data Variations

Because of the large number of variables present in sales control, the author is attempting to show a different variance with each table drawn.

EXHIBIT 9-1. CUMULATIVE AND MONTHLY PRIMARY SALES DATA (MAN)

Code	Item	Salesman				Code	Department
		Jones	Smith	Brown	Greene		
59	Customer estimated yearly potential	$280,000	$260,000	$152,000	$264,000	nn	$956,000
60	Customer cumulative potential to this month	140,000	130,000	76,000	132,000	oo	478,000
61	Sales this month	3,700	4,600	3,600	9,100	pp	21,000
62	Cumulative sales this year	24,000	44,000	26,000	102,000	qq	196,000
63	Contacts this month	100	100	200	150	rr	550
64	Quotations this month	4,900	4,900	9,400	9,400	ss	28,600
65	Cumulative quota this year	62,000	62,000	118,000	118,000	tt	360,000
	This month total no. of:						
66	Companies contacted	14	30	30	28	uu	102
67	Companies quoted	12	12	26	16	vv	66
68	Companies sold	7	11	17	15	ww	50
69	Total number of companies sold this year	11	39	22	22	xx	94
70	Total cumulative expenses to this month	*2,910*	*3,810*	*3,480*	*3,230*	yy	*13,430*
71	Salary	2,080	2,080	2,080	2,080		8,320
72	Entertainment	430	1,020	890	760		3,100
73	Auto	400	710	510	390		2,010
74	Cumulative contacts to date	500	800	600	450	zz	2,350

It must be realized that the same format can be used for the analysis and control "by product" (as in Chapter 8), instead of "by man," which is shown in the table. Similarly, with the introduction of the "number of *different* companies" variance, the reader will be prompted to make his own controls, using that factor, of course where feasible and necessary.

It should be obvious that in an earlier chapter, when reference was made to a new or old customer or to total customers sold, the meaning was *number of orders.* And so an evaluation of salesmen was made in part by the comparison between the number of orders quoted and sold, or contacted and quoted, or contacted and sold, without giving weight to the number of *different* companies sold.

Just as it is important to sell as many contacts as seen, it is important that these orders are not all sold to the same customer. If that were done, we would have only as many different customers as there are salesmen. Obviously, then, an important evaluating factor is the *number of different companies sold* within the structure of the *number of orders sold.* Even if no sales take place, the evaluation of contact activity should always reflect this: there must be a balanced relationship between the number of different companies contacted and the number of contacts made. Too many, in dilettante fashion, is as bad as too little, and probably worse in some cases.

DESCRIPTIONS OF ADVANCED RATIOS

First Group

Now for the ratios or controls themselves:

RATIO SA: CUSTOMER POTENTIAL ACQUISITION

$$\frac{\text{Cumulative sales this year}}{\text{Customers' cumulative potential to this month}} = \frac{62}{60}$$

This ratio reveals a vital fact in judging the progress of each man and of the department. It relates the cumulative sales to date to the customer's estimated yearly potential linearly prorated to date. It requires the policing of the accuracy of the denominator—the customers' potential. If the potential has been underestimated, then the ratio can become unnaturally high and the man gets an unfairly high appraisal.

The ratio serves to uncover improper assignments of high-potential accounts to low producers. In the case of Jones, he is one of the lowest producers, and yet he controls accounts having the largest total potential of any other man. This surely does not make sense and is poor sales management. Here, then, is control.

EXHIBIT 9-2. ADVANCED SALES RATIOS (MAN)

Ratio no.	Ratio title	Formula	Ratio value of salesman:				Department
			Jones	Smith	Brown	Greene	
SA	Customer potential acquisition *	$\frac{62}{60}$	0.171	0 338	0 342	0.774	0.41
SB	Average contact return *	$\frac{61}{63}$	37	46	18	60.6	38 2
SC	Held accounts index	$\frac{69}{xx}$	0 117	0 415	0 234	0 234	
SD	Average monthly company sale *	$\frac{61}{68}$	529	418	212	606	420
SE	Average company sale *	$\frac{62}{69}$	2.18M	1 13M	1.18M	4 65M	2 08M
SF	Expense-potential index *	$\frac{60}{70}$	48.1	34.1	21.8	40 9	35.6
SG	Sales-expense index *	$\frac{62}{70}$	8.25	11.5	7 47	31 6	14.6
SH	Average entertainment economy *	$\frac{62}{72}$	54 8	43.1	29 2	134	63.2
SI	Entertainment-potential economy *	$\frac{60}{72}$	326	127	85 3	174	154
SJ	Quotation acceptance *	$\frac{62}{62 + 65}$	0.279	0.415	0 18	0 444	0.354

EXHIBIT 9-2. (*Continued*)

Ratio no.	Ratio title	Formula	Ratio value of salesman:				Department
			Jones	Smith	Brown	Greene	
SK	Quotation mortality*	$\frac{65 - 62}{65}$	0 613	0 29	0 78	0.135	0.456
SL	Expense productivity*	$\frac{65 + 62}{70}$	29 6	27 8	41.4	68.1	41.3
SM	Cumulative contact return*	$\frac{62}{74}$	48	55	43.5	227	83.5
SN	Average company contact index	$\frac{74}{69}$	45 5	20 5	27.3	20 4	25
SO	Average monthly company contact index	$\frac{66}{68}$	2	2.73	1.765	1 865	2.04
SP	Average company return	$\frac{68}{66}$	0 5	0 367	0.566	0 535	0.49

* Described in text.

The elementary ratios shown in earlier chapters simply established the fact that Jones was a low producer and that he handled his expenses in one way or another, etc. They did not show the impact of his productivity on the sales department in the way that *this control* shows it. For here we see just to what extent his productivity is depriving the company of its markets. Undoubtedly, what deceived the sales manager was the fact that he controlled or sold the fewest number of companies of the entire sales staff. What was not assessed up until now was that these 11 companies (see Exhibit 9-1) accounted for more potential than Smith's 39, Brown's 22, or Greene's 22.

The departmental index shows that as a department it was getting only 41 per cent of the customers' potential available to them. Again it is worthwhile repeating that just the assigning of a new man to an account can boost the purchases from that account. So while the total number of customers can remain the same and their potential can remain at the same level, very often a rotation of men and accounts can raise each man's acquisition of potential and improve the department's score of obtaining potential.

On the other hand, Smith and Brown obtain around the 34 per cent level of their customers' potential, but each under different circumstances. Smith gets it at a higher level of assigned potential and therefore has a higher sales level than Brown. Smith sells the most companies and apparently sells each about four times a year. Brown sells a little more than half the number of companies that Smith sells and apparently sells each about nine times per year. The sales manager should decide whether Brown is functioning as an order taker or salesman. If Brown and Smith switched methods under the circumstances, it would make more sense. Then Brown's persistence might yield a greater potential with the larger number of accounts and Smith could function to increase the number of accounts sold.

RATIO SB: AVERAGE CONTACT RETURN

$$\frac{\text{Sales this month}}{\text{Contacts this month}} = \frac{61}{63}$$

This ratio is a simple one and the equivalent of Ratio SIV on a monthly basis, six months later. Let's see what happened: Jones and Brown have not progressed too far. Smith, however, showed a decrease, confirming, more or less, that Smith should have less customers and should see them more often. Obviously, the company's competitors are getting the balance of the potential—a matter of $86,000.

Greene's average sales per contact also dropped in this month, and the department's score is less than one-half of what it was for a week

six months ago. Now perhaps that week was not really representative, so let's look at the ratio that shows the cumulative return per contact over a six-month period.

RATIO SM: CUMULATIVE CONTACT RETURN

$$\frac{\text{Cumulative sales this year}}{\text{Cumulative contacts to this month}} = \frac{62}{74}$$

This ratio shows the respective performances for a six-month period and places the men in the proper perspective. In spite of all the faults of Jones, he outperforms Brown, which, as was pointed out before, could be due to Brown's skipping around too fast. Notice that with sales counseling, his contact quantity is within reason. Smith, though, had more contacts because he was servicing more accounts, and if he slowed down to perhaps Brown's 600, Smith probably could have obtained a greater share of his customers' potential.

Jones *is* responding to counseling as seen in Ratio SD.

RATIO SD: AVERAGE MONTHLY COMPANY SALE

$$\frac{\text{Sales this month}}{\text{Companies sold this month}} = \frac{61}{68}$$

This ratio shows the average amount of sales obtained per different company sold. Jones is second only to Greene, and Brown is on bottom. Apparently, Jones spends a long time per month with each company. Perhaps a little less would not lower the sales level from his seven companies and may give him a chance to go after a few more. Brown, on the other hand, should perhaps spend more time on his visits with his customers and cut down on the number of times per year he sees them.

The activity and the use made of customers' potential are shown in Ratio SE.

RATIO SE: AVERAGE COMPANY SALE

$$\frac{\text{Cumulative sales this year}}{\text{Total number of companies sold this year}} = \frac{62}{69}$$

In this ratio Jones exceeds the department average and is second only to Greene. Going back to the basic data, Jones sold less than anyone else in the six-month period, but he managed to sell high to each company. Does Jones have the potential to develop into a second Greene? Would it be feasible for the company to transfer a few accounts to Jones (of course, properly compensating the salesman from whom they were transferred)?

Let's consider expenses for a moment. Should the level of expense disbursement bear a relationship to the potential sales available to each man? This is probably a reasonable assumption. But let's add one more: should not the level of these expenses be pegged to that level of potential which the man has demonstrated he can get, instead of to the "pie-in-the-sky" level? Let's see the results of a control set up to report just that, Ratio SF.

RATIO SF: EXPENSE-POTENTIAL INDEX

$$\frac{\text{Customers' cumulative potential to this month}}{\text{Cumulative expenses this year}} = \frac{60}{70}$$

This formula shows how expenses have been justified by the level of obtainable customers' potential. This is a basic ratio and shows that Jones leads ostensibly, with the most economical use of expenses, but only in so far as potential is concerned. Let's see what he did with the expenses and actual sales, according to Ratio SG.

RATIO SG: SALES-EXPENSE INDEX

$$\frac{\text{Cumulative sales this year}}{\text{Cumulative expenses this year}} = \frac{62}{70}$$

Here is a proof-of-the-pudding appraisal. Jones is second from the bottom on this one. Brown is on bottom. This ratio relates the actual performance for the expenses disbursed, and both Brown and Jones need counseling in this area.

In which type of expense did excesses occur with the men? For this we again move toward that expense item of wide latitude, entertainment.

RATIO SH: AVERAGE ENTERTAINMENT ECONOMY

$$\frac{\text{Cumulative sales this year}}{\text{Cumulative entertainment expenses}} = \frac{62}{72}$$

This ratio relates the sales to date with the entertainment expenses to date. It again shows Brown to be on bottom, followed by Smith and Jones next to the top. When compared with the previous ratio, it shows that Brown did not use entertainment expenses judiciously; Jones definitely knew what he was doing in this respect; and Smith's judgment was a little faulty. Since Jones did fine on the use of entertainment expenses, it is clear that what pulled down his over-all expense average was the use of other expenses, like mileage. This is a possible indication that Jones was just not a man to be sent into the "hinterlands."

RATIO SI: ENTERTAINMENT-POTENTIAL ECONOMY

$$\frac{\text{Customers' cumulative potential to this month}}{\text{Cumulative entertainment expenses}} = \frac{60}{72}$$

This ratio is a refinement of Ratio SF, which pinpoints the justification of the entertainment segment of expenses. It shows what trend the entertainment expenses should take, and this trend was achieved.

It should be a truism, but unfortunately it is not, that today's quotations are tomorrow's sales. Often a quotation does not become a sale, for many reasons. Among them are failure to get the full specifications from the customer, poor attitude, no follow-up, and delay in submitting estimates or samples. Expenses are incurred on behalf of both sales and quotations, and so a fair way of looking at the expense level incurred is to match it against the total of sales and quotations. There are obvious negative features of doing this. Some salesman may exploit that method if he knows it is in effect, and the sales department will wind up with a flood of worthless inquiries and will spend money preparing insincerely obtained quotations. The following ratios are some controls to help out.

RATIO SL: EXPENSE PRODUCTIVITY

$$\frac{\text{Cumulative sales and quotations this year}}{\text{Cumulative expenses this year}} = \frac{62 + 65}{70}$$

This ratio relates the total of sales to date and quotations to date with the cumulative expenses. We find that Brown is up high next to Greene and that Jones is second from the bottom. We then consult another important ratio, Ratio SK.

RATIO SK: QUOTATION MORTALITY

$$\frac{\text{Cumulative quotations to date} - \text{cumulative sales to date}}{\text{Cumulative quotations to date}} = \frac{65 - 62}{65}$$

This ratio takes into consideration that only a portion of quotations is converted into sales; the rest dies. How that trend continues during the year is the subject of this ratio. A positive equivalent of this control is Ratio SJ.

RATIO SJ: QUOTATION ACCEPTANCE

$$\frac{\text{Cumulative sales this year}}{\text{Cumulative sales and quotations this year}} = \frac{62}{62 + 65}$$

This ratio is the reciprocal of Ratio SK and shows the portion of total dollar activity which was converted into sales so far this year.

Both these ratios show the effectiveness with which quotations are

solicited and accepted. We all know that some companies should not try to quote on everything that comes along. The company that does that spends a great deal of money grinding out quotations. Not only does the quotation function cost money, it makes planning difficult. Salesmen should be trained to quote selectively.

In this instance, the measure of the economic justification of expenses is obtained by a relationship between Ratios SK, SL, and SN. This is one of the tertiary ratios, which are discussed in the following section.

Advanced Ratios: Second Group

A large number of elementary ratios may be constructed to evaluate certain segments of the sales effort. Each can accurately pinpoint a characteristic or a condition. However, there is a need for a more condensed type of evaluating tool for busy management, to provide it with guides and trends. These condensed tools are devised by combining ratios into third-order, or tertiary, type, similar to procedure in the advanced control of production.

For example, in the last section it was desired to inquire about the productivity of expenses, to see its economic justification, considering the degree of quotation acceptance salesmen were receiving, the level of expense disbursements, and the amount of activity each salesman was generating. To include all these factors of sales effort a tertiary ratio is needed.

The ratio in itself is not a control. In the above-mentioned example the tertiary ratio produced an index of expense justification. This evaluation was based on six months' data. Obviously, any final figure is the result of management or some type of overt control. However, *control,* as it is meant in this context, means plotting the movement of this ratio from period to period, comparing the movements of other ratios to it for the same period, and then observing points of optimum economy.

DESCRIPTIONS OF TERTIARY RATIOS

The following explanations of tertiary ratios are constructed from the data of this and previous sales chapters as listed on Exhibit 9-3.

TERTIARY RATIO SAA: SALES, EXPENSES, AND CONTACT EFFECTIVENESS

$$\frac{\text{Cumulative sales per expense dollar}}{\text{Cumulative contacts per company sold}} = \frac{SG}{SN} = \frac{62/70}{74/69}$$

This formula integrates the level of sales and the expenses of obtaining those sales with the effectiveness used in obtaining accounts from which the sales developed. Obviously, the greatest sales yield per expense dollar and/or the less contacts required to sell the account (since

Exhibit 9-3. Tertiary Sales Ratios (Man)

Ratio no.	Name of ratio	Formula	Ratio value of salesman: Jones	Smith	Brown	Greene	Department
SAA	Sales, expenses, and contact effectiveness	$\frac{SG}{SN}$	0 181	0.564	0 273	1.48	0.585
SBB	Contact–order productivity to department performance	SXX × SXXI	0.0383	0.116	0 0526	0.468	
SCC	New account probability	SXIX × SJ	0	0	0 0995	0.114	0.0694
SDD	New account probability—dollar-weighed	$SXIX \times SJ \times \frac{19 + 20}{s + t}$	0	0	0.012	0.0953	
SEE	Index of probability	SA × SJ	0 0477	0.140	0 0615	0.344	0.145
SFF	New sales and account performance	$SI \times SII \times \frac{19}{8}$	0	0	6.85	65.6	18.0
SGG	New product sales–contact–account performance	$\frac{SV \times (14 + 19)/(3 + 8)}{SXXVII}$	0	112	62 5	901	317
SHH	New customer sales–contact–account performance	$\frac{SV}{SXXIX \times 7/(8 + 9)}$	0	0.0232	0 0495	0.248	0.0788
SII	Current trend index	$\frac{SD}{SE}$	0 243	0.37	0 18	0.13	0.202
SJJ	Contact–potential performance	SA × SB	6.33	15 55	6.15	47	15.65
SKK	Account assignment justification	$\frac{62}{oo} \times SB$	1 85	4 24	0.98	12.95	
SLL	Expense justification	SF × SJ	13 4	14.15	3 93	18.15	12 6
SMM	Compatibility index	SA × SE	0.373	0 382	0 404	3.60	0.853
SNN	Over-all performance index	SA × SJ × SG	0.393	1.61	0.459	10.9	2.12

contacting activity invariably impacts on expenses) will make this ratio rise, as indication of a positive circumstance.

It is possible for the numerator to rise and result in a *decrease* in this ratio's value if the denominator rises faster. So while more sales can be produced for each dollar of expense, the number of contacts necessary to land the account might be high enough to drop the value of this ratio.

This is a valid movement and shows the direction in which the contact effectiveness is heading. In this type of situation, management can expect a later drop in the numerator as the expenses of the excessive contacting effort are added cumulatively. Again, as we have said throughout the book, the emphasis is on *relative,* and not absolute, values. No one can say what the "correct" or "best" value is for this ratio—that is unimportant. What is significant is the direction in which the values move once they have been placed in operation.

It is possible also for this ratio to remain still with an increase in sales per expense dollar. This would be caused by a drop in contacting effectiveness sufficient to offset the positive benefits of the higher expense yield. Likewise, a rise can be effected with *no* increase in the sales per expense dollar but just from an improved contact effectiveness. And again, a large enough rise in the sales per expense dollar can be great enough to overcome a drop in contacting effectiveness.

This ratio had great value to the sales manager in assessing the growth of his men with respect to their use of judgment in incurring expenses and their ability to obtain sales from fewer contacts, or, putting it another way, from making each contact count. Since the expense figure in this ratio is a gross one, it naturally includes the entertainment segment, which often has more effect on sales than on any other variable-expense element. Since this is a cumulative ratio and not a short-period one, the effects of judgment in incurring entertainment expense should be felt in total performance and no particular consideration need be given to it.

This type of tertiary ratio, as we learned from previous chapters, is a generalized type; that is, it is not constructed to discriminate in favor of types of customers or products. To simplify the concepts, the primary data of Exhibit 9-1 are presented in this generalized form. However, each of these ratios can be expanded to evaluate the variations encountered in new and existing customers and products.

TERTIARY RATIO SBB: CONTACT–ORDER PRODUCTIVITY TO DEPARTMENT PERFORMANCES

$$\frac{\text{Total no. accts. sold and quoted}}{\text{Total no. contacts made}} \times \frac{\text{total sales and quotations}}{\text{dept. total sales and quotations}}$$

$$= \text{SXX} \times \text{SXXI} = \frac{23 + 24}{1} \times \frac{12}{1}$$

This tertiary ratio relates the effectiveness of the contact effort, in terms of accounts sold and quoted, to the percentage of the department's total sales and quotation amounts obtained by the man. Whereas the man might have converted a large percentage of his contacts into quotes and sold accounts, which is certainly a positive factor, it may not have as much importance when this is compared with the resulting percentage of the dollar value of all sales and quotation amounts received in the department.

This ratio integrates both of these efforts. For example, a man can have a high score on converting contacts into sold and quoted accounts, which might be due to a high application of effort. It might also be due to a low number of contacts, with most of them developing into sold or quoted accounts. For this reason Ratio SXX by itself can be misleading. However, if the high score on Ratio SXX was really due to high effort, then the results of that effort should come to fruition in Ratio SXXI. If it doesn't, management had better look to Ratio SK to see if the reason for that is caused by a high quotational mortality. If the high score on Ratio SXX was due to a high performance on a few contacts, then that high value will immediately be reduced in this tertiary ratio by the presence of Ratio SXXI, which will feel the impact of the lower effort.

If, however, the ratio value does not decrease, in spite of the relatively low contact effort, this is an indication to management of a few-account salesman, where little contact effort has to be invested to produce sales.

TERTIARY RATIO SCC: NEW ACCOUNT PROBABILITY

$$\frac{\text{New acct. quotations}}{\text{Total sales}} \times \frac{\text{cumulative sales to date}}{\text{cumulative sales and quotations to date}}$$

$$= \text{SXIX} \times \text{SJ} = \frac{21 + 22}{25} \times \frac{62}{62 + 65}$$

This ratio shows the chances that the new-business attempts (Ratio SXIX) have in developing into new, booked business. Ratio SJ shows the quotational acceptance that the man has received to date, and this value is used to control the period performance he shows in his attempts to get new business. While the attempts may look fine in a given period, applying the quotation acceptance ratio places this period performance in a more balanced perspective. This tertiary ratio evaluates period performance only and is not used as a long-range appraiser of the man; it is a device for lending more managerial weight to the elementary ratio.

A glance at Exhibit 7-3 shows Brown leading Greene by over 2 to 1,

meaning that of both their total sales, Brown quoted a higher percentage of new business than Greene. However, the values of Ratio SJ of Exhibit 9-2 shows that Greene has well over double the success with his quotations that Brown has with his. As a matter of fact, Brown is the lowest in the department on quotation acceptance. Putting these two facts together in this tertiary ratio gives Greene the higher score.

This ratio is excellent as a counseling device. It "takes Brown down a peg" in his opinion of what he was really accomplishing. Sales management would know not to take his high period performance too seriously. The same thing happens with many men who do not have mature attitudes in their selling. When the word goes out that more new accounts are desired, some salesmen will work hard at this, to the sacrifice of their regular booked business. Some ratio values for Ratio SXIX climb well above 100, indicating that the value of new-account quotations is exceeding the total level of their individual sales.

This ratio can be made more incisive when an advanced ratio similar to Ratio SJ is used, which gives the quotation acceptance for *new-account* quotations rather than for the over-all quotational score, irrespective of the type of account.

The reader will notice that consideration was not given to the fact that even though Greene's score on Ratio SXIX was lower than Brown's, Greene still had three times the dollar value of new-account quotations. Arithmetically, the reason is that Greene's total sales was seven times that of Brown's, and so the ratio value for Greene decreased. The tertiary ratio can, of course, be modified to give weight to the added contribution that Greene was making to new-account attempts, and this would be done by multiplying this tertiary ratio by the percentage of new-account quotations each man brings in compared with the total of the department. This modifying ratio would be $(19 + 20)/(s + t)$. The values for the new tertiary ratio thus created is shown under Tertiary Ratio SDD.

This shows Greene to lead Brown by almost nine times. In Tertiary Ratio SCC, since no effect was given to the magnitude of the dollar contribution of Greene, he only led by a little over 10 per cent. Almost the same thing can be accomplished by the tertiary ratio $[(21 + 22)/y] \times$ SJ. Ratio $(21 + 22)/y$ shows that new quotations each man brought in compared with the *departmental* total sales. This ratio would weight the performance more in Greene's favor, but not as heavily as Tertiary Ratio SDD.

One concept should be kept in mind in attempting to give dollar weight to values in these types of ratios. Ratio SXIX gives Brown a higher weight because it deals in percentages, even though Greene's

dollar contribution is higher. As far as management is concerned, this may be enough, since the purpose of the ratio is to see how each man distributes his time and efforts; it rates how well proportioned each man is. When sales management is dealing with men of different maturities and motivations, it is difficult to rate them by a single common denominator. Nothing will discourage a young salesman so much as a low score and a feeling that his personally high efforts contribute little to the company.

The aim in these ratios, since they deal with relative and not absolute values, is to engender in the man a feeling of progress or regression *within himself* without resorting to a larger frame of reference. Without lending dollar weighting, the ratio evaluates progress of the man in comparison with *his* past performances. Allowing Ratio SXIX to enter the Tertiary Ratio SCC will give more weight to his personal progress than to his contribution to the department's growth. This can stimulate a man to higher and more tangible accomplishments.

Of course, the wise sales manager will counsel the man and will help him to proportion his time better, so that his personal efforts are closer to the over-all aims of the department and the company. In some situations, both Tertiary Ratios SCC and SDD were used. The former was published, and the sales manager held the latter as a counseling device between himself and each of his men. Needless to state, the manager must likewise guard against overconfidence created by the non-dollar-weighted ratios.

TERTIARY RATIO SEE: INDEX OF PROBABILITY

$$\frac{\text{Cumulative sales to date}}{\text{Cumulative customer potentials to date}} \times \frac{\text{cumulative sales to date}}{\text{cumulative sales and quotations to date}}$$

$$= \text{SA} \times \text{SJ} = \frac{62}{60} \times \frac{62}{62 + 65}$$

This ratio shows how the degree of customers' potential obtained by each man to date will be affected by the man's record of quotation acceptance. This ratio is a long-term evaluator of the men and the department. It relates sales performance on potential to the amount and successes of obtaining quotation opportunities and then converting them into sales. These factors are all interwoven into the fabric of a man's success as a salesman. High quotational acceptance is evidence that he elicited quotations selectively and followed them up carefully. This kind of talent should be related to the amount of customers' poten-

tial a man is assigned or allowed to build up, which should eventuate in both a high sales level and a high percentage of acquired customers' potential.

Brown's quotation acceptance is the lowest and as a consequence he was permitted to build up the lowest level of customers' potential, $76,000. This is good management. On this low potential he made a respectable showing, getting 34.2 per cent of the potential. Jones, on the other hand, has the next-lowest quotation-acceptance score because of his tendency to quote less than Brown, and he was allowed to build up the largest customers' potential of any man in the department. This was *not* good management, especially when the company should have known that Jones is not an aggressive quoter and therefore would probably attain the lowest percentage of his potential. He did exactly that, with his sales equaling 17.1 per cent of his customers' potential.

The effects of both these characteristics are felt in this tertiary ratio. Low scores are indications that management did not assign account potential in accordance with the expected performances of the men.

TERTIARY RATIO SFF: NEW SALES AND ACCOUNT PERFORMANCE

$$\frac{\text{New sold accts. for new prods.}}{\text{Total accts. sold}} \times \frac{\text{new accts. sales for new prods.}}{\text{total sales}} \times \frac{\text{new accts. sales for new prods.}}{\text{new sold accts. for new prods.}}$$

$$= \text{SI} \times \text{SII} \times \frac{19}{8} = \frac{8}{23} \times \frac{19}{25} \times \frac{19}{8}$$

As can be seen, items 8 cancel out, leaving the ratio to describe and evaluate the relationship between the new-customer, new-product accounts, and dollars sold as weighted in the total number of accounts and dollars sold. This tertiary ratio gives a balanced evaluation of the man's efforts to obtain new-product business from new customers, without giving undue weight to either large sales dollars or a great number of accounts sold.

This ratio weights the effects of both the accounts sold and the dollars involved and then gives it a rating for the sales dollars contributed to the department. So while Brown seems to lead in Ratio SI (Exhibit 7-3) and does not lag too badly in Ratio SII, the tempering by Ratio 19/8 accounts for the difference in the respective men's contributions to the department's record.

This tertiary ratio shows that while Brown's attempts were strong and he was heading in the right direction as far as proportioning his effort was concerned, the net effect on the department was a rating of

about one-ninth of Greene's. Like any of the others, this ratio can be expanded to show performances in other areas.

TERTIARY RATIO SGG: NEW PRODUCT SALES–CONTACT–ACCOUNT PERFORMANCES

$$\frac{\text{New product sales}}{\text{Total sales}} \times \frac{\text{total contacts}}{\text{new product contacts}} \times \frac{\text{new product sales}}{\text{new product accts. sold}} = \frac{\text{SVI} \times (14 + 19)/(3 + 8)}{\text{SXXVII}} = \frac{14 + 19}{25} \times \frac{14 + 19}{3 + 8} \times \frac{1}{27}$$

This ratio evaluates the economic meaning of the new-product contact effort by integrating the proportion of the total sales that it represents with the percentage of the total number of contacts it required to obtain those sales with the size of the new-product account opened. Again, this type of ratio can be constructed for other classes of products and customers. This tertiary ratio is most valuable for the sales managers as a period evaluator of performance. Upper management is certainly interested in the departmental equivalent of this ratio since it furnishes an idea of how well the department is being managed for that specific area of company interest.

Of course, if an aim of the company is the active promotion of new products, the men should be directed in a way which raises the value of this ratio. However, it may not always be so, as we demonstrated earlier in the book. Perhaps the company wishes to concentrate on opening new accounts, in which case this ratio would not be important and one which applied would have to be watched.

There are many things which could make this control vary up or down. Ratio SVI might go up either because of a rise in the new-product segment of total sales or because of the drop in over-all sales, and it might show a preoccupation with new-product business. If this is the case, it will be revealed by Ratio SXXVIII, which reduces the value of the tertiary ratio as *its* value increases, thereby lending perspective to the high value of Ratio SVI.

If Ratio SVI rises because of a larger segment of new-product sales, the effectiveness in obtaining those sales will be considered by the presence of Ratio SXXVIII. Obviously, as the segment of new-product sales rises, with lowered contact effort, this surely is a positive factor. Both of these circumstances are again modified by the size of the new-product order sold.

Unlike new-customer accounts opened, where the initial order size may not be important and may be sacrificed in favor of getting new accounts on the books, the new-product order may involve a high trans-

action cost. Since new as well as existing customers can be sold new products, management should look for a higher-average new-product sale per account sold than for an average new-customer sale per account sold. The average size of the new-product sale will have a direct effect on the value of this ratio.

TERTIARY RATIO SHH: NEW CUSTOMER SALES–CONTACT–ACCOUNT PERFORMANCE

$$\frac{\text{New customer sales}}{\text{Total sales}} \times \frac{\text{total contacts}}{\text{new customer contacts}} \times \frac{\text{new customer accts. sold}}{\text{new customer contacts}} = \frac{\text{SV}}{\text{SXXIX} \times 7/(8+9)} = \frac{19+20}{25} \times \frac{1}{7} \times \frac{8+9}{7}$$

This ratio is of a somewhat different character from the one described above. It evaluates the economic meaning of new-customer sales consistent with the proportion of total contacts necessary to obtain them and adds emphasis to the number of new accounts opened in proportion to the contacts made solely on their behalf. This type of ratio is excellent for use by the sales manager, and its departmental equivalent gives upper management an indication of the weighted direction in which the new-account effort is heading.

There are many internal events which will cause this ratio to move in either direction. If Ratio SV rises, the rise can be taken as positive if the segment of new customer sales is increasing. But if the ratio rises because of a decrease in total sales or because of a decrease in total sales amounting to more than the increase in new-customer sales, it may be negative. If the latter happens, then Ratio SXXXIX will tend to increase because of the drop in total contacts. This usually has the first effect, that is, of decreasing total sales, and it will reduce the value of this tertiary ratio. If, however the Ratio SV increases because of increase in the new customer segment of total sales, this will usually occur because of increasing new customer contacts. It will tend to decrease Ratio SXXIX, thereby raising the value of the tertiary ratio.

Both of these considerations will then be affected by the number of new accounts opened in relation to the number of new customer contacts made. In other words, the ratio $7/(8+9)$ gives the number of average new-customer contacts it took to open a new account. Since this was considered more important than the dollar value of the new accounts, the full effect of the ratio was used to modify the other; that is, irrespective of the result of the first two ratios, as more new accounts were opened per new contact, so the tertiary ratio value increased.

TERTIARY RATIO SII: CURRENT TREND INDEX

$$\frac{\text{Sales this month}}{\text{Companies sold this month}} \times \frac{\text{total no. companies sold to date}}{\text{cumulative sales to date}}$$

$$= \frac{SD}{SE} = \frac{61}{68} \times \frac{69}{62}$$

This ratio relates the average company sales this month with the average company sales to date, this year. (The values of the calculated ratios cover six months as the period "to date.") The purpose of this ratio is to see whether the men and the department are advancing over the previous six months' sales productivity, or lagging. If the ratio value is below 1.00, it shows that present productivity is lagging, and if it is above, the productivity is showing an improvement over the past period.

Of course, there are many reasons why current sales productivity may be considerably different from past efforts. First of all, it is possible to put in the same effort and not obtain the same results because of seasonal and regional variations. Another important factor could be the nature of the product mix being sold. A product-mix revision could have a dramatic effect on this ratio with or without the influences of seasonal fluctuations. This type of ratio has its maximum value when it is expanded to show trends for territories, products, and classes of customers. Smart management will usually make allowances, perhaps in the form of an applied variation percentage, to account for expected seasonal fluctuations. Then, from that point forward, this type of control becomes very sensitive and incisive.

Interestingly enough, in this tertiary-ratio value, Smith is the leader, with Jones next and, of all things, Greene on bottom. It certainly provides a reason for giving praise to Smith and Jones and investigating what happened to Greene. Perhaps Greene did not put in full time this month; perhaps he was content to rest on his laurels for a while.

TERTIARY RATIO SJJ: CONTACT–POTENTIAL PERFORMANCE

$$\frac{\text{Cumulative sales to date}}{\text{Customer cumulative potential to date}} \times \frac{\text{sales this month}}{\text{contacts this month}}$$

$$= SA \times SB = \frac{62}{60} \times \frac{61}{63}$$

This ratio relates what each man (and the department) did with the potential he controls to date so far this year (six months) with his contacting effectiveness. The relationship serves as an indicator as to how fast the man might speed up the acquisition of his customers' potential. In other words, this tertiary ratio shows the trend of the speed by which acquisition of customers' potential will be accomplished.

If it takes too many contacts to make sales, it will have a slowing effect on the speed of acquiring customers' potential, and so this tertiary ratio value drops. Since it is a monthly evaluator, then, as the relationship of monthly sales to monthly contacts required to make those sales improves, so do the chances of obtaining the customers' potential.

TERTIARY RATIO SKK: ACCOUNT ASSIGNMENT JUSTIFICATION INDEX

$$\frac{\text{Cumulative sales to date}}{\text{Departmental customer cumulative potential to date}} \times \frac{\text{sales this month}}{\text{contacts this month}} = \frac{62}{00} \times \text{SB}$$

This ratio relates what percentage of the total departmental customer potential was sold by each man to his sales-contact productivity for the current month. It shows the validity of the assignment of accounts to each man. Therefore it reveals the judgment of the sales manager in the way he assigned the accounts or permitted the accounts to be retained by the men.

The thesis underlying this tertiary ratio is that there should be a relationship between the potential that a man controls and his current success in contact productivity. If a man sells a high percentage of the departmental potential, this would be borne out by high monthly performance. However, if the man has a high contact productivity and sells a high level of departmental potential, management should check to see whether it has assigned to him sufficient account potential.

For example, Smith is next to the highest in selling the percentage of the department's total. He is next to highest in his contact productivity as well. This makes sense, and management should consider rotating accounts so as to give him a higher level of customer potential. This tertiary-ratio value shows that, regardless of what Ratio SA shows, Smith should be the next candidate in the department for having potential assigned to him.

TERTIARY RATIO SLL: EXPENSE JUSTIFICATION

$$\frac{\text{Customer cumulative potential to date}}{\text{Cumulative expenses to date}} \times \frac{\text{cumulative sales to date}}{\text{cumulative sales to date} + \text{cumulative quotations to date}} = \text{SF} \times \text{SJ} = \frac{60}{70} \times \frac{62}{62 + 65}$$

This ratio relates the degree of quotation acceptance to the expense level incurred, justified by the potential controlled by the man. As

expenses climb in relation to the potential held by the man, this ratio value decreases, and the only thing that can restore the drop is a previously high quotational-acceptance record, which gives promise of the eventual economy of the expenses.

According to the values shown in Exhibit 9-3, Brown was least justified in incurring his expense level. Smith incurred more expense to date than Brown, but was justified in so doing by a higher level of quotation acceptance and a higher customer potential. The reason for Jones's fairly high score on this tertiary ratio was a lower level of expenses to date, a higher quotation acceptance than Brown's, and a higher customer potential to cope with. Greene combined a reasonable level of expenses with the highest quotation acceptance in the department plus the target of the second-highest customer potential.

This ratio shows the long-range trend for expense justification, and like all the other general types, this one can be expanded to appraise other, more refined areas.

To determine the absolute justification of expenses, that is, one based on attained potential rather than on the maximum of the customers' potential, the equation for this type of ratio would have to be altered to admit a consideration of the percentage of potential attained.

TERTIARY RATIO SMM: COMPATIBILITY INDEX

$$\frac{\text{Cumulative sales to date}}{\text{Cust. cumulative potential to date}} \times \frac{\text{cumulative sales to date}}{\text{Total no. companies sold to date}} = \text{SA} \times \text{SE} = \frac{62}{60} \times \frac{62}{69}$$

This ratio relates the percentage of the customers' potential actually obtained to the average sale per company sold. It is very revealing of the degree of compatibility between the buyer and seller.

When the number of accounts sold for the sales made begins to rise, this is indication that small amounts of sales are coming from each or that a few accounts are supplying the major amounts, the others not being given sufficient attention. This is confirmed by the Ratio SA, which will decrease if the neglected or unsuccessfully contacted accounts have large potentials.

Of course, the decrease in this ratio value is originally started by the drop in Ratio SE, with an increase in the number of companies sold. It is a vital ratio and one that should be consulted regularly. It is a long-range evaluator, and it will show the growth of the men and of the department in terms of the sales manager's ability to rotate men and accounts properly. The ratio can be expanded for other variables, as pointed out before.

TERTIARY RATIO SNN: OVER-ALL PERFORMANCE INDEX

$$\frac{\text{Cumulative sales to date}}{\text{Customer cumulative potential to date}} \times \frac{\text{cumulative sales to date}}{\text{cumulative sales and quota to date}} \times \frac{\text{cumulative sales to date}}{\text{cumulative expenses to date}}$$

$$= \text{SA} \times \text{SJ} \times \text{SG} = \frac{62}{60} \times \frac{62}{62 + 65} \times \frac{62}{70}$$

This ratio is one of many over-all ratios by which the major areas of a man's efforts can be evaluated. It is a long-range running appraiser which shows the total effect of his (and the department's) performance in obtaining the amount of customer potential represented by the accounts which he presently holds and the performance on quotation acceptance (which hints as to future performances) plus the economy by which expenses were incurred.

It's clearly seen, by examining the values set down for this tertiary ratio in Exhibit 9-3, that Greene is unquestionably the top in his department, followed by Smith, Brown, and finally Jones. The small lead that Brown has above Jones can be explained by the fact that Brown has penetrated a higher degree of his customers' potential than Jones did, even though it was the smallest potential of any of the men. And while Brown fell below Jones in economy of expenses and in quotation acceptance, the drop was overcome by Brown's superior performance in obtaining the large share of potential. If this was evaluated on an absolute dollar basis, then Jones would have pulled ahead, even though he was slightly below Brown on the actual sales obtained.

This type of tertiary ratio gives equal weight to each of the three major areas being evaluated, which may or may not be in keeping with management's aims. It is always a function of the particular company, its products and markets, and the usually hard-to-change policies which have become deep-rooted over the years.

In one company, weights were given to these three segments. This company felt that its sales expense levels incurred had become a minor threat to profits, especially when so much was spent on quotations (involving a high transaction cost). This company was in the graphic arts industry, and it took an average of four hours each to prepare an estimate and a rough layout for the prospect's approval. When inquiries were accepted indiscriminately and quotations prepared on all that the men could bring in, plus what "walked in" over the telephone, the company's transaction expenses went sky-high. It was worth more to the company to have a high degree of quotation acceptance plus a low level of expenses per sales dollar (which automatically implies a *selectivity* in quotations) than it was to have a high customer potential acquisition. Therefore the equation of Tertiary Ratio SNN was modi-

fied to give effect to that expressed desire, and it was revised to $SA + 4(SJ \times SG)$, meaning that the last two terms of the equation were receiving four times more weight than the first. The factor of 4 was empirically selected as great enough to prevent the activity of Ratio SA from overshadowing the effects of Ratios SJ and SG.

Managerial Control of the Sales Function

Up to this point in the sales section, we have discussed methods of evaluating men and products in relation to the market covered and the economics effected. We have done the same in the production section. The last third of the book does the same for capital and financial matters. We have performed these evaluations by means of ratios constructed from primary or unweighted data, collated in such a form as to lend ease to the later application of these ratios.

Some of the ratios were rather simple; others more inclusive and complex. The simple ratios gave an average evaluation to the area under examination, such as gross sales per gross expense dollar. Or they pinpointed an area, such as dollars sold for new products to new customers per dollar of entertainment expense. These ratios furnished sales management a ready evaluation of how men performed. When the ratios were recast to reflect product activity, sales management could evaluate how the company's various products were doing for ease of selling, territorial acceptance, expenses required, etc. When either of these types of ratios was calculated on a departmental basis, it provided an evaluation of how the department as a whole was functioning in a specific activity area.

Then, in those situations which called for a condensed grasp of a particular major activity area, higher-order, or tertiary, ratios were constructed. These enabled management, particularly upper management, to discern the major trends which might be escaping the local sales management's attention. The latter was busy policing the subleties of the sales economy by use of the elementary ratios. The tertiary ratios involved new terms and combined some of the elementary ratios previously given.

However, ratio evaluating is not control; it is an on-the-spot assessment of what happened last week, last month, or in the last six months. Calculating the ratio provided no control or mechanism by which management could influence future events. Nor could management make a decision to take effect in the future until it knew the interplay between the variables existing in the ratios.

As we have said repeatedly, any action in one area of the company causes changes in other areas of the company, sometimes so slight that they go unnoticed. Managerial control means, first, acquiring a knowledge of how ratios move with respect to each other, from period to

period; secondly, picking out areas in their interrelationships which appear to show an optimum in the economy; and finally, before decisions are made, testing by means of ratio movements to find the optimum condition for supporting that decision. In that way the decision is made with due knowledge of the movement of the ratios affected by it (when it will be made) and of where and under what conditions and circumstances the future decision will produce the optimum positive effect for the company.

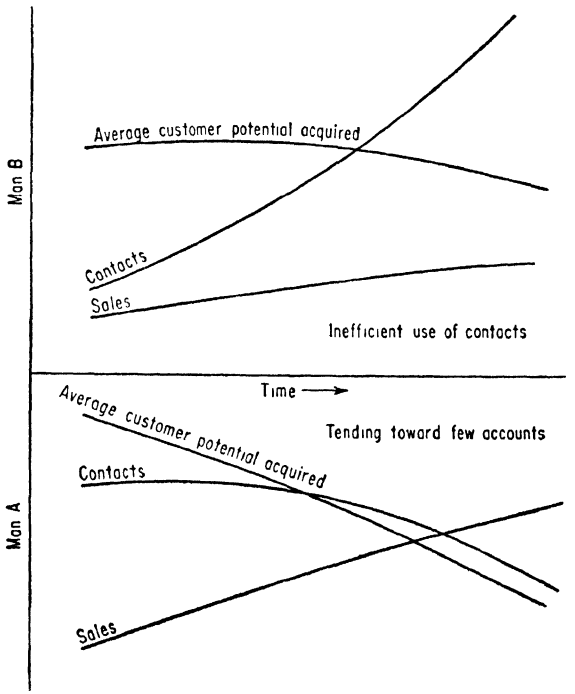
The following charts show typical movements of some of the ratios discussed, including charts that indicate the fallacy of acting on unweighted data. The chapter concludes with charts of specific company situations, and it diagnoses the troubles of each.

Clues to Salesmen's Habits

Exhibit 9-4 depicts the activities of two different salesmen in the department and shows how the sales manager can obtain clues. Man A, on the bottom of the chart, shows an increase in sales, but with a gradually reducing level of contacts and a sharper drop in the potential of the customers' accounts now held by him.

This situation is typical of those men who prefer to "build up a few

EXHIBIT 9-4. CLUES TO SALESMEN'S HABITS



good accounts" and then avoid trying to obtain any more accounts. Or they do not spend time with their other held accounts in an effort to acquire the maximum amount of potential from them. Instead, the contacting effort is diverted into the activity of gilding a few accounts, even to the point where they are in excess of the normal potential.

This takes the salesman less time to do, it is pleasanter, less tiring or tensing, allows him more leisure time, and provides satisfactory income. Under this circumstance, as we have pointed out before, such salesmen are really partial sales "bodies." And even though they are not doing anything wrong in the moral sense, they are rendering the sales-management effort somewhat impotent and depriving the department of the full load of their sales-contacting efforts.

This kind of salesman can be induced to follow management's aims, but it takes a special kind of financial incentive to make him do it. This subject is discussed at the end of this chapter.

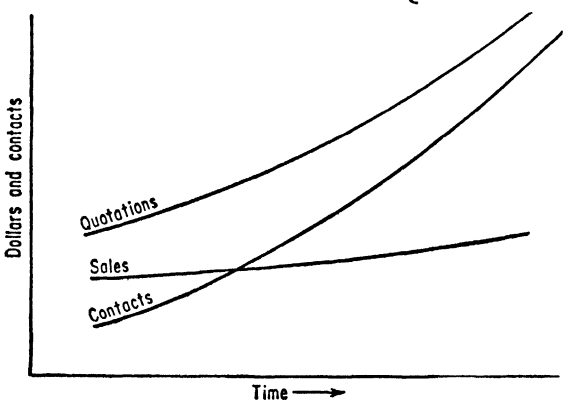
Man B, listed at the top of the chart, is quite another story. His contacts constantly rise, but his sales move ever so slowly upward, far slower than his contacting. Even though his sales are slowly rising, the amount of customers' potential he is acquiring is falling. This shows he is contacting the wrong customers. If a lower level of contacts were made, but to a different "account mix," a rise both in sales and customers' potential could occur.

This type of chart is one of the first tip-offs to the sales manager, one which calls for analysis of where the man spent his time and whom he saw. The manager should then suggest what he thinks is a better course of action. This chart will trace the selected course.

Indiscriminate Quoting

Exhibit 9-5 shows a situation where contacts rise rapidly and the quotations *almost as fast.* It shows immediately that the man (or the

EXHIBIT 9-5. INDISCRIMINATE QUOTING

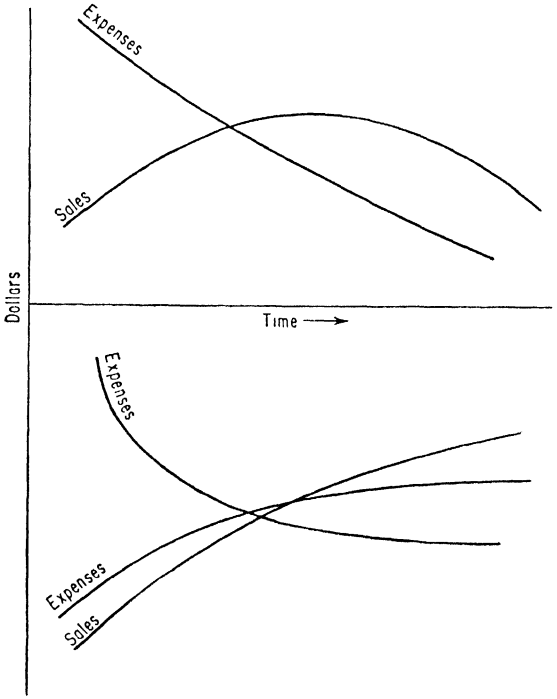


department) quotes to almost every contact. However, when this course is followed by practically no change in sales, then it can be assumed that the quotes are made indiscriminately (for one thing) and, just as important, the quotes are not being followed up, are not being prepared properly, or are overpriced.

Expense Sensitivity

Exhibit 9-6 shows the effect of expenses on sales. The top part shows a period in which sales are rising and the level of expense dropping.

EXHIBIT 9-6. SALES EXPENSE SENSITIVITY



This is fine. However, when an economy wave is started even after a drop in expenses, it can have a negative effect on sales. This is shown by the slowly tapering off and then dropping sales curve. It also shows extreme frugality in expenses.

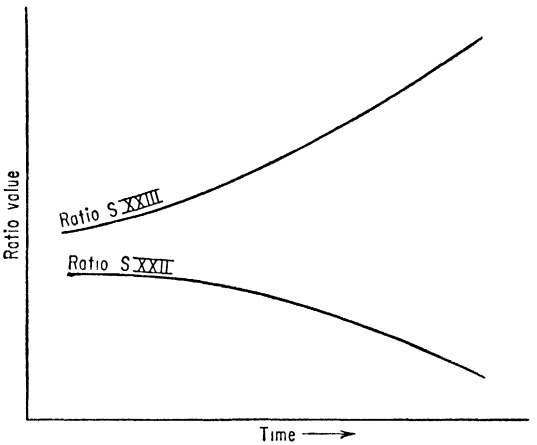
The lower part shows how the expense level can be optimized in relation to sales. We have said earlier that the size of the expense, particularly the entertainment expense, is not too important once it has reached a certain level. Below this level, sales may be affected; above this level, there is usually not much of an increase. The reader is invited

to select either of the two expense curves shown, depending on *his* relationship to the problem; that is, the expense level has to be optimized up or optimized down, depending on the state of the expenses before optimizing was desired.

Quotation Mortality

Exhibit 9-7 shows a movement between two elementary ratios. The increase in Ratio SXXIII shows that either few accounts are being quoted in relation to a level of quotation dollars or else that the amount

EXHIBIT 9-7. HIGH QUOTATION MORTALITY



Ratio S XXII = average account sale
Ratio S XXIII = average quotation

of quotation dollars per account quoted has risen. The drop in Ratio SXXII can either be due to the fact that a large number of accounts were sold in relation to a certain level of sales or else that the total sales per account sold is dropping.

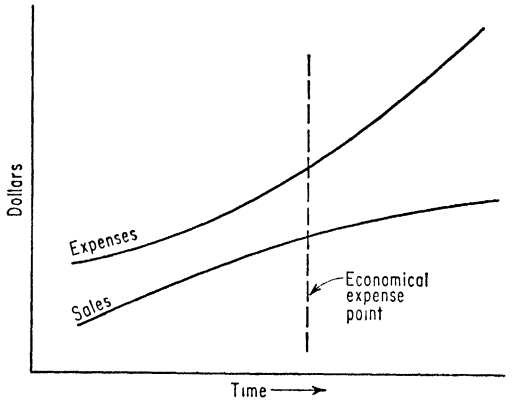
Since the rise in Ratio SXXIII is occurring at the same time that Ratio SXXII is dropping, it is clear that the quotations are not developing into sales, and therefore this condition shows a high quotation mortality. This relationship should be watched for each man, and top management should watch the departmental values of it so as to spot the trend quickly.

Optimum Expenses

Exhibit 9-8 shows how the economical expense point can be determined. This shows a condition where, up to a certain point, an increase

in expenses produces an increase in sales. Then, above this point, the expenses rise faster than the rise in sales. Management must determine whether the profits on the added sales are worth the increase in sales and the increases in risks and changes in the capital structure brought about by the support of these higher sales levels.

EXHIBIT 9-8. DETERMINATION OF ECONOMICAL EXPENSE LEVEL



This relationship applies to both the department as a whole and the individual men. In the case of men, it shows that added expenses are not achieving the desired effect. It also might be an indication of expense-account padding.

Primary Data versus Derived Ratios

Exhibit 9-9 shows a comparison between primary data and ratios which derive from it. The bottom portion charts three pieces of the data shown in Exhibit 9-1. Note the wide excursions in the data. From the looks of it, one might hastily conclude that Brown was a very active man, having the most companies sold and being the most useful in propagandizing the company's existence. The top shows the ratios which indicate that Brown was the poorest performer, at least from the aspect of these three pieces of data.

Comparison of Data Movements

Exhibit 9-10 takes four pieces of primary data listed on Exhibit 9-1, items 60, 70, 65, and 62, and plots their values on the lower portion of the chart. This makes very difficult the task of determining which men need what kind of assistance. The first step involves the three ratios shown in the top portion of the chart, namely, Ratios SA, SG, and SJ. This shows who leads and who lags in certain weighted areas.

EXHIBIT 9-9. PRIMARY DATA VERSUS ELEMENTARY MAN-PERFORMANCE RATIOS

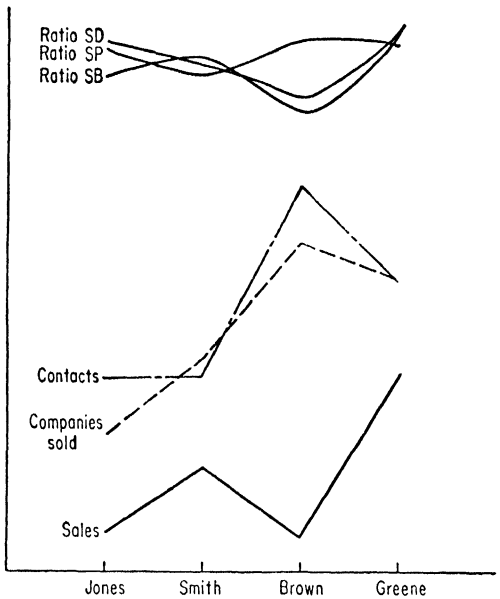
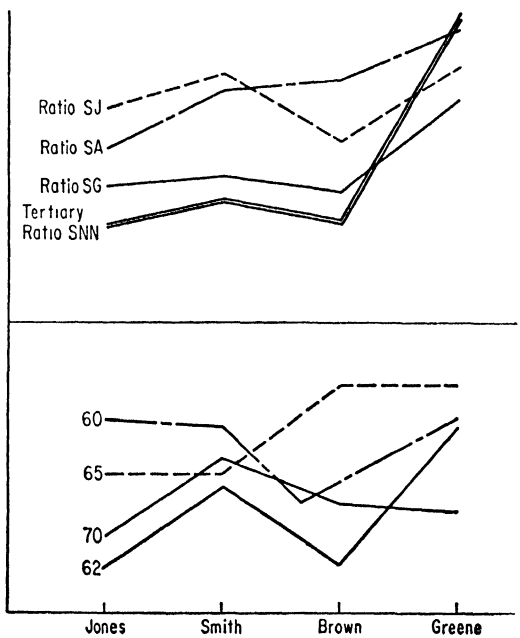


EXHIBIT 9-10. MOVEMENTS OF PRIMARY DATA: ADVANCED AND TERTIARY RATIOS FOR EVALUATING MAN PERFORMANCE

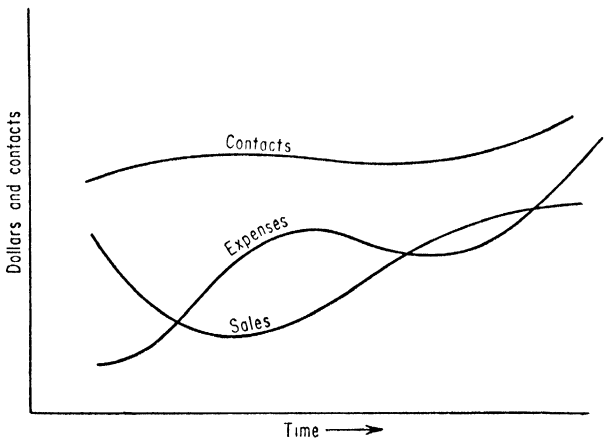


For an appraisal of over-all performance in these three areas, the Tertiary Ratio SNN is plotted, showing the balanced order of performance: Greene leads, Smith is next, then Brown, and last Jones.

Product Sales Activity

Exhibit 9-11 shows the movement of the activity of a given product from period to period. Three pieces of data are shown: contacts, expenses, and sales. Several interesting things can be spotted in this very simple representation of the movements. The first thing that catches our eye is the fact that at the beginning of the period, sales descend, with an increase in expenses and a relatively steady level of contacts.

EXHIBIT 9-11. MOVEMENT OF PRODUCT'S PROGRESS BY PRIMARY DATA



Does this have significance? Which man is responsible for this condition? If the ratio is developed departmentally and most of the men know of the acceptability of the product in the various areas, then just one man may be incurring expenses in the promotion of this product in areas that are uneconomical to penetrate.

About two-thirds through the period shown, it seems that sales are increasing, with a decrease in expenses and a decrease in contacts. What caused this? Was it that in this period the men were directed into a new territory? Was it due to a change in catalogue or other promotional material? Was there a rotation between accounts and men?

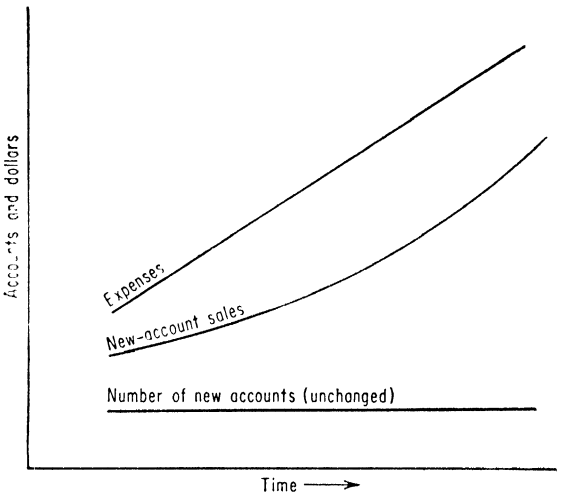
The chart shows that there is always a constant interplay between the variables and that favorable relationships are not accidental but are always caused by something which can be detected and planned for if desirable.

New Sales versus New Customers

Exhibit 9-12 is another product chart. This type of chart can be diagnostic. It shows an increase in new-account sales for the product, but this should not mislead the management. In this case, the increases are from the same two new accounts involved all along, as the number of new accounts has remained unchanged. The point is, why must the expenses rise if the same two accounts are the ones sold?

Some men will point to an increase in new-account sales as justification for putting in a larger expense account. The men who contributed to this circumstance should be ferreted out and counseled.

EXHIBIT 9-12. DIAGNOSIS: NEW ACCOUNT SALES FROM FEW CUSTOMERS

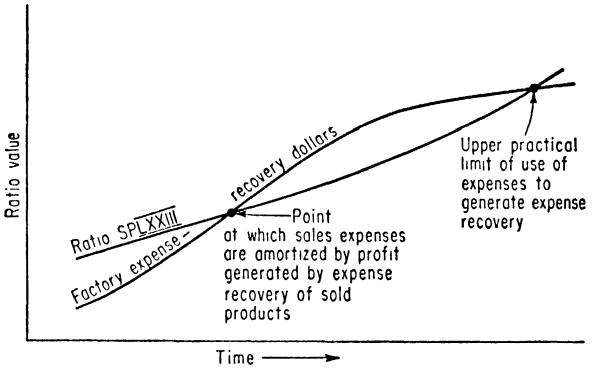


The important facet of management counseling is to let the men know that they are being scientifically managed: management is not reacting to isolated (unweighted) data. Nothing gains so much respect for authority as having the right information at the right time and in a way which anticipates every reason or excuse offered by subordinates. A chart of this nature is valuable when drawn for individual men.

Justification for Sales Expenses

Exhibit 9-13 shows the relationship between Ratio SPLXXIII listed in Exhibit 8-3 and the amount the product recovers in production. This is a subject discussed thoroughly in the next chapter and only touched upon briefly here. The ratio shows the level of expenses being spent in relation to sales of this particular product. Here is a case where it

EXHIBIT 9-13. RECOVERY JUSTIFICATION FOR HIGH SALES EXPENSES



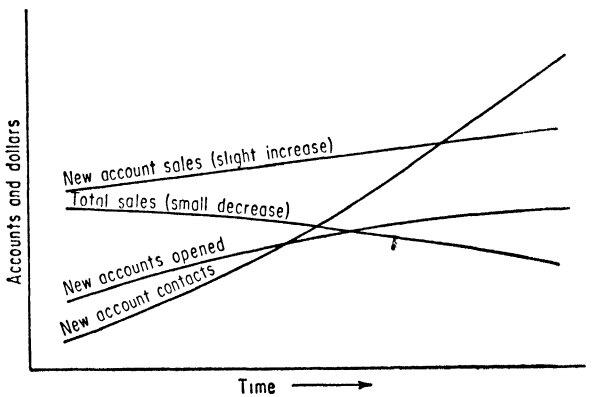
$$\text{Ratio SPLXXIII} = \text{sales} - \text{dollar expense} = \frac{51}{47+48}$$

might be economically justified to tolerate a higher product selling-expense level if it attracts a level of sales high enough to cause a recovery in production sufficient to more than wipe out the added selling expenses.

Positive Sales Management

Exhibits 9-14 and 9-15 show how sales management can react to an upper-managerial directive to open more new accounts. Exhibit 9-14 shows the results of *positive sales management.* Here there is a gradual rise in the number of new accounts opened as a result of a sharp spurt in new-account contacts. There is also a modest rise in the dollar value of the new-account sales, and because of a change in emphasis, there is a slight decrease in over-all sales.

EXHIBIT 9-14. TARGET: NEW BUSINESS—POSITIVE SALES MANAGEMENT



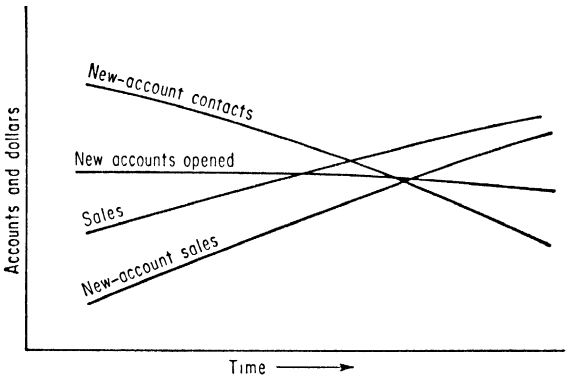
Upper management is very willing to tolerate the small reduction in over-all sales in favor of placing many new accounts on their books. However, all sales managers do not manage so effectively.

Negative Sales Management

Exhibit 9-15 shows the negative factors resulting from an improperly managed drive for new customers. At first glance things look rosy: over-all sales as well as new account sales are on the upgrade, but the *number* of new accounts opened dropped.

What happened here was that the drive was made on the new accounts opened very recently, and the sales manager, fearing that effort

EXHIBIT 9-15. TARGET: NEW BUSINESS—NEGATIVE SALES MANAGEMENT



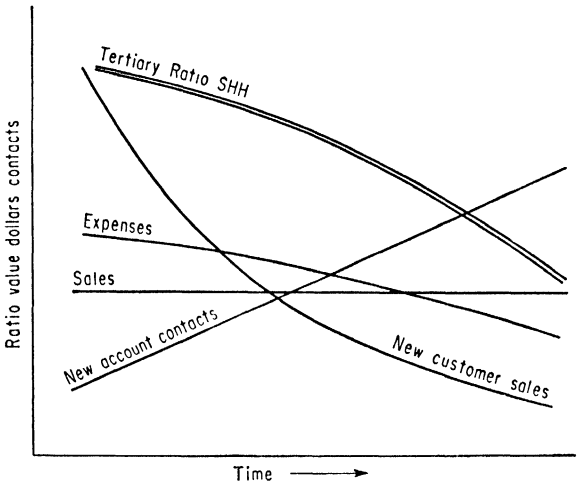
was being channeled away from his old accounts, dropped the new-account contacts rather severely, defeating the entire purpose of upper management's motive.

Sales-expense Frugality

Exhibit 9-16 is a diagnostic chart, one drawn to determine the reason for the drop in new customer sales. All the data available in the records of the company were plotted over a ten-month period on this chart. What happened here was an expense drop that had a questionable economy. With new-account contacts rising in the face of lowered expenses, it indicated that there was a lack of geographic penetration and/or a severe frugality of expenses, particularly in the entertainment area. All new-account activity was taking place locally, and the men admitted to extreme caution in taking prospects to lunch because it appeared that the sales manager was afraid the social overtures would look too obvious.

By this time the reader should have formed the impression that managing on the basis of isolated facts is not managing. However, if these three facets of the economy had not been put together at one time, the correct conclusion would have escaped management for an even longer period. When ratios are formed using such data, the circumstances will

EXHIBIT 9-16. DIAGNOSIS: EXPENSE FRUGALITY



Tertiary Ratio HH = new-customer sales, contact, account performance

$$= \frac{\text{Ratio SV}}{\text{Ratio SXXIX } (\frac{7}{8+9})}$$

not stay buried long. Tertiary Ratio SHH would have made the situation stand out like a sore thumb from the very beginning.

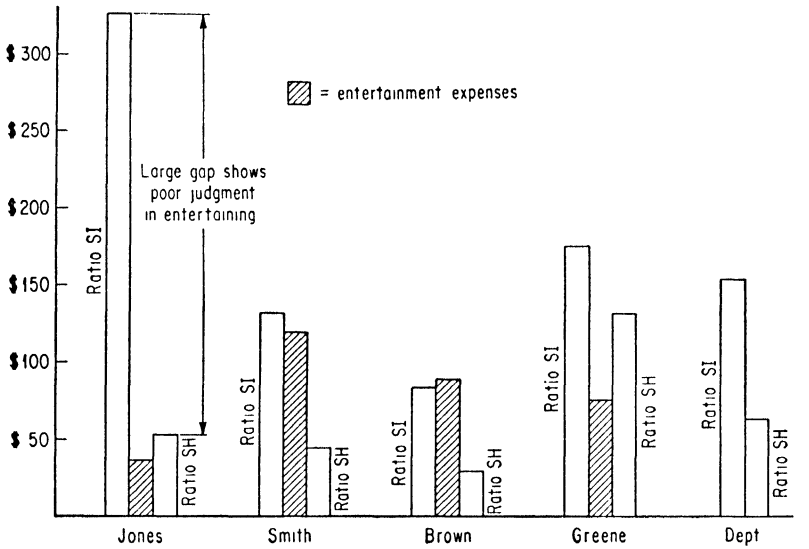
Effect of Entertainment Expenses

Exhibit 9-17 shows the effect of entertainment expenses over a cumulative period. First, the primary data of the entertainment expense are plotted to show that Jones has spent the least and Smith the most. To see whether these sums were used judiciously, we peg the potential and actual sales against this expense level and obtain Ratios SI and SH.

Ratio SI shows the justification between the amount of potential controlled by the salesman and the steps he takes to obtain it. We find that Jones used the poorest judgment in this respect, for while he held a large potential, he used the smallest amount of entertainment expense. This curve shows that a large amount of customer potential had to be supported with a minimum amount of entertainment expenses. Whether it supported the potential effectively is shown by the curve of

Ratio SH, which shows the lowest sales return per dollar of entertainment expenses. And the gap appearing between the two curves is indication of the judgment used by the salesman. Obviously, Jones had the poorest judgment in this respect, with Smith next and Greene leading the group.

EXHIBIT 9-17. EFFECT OF ENTERTAINMENT EXPENSES



A contributing factor to the low sales can be a level of incompatibility between man and customer, or it may be due to a low level of contacts. To substantiate whether or not this is the case, both of these factors can be plotted. However, as will be obvious to those who try this, the conclusion drawn will cite the poor use of entertainment expenses on the part of Jones.

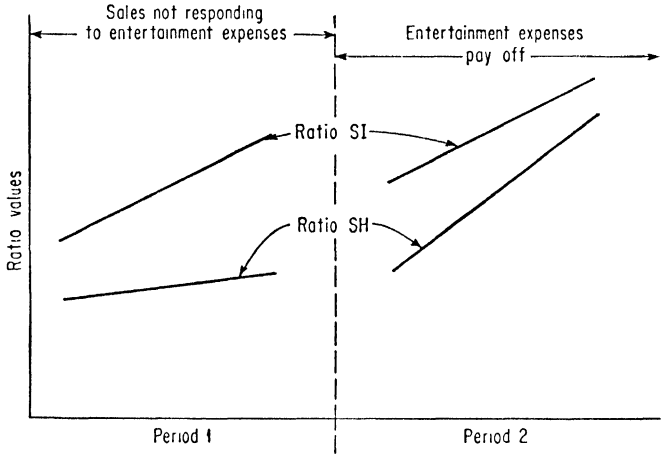
Justifying Entertainment Expenses

Exhibit 9-18 shows the comparison of the movement of the economy of entertainment expenses during two periods. Important in this type of analysis is the rate of speed at which the two curves move with respect to each other. In the first period, there is a steady climb in the amount of potential that has to be supported by each entertainment expense dollar. This may be due to an increase in the number of customers, with their potential added to the pot; or a decrease in entertainment expenses; or a combination of both in such a way as to raise this ratio.

On the other hand, sales for each entertainment-expense dollar is falling off either because of a drop in sales, an increase in entertainment expense, or a combination in such a way as to drop the ratio. In any event Ratio SI is rising faster than Ratio SH, and this is an indication that entertainment expenses are rising and sales are dropping, or at least not rising as fast as the entertainment expenses.

This means, furthermore, that sales are not responding to the disbursement on behalf of entertainment. The reasons are myriad, as we have discussed before. The entertainment may be spent on the wrong

EXHIBIT 9-18. DETERMINING THE ECONOMY OF ENTERTAINMENT EXPENSES



type of customers. Or, because of the incompatibility between man and buyer, the expense does not have a particularly positive effect. In other words, the "customer mix" for entertaining is wrong. Or it might be the territory that's at fault or the type of products for which the expenses were incurred. These require evaluation, by means of other ratios, in order to remedy the situation.

In the second period is shown the results of trouble-shooting, or it may simply be the depiction of a situation in which sales are *responding* to the entertainment expenses. This type of over-all evaluation is a must for any sales manager. In addition, these simple ratios should be expanded in order to pinpoint the exact areas of response. Is it a particular territory, for certain products, done by certain men, are all questions which can be answered and controlled by this type of evaluation.

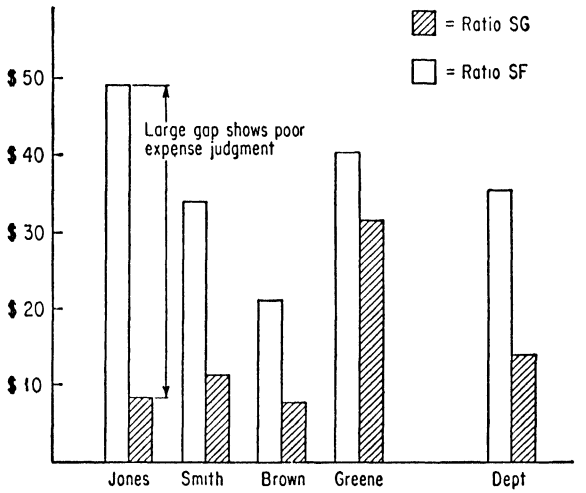
This second period shows that the entertainment expense dollar *is* supporting actual sales at a greater rate than the potential. It shows

that because of proper sales management of products, men, market, etc., the entertainment expense is a valuable tool for accelerating sales.

Expense Judgment

Exhibit 9-19 is similar to Exhibit 9-17 but applied to the total expense instead of just the entertainment segment. The differences are not as severe as the entertainment charting because of the large element of fixed expenses included. It's still good enough to provide a hint of

EXHIBIT 9-19. SALESMEN'S JUDGMENT OF EXPENSE DISBURSEMENTS



which men are most effective with the use of expenses in case management does not wish to expand it to the entertainment-expense level.

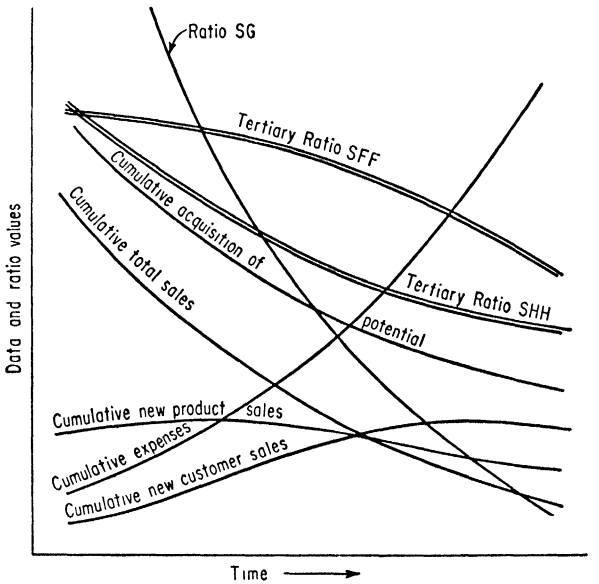
One-fact Managing

Exhibit 9-20 shows the result of one-fact management. The period shown for which the curves were provided covered a period of fourteen months. No ratio control was in effect at the beginning of the period, but at the end, ratio control was installed and then applied to the historical data to "test back" the data, as if the ratios had been in effect at the beginning of the period.

This management was very new-account-conscious, and so almost any act in the company was justified by an increase in new-account business. As the curves show, there was an increase in new-account business, but coexistent with a rapidly climbing expense level. There was also an increase in the sales of new products to *new customers*, but on the whole the total new-product sales were off.

The sales effort was so out of proportion in favor of new-account business that the existing accounts with high potential were neglected. The result was a drop in the over-all sales level and a deceleration in acquiring customers' potential. This surely did not make sense, but the sales manager kept making a very strong point regarding the increases in new-account business, and this hid the impact of important negations in the economy: uneconomical expense levels existing, the unrecovered developmental expenses of the new products (another strong

EXHIBIT 9-20. EVALUATION OF ONE-FACT MANAGEMENT BY TERTIARY RATIOS



Ratio SG = sales - expense index
Tertiary Ratio SFF = new sales and account performance

point of the sales manager was his increase of new products to new customers), and the drop in over-all sales on which the company's growth and survival depended.

Had simple ratios been in effect, the trend would have been arrested within the month. In this case Tertiary Ratios SFF and SHH gave the weighted story from the beginning.

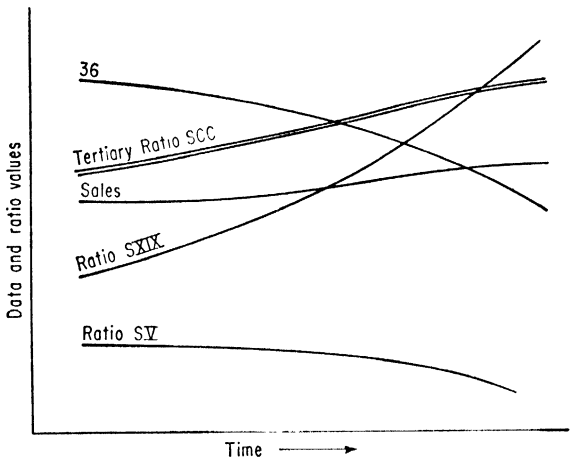
Fall-off of New Business

Exhibit 9-21 showed a situation where management was concerned about the lack of and dropping of new-account business, even though

new-business attempts were going great and quotations to new accounts were on the rapid increase. The over-all sales plodded along at about the same or slightly increasing level, but not because of new business. Management was even misled by Tertiary Ratio SCC, which showed a small rise. Then quite accidentally, someone decided to plot the entertainment primary data superimposed on these data, and management was amazed that this consideration had been omitted in its evaluation and control.

The trouble with the tertiary ratio management used (SCC) lay in the fact that a more expanded ratio was required. Tertiary Ratio SCC

EXHIBIT 9-21. DIAGNOSIS: INSUFFICIENT ENTERTAINMENT OF NEW ACCOUNTS



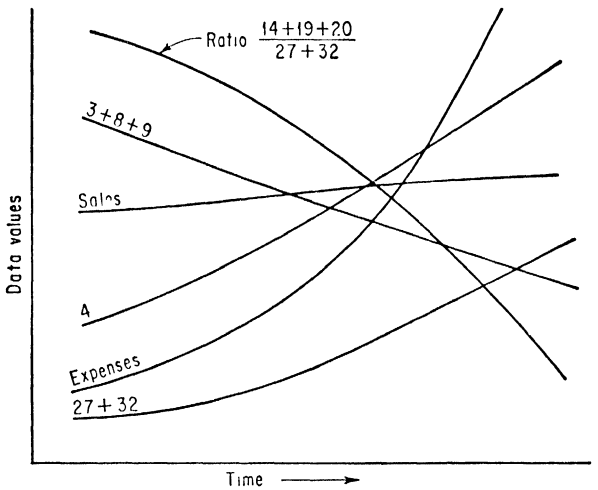
Ratio SV = new-customer sales productivity
Ratio SXIX = new-business attempts
Tertiary Ratio SCC = new-account probability

is the product of a specific ratio, Ratio SXIX, which pertains to the level of new-account quotations in the total sales, and a generalized ratio, Ratio SJ, which gives the quotation acceptance as an average condition throughout the department, or by each man, without any special consideration given to new accounts. This type of ratio is satisfactory only in obtaining over-all and nonspecific evaluations. What happened here was that on over-all business, which included existing accounts as the principal segment, there was enough quotation acceptance to override the small amount of new quotations being lost. After this experience, the company expanded its tertiary ratios to include expense justification and new-account probability, using new-account primary data.

Swindling with the Swindle Sheet

Exhibit 9-22 depicts a situation in which one salesman got out of hand. This took place over a seven-month period, and the data were plotted only at the end of that time to convince management that it needed some form of objective managerial control. As can be readily

EXHIBIT 9-22. DIAGNOSIS: EXPENSE-ACCOUNT "PADDING"



seen, this man sold mostly existing products to existing customers. This is shown by the curve of item 4 (a piece of primary data on Exhibit 7-1). The curve of $(27 + 32)$ shows an increasing level of contacts to new customers for existing products and for new products to all customers. Yet the curve of $(3 + 8 + 9)$ shows a drop in selling such accounts.

This man was an experienced salesman, and these events seem inconsistent. On the one hand, his contacts are rising, and as fast as they are rising, the number of accounts sold resulting from those contacts is dropping. Doesn't make sense, does it? And with it all, his expenses were sharply increasing and his over-all sales level creeping up slowly.

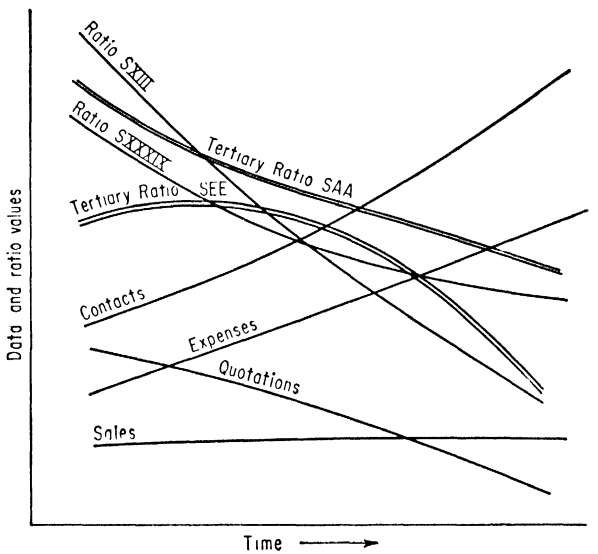
Obviously, this man was making a large number of ineffective contacts as a means of obtaining additional expense funds, if he was indeed making the contacts at all. A later investigation, spot-checking with firms whom the principals of the company knew on a social basis, revealed that some of the calls claimed to have been made by the man were not made.

This situation could have been spotted earlier by the use of the simplest form of ratios. The primary data had to be plotted, which in turn had to be weighted mentally in order for management to reach some sort of conclusion. The ratio $(14 + 19 + 20)/(27 + 32)$, shown in the chart, would have spotted the condition immediately. Then if data were collected showing a separation between type of customers and of products, a further confirmation could be made. A high expense level supported by little sales is obviously not justified, nor is it justified by a slowly increasing total sales level that consists principally in existing-account, existing-product business.

Timid Salesman

Exhibit 9-23 shows the situation and diagnosis of another salesman's characteristics. From just the type of primary data plotted, it seems he

EXHIBIT 9-23. DIAGNOSIS: TIMID SALESMAN



Ratio SXIII = quotation activity
Ratio SXXXIX = expense productivity
Tertiary Ratio SAA = sales, expenses, and contact effectiveness
Tertiary Ratio SEE = index of probability

makes many contacts but does not follow them up to the quotation point. It developed that this man was very timid and functioned purely as a "bird dog." Later, during a personnel-evaluation program, it further developed that this man was fearful of approaching the quotation

point. He felt he was performing a service to his company in just making the "contact," hoping the prospect would *request him* to quote on an order in the future.

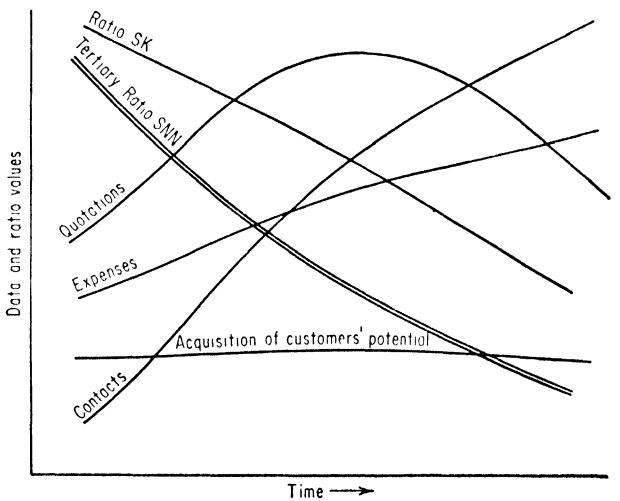
As a result of his particular temperament, his sales level barely changed, the expenses climbed because of the high contact rate, and the quotations fell rapidly. The impact of his inability to elicit quotes is shown dramatically in Ratio SXIII. The lack of expense economy is shown by Ratio SXXXIX. The relationship between sales, expenses, and contacts is shown by the Tertiary Ratio SAA; the lack of quotation activity and its effect on sales and customer's potential is shown by Tertiary Ratio SEE.

The different slope of Ratio SEE indicates that at the early part of the period shown, some of his customers dropped off the company's books, thereby leaving a higher relationship of present sales to a new level of potential. However, once the level of quotations began falling off, the Acceptance Ratio SJ made its effect felt more than Tertiary Ratio SAA.

Buyer-Seller Compatibility

Exhibit 9-24 is a graphic showing of the activities of one salesman who undoubtedly was assigned the wrong "account mix"; that is, sales management failed to consider the aspect of buyer-seller compatibility.

EXHIBIT 9-24. DIAGNOSIS: BUYER-SELLER INCOMPATIBILITY



Ratio SK = quotation mortality

Tertiary Ratio SNN = overall performance index

= Ratio SA x Ratio SJ x Ratio SG

This man was bright and energetic; he made many contacts, and he spent on them a reasonable level of expenses. He carefully selected customers to take to lunch, to the ball games, etc. He also matched up customer potential with plant location and the expense he would have to incur on lodging and transportation to make a personal call, and he did this with intelligence.

On the other hand, the amount of customers' potential which he acquired was low—much too low for a man of his ability—and this level barely changed. Coincident with a fixed level of potential acquisition, there was a fast rise in quotations and then a tapering off to, finally, a rapidly dropping level at the end of the period.

Out of politeness, some customers permitted him to submit quotations, but out of a dislike of the salesman on the part of some of them, the quotations did not result in sales. It got to the point where it was embarrassing to allow the salesman to quote, and at this point quotations fell off. Salesmen from competing companies were allowed to alter their quotes to make them readily comparable. But this salesman's quotes were received and forgotten. This condition is shown by Ratio SK, which deals principally with quotation mortality. However, if the Tertiary Ratio SNN had been in effect, the condition would have shown up rapidly.

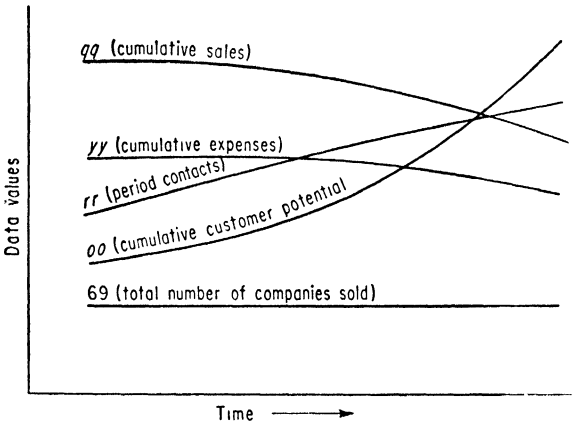
The trouble here was that the sales manager gave no consideration whatever to the question of compatibility; upper management maintained the tertiary ratios and brought this fact to the sales manager's attention with the request that he carefully review the present-account assignments, looking toward a maximum alignment between men and accounts.

Mismanagement of New Business

Exhibit 9-25 shows the record of a department over a period of four months and records the results of the mismanagement of the sales department in implementing an upper-management directive to get more accounts and at the same time demanding an economy wave. These dual tasks can be accomplished if the managerial action is balanced.

The expenses did decrease somewhat, and so did the sales. The contacts increased sharply in response, to get more customers, and more were booked. As a result, the potential increased. However, this was done at the sacrifice of the existing customers because there was less contact time available for them. The drop in cumulative expenses showed the possible inconsistency. As a result of neglecting existing customers, some dropped out. Item 69 is very revealing in this respect, for when it remained fixed, it pointed to the fact that as many existing customers dropped off the books as were acquired.

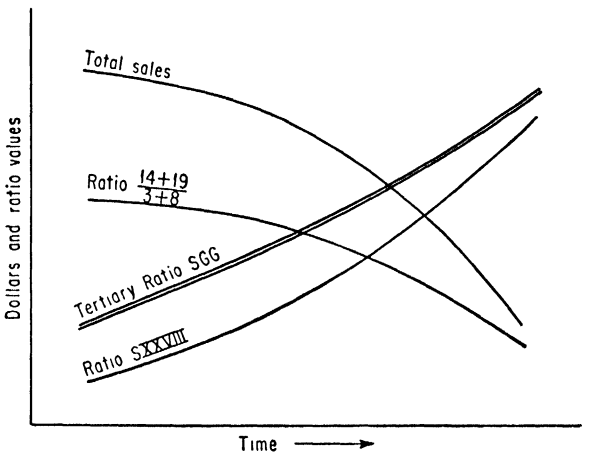
EXHIBIT 9-25. MISMANAGEMENT OF NEW-BUSINESS SOLICITATIONS



Unbalanced Sales

Exhibit 9-26 charts a situation where the rise in new-product sales was made at the sacrifice of total sales. Ratio SXXVIII shows a rising percentage of new-product contacts in the total contact structure. The ratio $(14+19)/(3+8)$ shows that the value of each new-product account opened was decreasing. The integration of these conditions is shown by a rise in Tertiary Ratio SGG, which is negative movement for that ratio.

EXHIBIT 9-26. DIAGNOSIS: NEW-PRODUCT SALES SACRIFICED TOTAL SALES



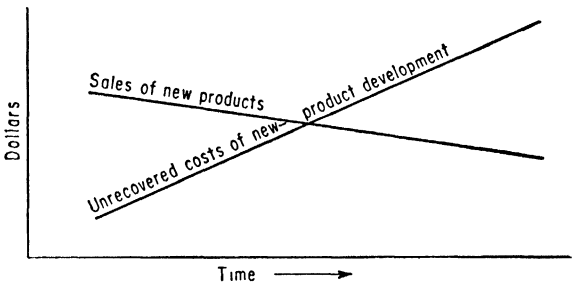
Ratio SXXVIII = new – product contact activity
Tertiary Ratio SGG = new–product sales–contact–account performance

Sales Not Supporting Production

Exhibits 9-27 and 9-28 deal with the relationship between sales activity in terms of product mix and the needs for that sales activity in the production economy. More is to be said on the subject in Chapter 10, but it is well to introduce it here in graphic form.

Exhibit 9-27 shows that the product has a certain economic value to production when it is in the process of manufacture. The principal reason for this is that the type of product and its manufacturing operations can have a greater or lesser effect on recovering the fixed expenses which the company must get back consistently in order to make

EXHIBIT 9-27. SALES NOT SUPPORTING RECOVERY NEEDS



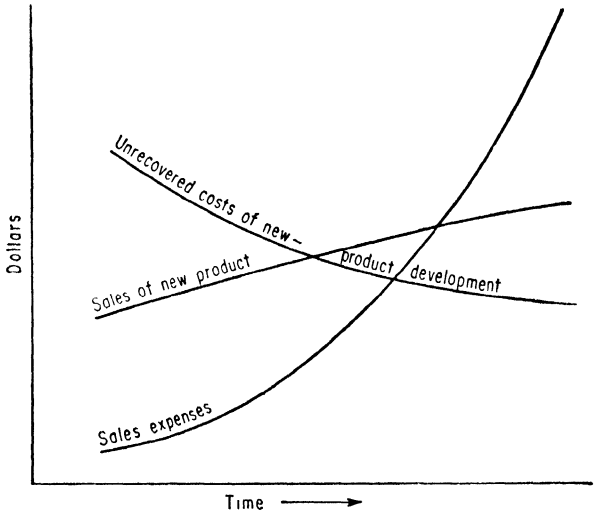
a profit. (This is shown graphically in Exhibit 9-29.) If the sales of an important fixed-expense-recovering product decrease, then the impact on the total company economy can be severe. In the chart it shows that as sales decrease, the unrecovered fixed expenses become seriously greater. Often this condition lies behind, or should be behind, certain product sales drives.

Sales Expenses versus Expense Recovery

In Exhibit 9-28, sales activity *is supporting* the needs of expense recovery. Here the expenses to be recovered are those spent in the development of the particular product. The level of sales expenses shown is way above that normally tolerated in the sales department, since the sales are not rising as fast. At first glance, one might believe that the increase in expenses has unwarranted. However, when the development expenses are considered (or other fixed or period expenses in existence), then it is possible that the excess expense cost is negligible compared with the economic gain achieved by the additional recovery of the expenses which is brought about by added sales of the product.

In managerial control of sales, the state to achieve is the proper direction of the men operating within that product activity which is sup-

EXHIBIT 9-28. HIGHER SALES EXPENSES JUSTIFIED BY INCREASED EXPENSE RECOVERY



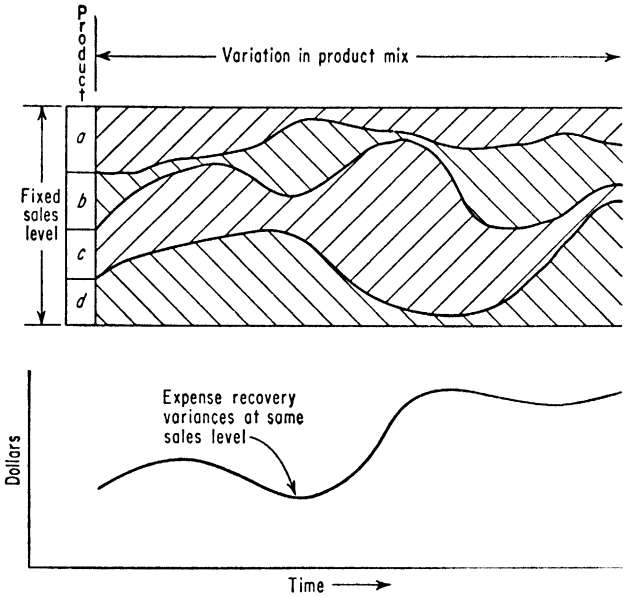
portive to the needs of the total economy. As we shall see in the capital and financial sections, this must also include a consideration of the financial elements, for while sales effort is keyed to the production needs, it must also be optimized to the capital structure so as not to overburden it in the fulfillment of the production-sales aims.

Product Mix versus Recovery

Exhibit 9-29 illustrates more graphically the relationship between a varying product mix within the same sales structure and the changes it causes in expense recovery. Obviously, product *c* has the greatest influence on expense recovery. Perhaps this is due to the fact that when a dollar's worth of this product was produced, it utilized the most expensive facilities in the plant for the longest time. Or it involved a combination of facilities expense and usage which obtained the maximum expense recovery of any of the other products. Exhibit 9-30 shows a tabulation of three conditions of product mix for the same three products and at the same sales level of $1 million and how this product mix affected the end profits when the cost of facilities usage was not considered.

The exhibit shows that not only must sales efforts be keyed to that activity which will recover the optimum of the fixed expenses, but the cost estimating of the products must also be flexible enough to reflect the variable use of the facilities incurring those fixed expenses. Most

EXHIBIT 9-29. EFFECT OF PRODUCT MIX ON EXPENSE RECOVERY FOR SAME SALES



cost-estimating systems fail in respect to allocation of overhead expenses to products. In passing, we should mention that the cost-estimating method which fairly and equitably assigns overhead is the *machine-hour rate system,* sometimes called the *direct facility costing system.*

A Method of Stimulating Salesmen Reach to Company Goals

Management has generally two major problems to overcome in the work of its salesmen. First is their tendency to work where they get the most return for the least effort and tension. Second is their desire to work in a manner which gives them the greatest remuneration for the least time invested. These are admirable motives, and if the men are satisfied with their income earned on that basis and if the company is satisfied that their activity supports its needs and aims, then no more need be said. However, if the company suffers from lack of new customers or from full-time-coverage, then the prime motives of the men have to be adjusted, by financial stimulus if necessary, to make them conform to the needs of the company.

New- versus Old-customer Effort and Return

Most men find it easier to call on and deal with old customers. They know the path is smoother and more automatic, so why make problems

EXHIBIT 9-30. HOW PRODUCT MIX AFFECTS PROFITS

	Part A	Part B	Part C	Total
I: Estimates				
Direct labor	$0 06	$0 60	$2 40	
Material	0 05	1.05	0.90	
Total overhead at 150% (taken from historical data)	0 09	0 90	3 60	
Estimated total cost	$0.20	$2 55	$6.90	
Estimated profit at 10%	0.02	0.28	0.77	
Actual selling price	$0.22	$2.83	$7.67	
Total sales				$1,000,000
Hoped-for profit				$ 100,000
II: Reality: condition A				
Assumed product mix, %	30	10	60	
Quantity sold	1,363,636	35,335	78,226	
Direct labor	$ 0 06	$ 0 60	$2 40	
Material	0 05	1 05	0.90	
Actual total overhead	0 14	1.20	3 16	
Actual total cost	$ 0.25	$ 2 85	$6.46	
From I: actual selling price	0 22	2 83	7.67	
Actual profit or (loss)	$(0 03)	$(0 02)	$1 21	
Sales	$300,000	$100,000	$600,000	$1,000,000
Hoped-for profit	30,000	10,000	60,000	$ 100,000
Actual profit or (loss)	(40,909)	(707)	(94,653)	43,037
Negative estimating gap				$ 56,963
III: Reality: condition B				
Assumed product mix, %	70	20	10	
Quantity sold	3,181,818	70,671	13,037	
Direct labor	$0 06	$0.60	$ 2 40	
Material	0 05	1 05	0 90	
Actual total overhead	0 07	0.60	10 70	
Actual total cost	$0 18	$2 25	$14 00	
From I: actual selling price	0 22	2 83	7 67	
Actual profit or (loss)	$0 04	$0 58	$(6 33)	
Sales	$700,000	$200,000	$100,000	$1,000,000
Hoped-for profit	70,000	20,000	10,000	$ 100,000
Actual profit or (loss)	127,273	40,989	(82,524)	85,738
Negative estimating gap				$ 14,262

EXHIBIT 9-30. (*Continued*)

	Part A	Part B	Part C	Total
IV: Reality: condition C				
Assumed product mix, %	85	10	5	
Quantity sold	3,863,636	35,335	6,519	
Direct labor	$0.06	$ 0.60	$ 2 40	
Material	0.05	1.05	0.90	
Actual total overhead	0 055	1.20	14.20	
Actual total cost	$0.165	$ 2.85	$17.50	
From I: actual selling price	0.22	2.83	7.67	
Actual profit or (loss)	$0.055	$(0 02)	$(9 83)	
Sales	$850,000	$100,000	$50,000	$1,000,000
Hoped-for profit	85,000	10,000	5,000	$ 100,000
Actual profit or (loss)	212,500	(707)	(64,082)	147,711
Positive estimating gap				$ 47,711

Summary

The gap	Profits			
	Estimated	Actual		
		Condition A	Condition B	Condition C
	$100,000	$43,037		
Estimating loss		$56,963		
	$100,000		$85,738	
Estimating loss			$14,262	
	$100,000			$147,711
Estimating gain				$ 47,711

for themselves? New contacts require missionary work. After this effort, perhaps an order will develop, perhaps not.

In direct neglect of this understandable attitude, most managements pay the same commission regardless of whether the account has been on the books for twenty years or for two months. They are inviting the salesman to avoid new business!

Selling versus Servicing

There are shades and degrees of the contact-selling function, ranging from pure *selling* through all the different in-between functions to pure *servicing*. Why pay the same for one as for the other?

Sales Compensation Based on Account Age

For some years the author has recommended a sales-compensation plan in which the commission paid is pegged to the age of the account sold. A typical table is shown in Exhibit 9-31. It applies to just one industry. Each industry has its own commissions schedules, and each company has its own economic needs for new accounts. Therefore this table should be adjusted to fit the particular requirements.

EXHIBIT 9-31. COMMISSION SCHEDULE KEYED TO AGE OF ACCOUNT

Account age, years	*Applied commission rate, %*
Up to 1	6
1 to 3	5
3 to 6	3.5
6 to 10	2
Over 10	1

As shown in the table, an account that is less than one year old gets six times more commission than those over ten years old. Of course, the newly acquired account is in this first commission group. In some schedules, the time period ends at seven years or goes up to eighteen years. The commission differentials also vary considerably, depending on the specific case.

There are those who at first believed that old accounts would be neglected because of the "service" commission level. It does not happen to work out that way. After a short time the men find that they can earn their usual levels on less sales when a good part of it is for new business. They learn that it actually takes *little time* to service their old ones. Sometimes a phone call or a letter will do it. When money begins to flow, the devices for taking care of these old accounts are invented fast and furiously. At some companies, these old accounts are transferred, under an arrangement with the older salesman, to newer, less experienced salesman who use them for training and orientation, but under the watchful eye of the original salesman.

Full-time Incentive and Company Economy

In the interests of company economy, the author has used the plan shown in Exhibit 9-32 for getting the men to work as much of a full year as possible. First, the "normal" amount of annual sales per man was determined. In this case, $600,000 per man per year was deemed to be the goal of a 100 per cent "complete" salesman, neglecting for the moment the type of product or customer.

If men fell below that level, the commissions were multiplied by a factor less than unity, and so their commission earnings dropped. As

the "normal" level was exceeded, the commission multiplier grew larger than unity. At $2 million the man received a 40 per cent increase in his yearly earnings. This tempting bait kept the men working a greater average portion of the year since they were especially desirous of maintaining all their commissions and would not think of letting their yearly level go below $600,000; and they were tempted to meet the terms of each successively higher increase in income.

EXHIBIT 9-32. ANNUAL BILLING-LEVEL FACTOR: COMMISSION FACTOR

Yearly billing attained by individual men	*Commission multiplier*
Up to 50,000	0.70
100,000	0 80
200,000	0.90
800,000	1.2
1,000,000	1.25
2,000,000	1.4

In a company producing corrugated containers, only one out of a staff of twelve went below the normal level, and that one because of illness. The year previous, the average man yearly sales was 55 per cent of the level, solely because of the practices of three men who had one or two well-protected accounts.

The economical rationale for this type of arrangement is simple. The more each man brings in, the more it is worth to the company in terms of profit content. In other words, added sales bring management closer to their break-even point faster. A company doing $10 million yearly, with a break-even point of $6 million, has more profit in the tenth million of sales than it did in the sixth million.

There are of course problems in administering this type of plan. A break with long-held traditions is difficult, at best. The simplest way is to make some financial adjustments and then place the plan on equal footing with all the men. It is especially recommended for a department of new men or for new men entering the department even before the final adjustments are made.

PROBLEMS

1. Distinguish between sales potential, customer potential, geographic potential, product potential, industry potential.
2. Distinguish between sales penetration and saturation as pertaining to area, customer, product.
3. How is buyer-seller incompatibility uncovered by the use of ratios?
4. What are the advantages of using condensed sales ratios?

5. Explain the uses of the following advanced sales ratios and the activities affecting their value and discuss under what circumstances (negative or positive) they may rise or fall:
   a. Ratio SC
   b. Ratio SN
   c. Ratio SO
   d. Ratio SP
6. Construct a tertiary ratio using Advanced Ratios SK, SL, and SN to show the economic justification of expenses. Explain fully.
7. Construct five tertiary sales ratios (not listed in the text) incorporating at least three of the following elementary and/or advanced sales ratios and explain thoroughly the uses of each:
   a. Ratio SL
   b. Ratio SP
   c. Ratio SK
   d. Ratio SF
   e. Ratio SA
   f. Ratio SXLIV
   g. Ratio SXXXVIII
   h. Ratio SXXV
   i. Ratio SXXXII
   j. Ratio SXXI
8. Explain the uses (as in Problem 5) of the Tertiary Sales Ratio SDD.
9. Develop product values for tertiary sales ratios:
   a. Ratio SAA
   b. Ratio SBB
   (*Hint:* First the elementary product ratio equivalents of the man-effort ratio terms of the tertiary ratios have to be found.)
10. Develop a tertiary ratio which will show up rapidly the traits described in the following exhibits. Develop one or more tertiary ratios for each exhibit and explain.)
    a. Exhibit 9-6
    b. Exhibit 9-7
    c. Exhibit 9-12
    d. Exhibits 9-14 and 9-15
    e. Exhibit 9-18
    f. Exhibit 9-22
    g. Exhibit 9-25
    h. Thy Exhibit 9-28
11. Discuss various industries in which there are sharp differences between "selling" and "servicing."
12. How would you compensate salesmen for loss of their accounts transferred to other salesmen?
13. In installing a new sales-compensation plan based on a nominal salary, plus a commission keyed to the age of account, what adjustments would you make to salesmen who previously were compensated by straight commission?

CHAPTER 10 *The Integration of Production and Sales*

At this point in our concept, we have set up ratios for evaluating production effort and sales activity. We have set up both elementary ratios, for the attention of the lower echelons of authority in each division, and tertiary ratios, for those at the upper levels of management. We then turned to the problems of control and showed movements of both elementary, advanced, and tertiary ratios, representing the concept of control. From these figures, trends were ascertained and advance optimums selected.

Production and Sales as Separate Functions

In doing this we considered effort of production and sales as separate entities. The underlying reasoning was that, irrespective of the relationship of the two functions or their coordination by the next-higher managerial echelon, there was the need for evaluation and control intrafunctionally or intradepartmentally. The purpose of integrating these two major functions is to ensure that both efforts support each other and not work at cross-purposes.

Thus, while a high sales productivity in a specific product is a thing of joy to the sales manager, it does not help the company if the product is uneconomical to produce or if the large number of orders booked causes an uneconomical duplication of facilities. And while the plant manager is pleased with the high speed of producing an item, it is meaningless if the item does not sell well or if it costs excessively to promote in the open market.

Management and Coordination

The difference between the management of a technical function like sales, or production, or finance, or industrial relations, and the next-higher echelon of management is one of coordination. Each manager of

a specialized function, such as sales and production, should harness the drive necessary to attain a maximum, but should be directed by general management toward an optimum. Just as the sales manager is not expected to be a production man, neither is the latter expected to be a determiner of the sales-expense budget. Obviously, emphasizing any one function like overproducing or overselling can have a negative effect on the over-all economy of the company.

However, these characteristics are oversimplifications of the internal economics of the two functions and how one impacts on the other, either for the good or bad of the company.

A way to look at this relationship is to consider that each function is responsible for making a profit, for standing on its own feet, but in a way which will enhance the profitability of the entire company. Sometimes that might involve a purposely introduced excess into the economy of one of the departments.

Costs, Profits, and Capital

Before going on to the specifics of this chapter, it is necessary to review briefly the subject of cost. The relationship of cost to MC must be considered in forming a basis for the integration of sales and production. The question of cost is inextricably interwoven with decisions affecting sales and production.

In most multiproduct manufacturing, each dollar of sales does not yield the same profit. Some products bring in more or less profit than others, and this occurs for many reasons: sometimes the price-line pattern built up over the years has the characteristic of low total cost in relationship to selling prices, which it is impractical to disturb; some products use expensive facilities at a low capacity, which raises the cost; some products move quickly at little profit, involving considerable inventory-support capital.

Many decision makers use the product's profitability as the criterion for assigning sales effort. If a product shows a high profit margin (as revealed by a cost sheet), then they gang up sales efforts in the attempt to boost company profits and sometimes wind up with a loss instead. If the estimated profit on the cost sheet is an *actual* profit, then pushing sales might result in an uneconomical duplication of expensive facilities. This would mean owning underactive duplicated facilities which might cost the company more in unrecovered fixed expenses than the gains of keeping its original facility at full capacity. Besides, what must seriously be questioned is the accuracy of the "profit" stated on the cost sheet. What might be stated as a profit on the cost sheet may in fact be a loss if the overhead was improperly allocated to the

product and if consideration was not given to the volume of that product.

Another important criterion in the optimum coordination between sales and production is the extent to which the selection of a product mix impacts on the capital structure. Where one mix may satisfy the balance between product profitability and economical usage of facilities, it may not necessarily be easy or healthy for the capital structure to support.

Not all products carry the same material content in their total cost, and so a given product mix requires a certain inventory level to support it. As the mix changes, so does the company's investment in inventory; so does the liquidity of its current assets; so does its financial state of health.

Product-Volume Mix

The activity of a given product in the total sales picture of a company is termed a product-volume mix. Those companies that control this mix by controlling the individual efforts of sales and production are the ones with the greatest profit potential. With this information, the management is able to direct, appraise, and reward properly the efforts of its salesmen, and the two functions work at the same optimum purpose. The problem for the company is to key its reward so as to have the sales emphasis placed where it needs it.

Product mix has its effect both on production and sales economy; that is, selection of the optimum product mix and proper implementation by the sales effort can produce the greatest profit. In most multiproduct manufacturing, not all products contain the same elements of direct labor, overhead, material, administrative expense, and profit. Some products require more direct labor than others. Some involve more machinery running time than others. These variances play a large part in determining the economy of the plant and the direction which sales must take.

There can be two identical periods in which the sales are the same but with different product mixes (see Chapter 9). One mix will recover fixed expenses more than the other. One may involve principally handwork, the other mostly machine work, and yet the direct labor percentage of the sales dollar may be the same in both cases.

In the same manner, each period can yield a different profit, depending on the *nature* of the product mix. This considers that not all products do produce or are expected to produce the same unit profit.

Sales management must integrate the relationship between contact activity and the generation of the type of mix yielding the highest

optimum profit, consistent with the expense-recovery needs of the fa tory and with the need to develop new-customer markets, product and territories.

The managerial direction of sales contacts must involve the relatio ship between the product and the centers used in its manufacture such a way as to recover the maximum expenses of operating produ tion centers. Normally, salesmen tend to think in terms of produc rather than sold machinery capacity. And that is the way it should b Therefore this chapter contains illustrations of how conversion is mac from products to production centers. Only after this conversion is mac can we see to what extent sales is effective in recovering productio center expenses.

Just as each dollar of sales may not bring in the same amount profit, it likewise may not bring in the same amount of expense covery. Control of sales therefore must consider the gross volume sales together with the expenses to obtain it and the mix or blend the gross sales.

Sales Integrated with Production

For a discussion of the integration of sales and production, we sh use some of the sales data of the previous chapters. The first crossov point between sales and production obviously is the product. The sal department regards the product as a whole entity; not so the produ tion department. To them the product is a combination of many inc vidual parts, processes, operations, pieces, etc. As a matter of fact, it in this crossover area that the sales forecast and the production-activi budget begin to clash. After preparing the yearly sales forecast, t production-center activity has to be projected. Before that step can taken, the products have to be divided into their respective productic centers which create them plus the proportionate number of hours use of each center each product will require. In other words, produ sales dollars have to be converted into production-center activity hou each center showing how much time it will be in use for the productic of the particular product.

Production-center Costs

Exhibit 10-1 shows the annual overhead cost of each of the five pr duction centers A to E, the number of hours during the year each expected to operate, and the hourly overhead cost of each. The annu overhead cost of each center includes every expense in the operati and ownership of the business except materials and direct labor co These are not included because they are variable costs, i.e., costs whi

vary directly with production, and would serve to distort the examples to be given. The fixed and semifixed costs incurred in the operation of the plant are allocated to these production centers on various bases, depending on the specific nature of the expense. This is accomplished by the machine-hour-rate costing method. The projected annual hours represents the number of hours which management believes the centers will operate. Ideally, this figure should be the result of the aforementioned conversion of product sales dollars from a sales forecast into activity hours.

The hourly overhead cost charged is obtained by dividing the annual expenses by the expected annual hours. It is clear that if, at the end of the year, each center in fact operates for the length of time projected,

EXHIBIT 10-1. PRODUCTION-CENTER COSTS

Production center	Annual cost to make center available (all except direct labor)	Projected annual hours	Hourly OH cost
A	$ 8,000	2,000	$ 4
B	16,000	1,600	10
C	30,000	1,000	30
D	64,000	1,600	40
E	72,000	1,800	40
Total ..	$190,000		

then the sales price will have "recovered" all the annual expenses assigned to each center. To assess how closely this goal is being reached, we stop at the end of each quarter to measure the actual activity against the budget to see if we are "underrecovering" or "overrecovering."

Products Converted to Operational Hours

Exhibit 10-2 shows the breakdown of each product into the production centers that are involved in their manufacture. The sales of each product are represented by the number of hours each production center must operate to produce the sales level. In other words, when $20,700 of product *ab* is sold, it keeps production centers A, B, C, and D active 240, 20, 150, and 30 hours, respectively.

This exhibit shows condition A, the state of affairs at the end of the first quarter, a three-month period when there was a lack of integration between sales and production. Also shown on this tabulation are the actual hours for each production center as a result of the listed product sales; the actual recovery for each center, that is, the extension

of the actual hours by the hourly cost figure of Exhibit 10-1; and the projected hours for this quarter.

We are aware of the seasonal fluctuations present in many businesses, so that a three-month period in a company's activity is not necessarily one-fourth of the yearly activity. However, for the purpose of illustrative simplicity, we consider that this quarter's activity *is* one-fourth of the annual projection and that this rate of activity will obtain on a yearly basis.

EXHIBIT 10-2. CONVERSION OF PRODUCT SALES TO PRODUCTION-CENTER ACTIVITY (CONDITION A)

Product	Quarterly sales	Activity of production center:				
		A	B	C	D	E
Projected hours		500	400	250	400	450
Hourly cost		$4	$10	$30	$10	$40
Actual hours		600	200	400	225	675
ab	$ 20,700	240	20	150	30	
ac	9,792			75	30	75
bc	37,900	160		25		250
cd	10,500		50	75	45	50
WW	27,050	100	10	65		250
YY	14,000	80	60		80	50
ZZ	3,330	20	60	10	40	
Total	$123,222	600	200	400	225	675
Quarterly actual recovery		$2,400	$ 2,000	$12,000	$ 9,000	$ 27,000
Yearly actual recovery		$9,600	$ 8,000	$48,000	$36,000	$108,000
Needed actual recovery		8,000	16,000	30,000	64,000	72,000
Quarterly actual recovery		2,000	4,000	7,500	16,000	18,000
Maximum tolerable recovery (before duplication), quarterly		2,000	5,000	15,000	20,000	20,000

Note that center A is overrecovering in a way which will require a duplication of facilities. (We assume 2,000 hours per year, without considering the multishift aspect, on the premise that facilities duplication can take place even with three eight-hour shifts. This would obtain if center A was projected at 1,500 hours for the quarter with an actual activity of 1,800 hours.)

However, if center A is duplicated, it is not serious, since the annual cost is low ($8,000) compared with the other centers. Production center B is active 50 per cent of its expected activity. This underrecovery is

not very costly to the company since its hourly cost is fairly low ($10 per hour) compared with that of centers C, D, and E.

Note another fact: center B is projected at 400 hours. This center has the capability of 500 hours per linear quarter before the duplication of facilities sets in. Therefore this center should be a target for sales action because of the underrecovery and the *opportunity* for increased profit. If the sales function can integrate itself with the needs of production by selling 500 hours at the $10-per-hour figure, then the overrecovery is a direct contribution to profits. If, because of the higher activity, sales wishes to price marginally in the hope of attracting more business, then it can reduce that rate to $16,000/2,000, or $8 per hour (see Exhibit 10-1), without affecting the profit margin.

Production center C appears to be a profitable center. It is projected at 250 hours and is operating 400 hours per quarter. This represents an overrecovery of 150 hours, or a 60 per cent excess recovery. If overrecovery is due to activity, where the actual activity should have been the projected hours, that is, where the center was projected at too low a rate to start with, the overrecovery will result in higher selling prices and probable sales resistance. However, where the center is budgeted in a certain way to achieve a specific rate which the company considers to be competitive and the sales department obtains more than enough activity to keep it busy on that basis, then the overrecovery is an additive to profits.

The latter appears to be the case in this example. To make this point a little clearer, if the $30-per-hour cost is close to competitive pricing, it would not make sense for the company to create a new hourly cost just because 1,600 hours (instead of 1,000 hours) divided into $30,000 = $18.75 (instead of $30). Here again, it's always a thought that the reduction of a selling price can cause an increase in sales and total profit. In addition, center C has the target of additional recovery from the 400-hour level up to maximum capacity at 500, a 25 per cent increase.

Let's stop a minute and compare the circumstances at centers B and C. Both provide the additional sales target of increasing from 400 to 500 hours, but for different reasons. The difference lies in the accidental nature of the activity, the fact that it was not planned to support the needs of expense recovery in production. On the one hand, for center B, the 400 hours is that projected, the actual activity being 200. For center C, the 400 hours is an activity attainment which exceeds the projection of 250 hours.

The situation in center D is serious. It is like the situation experienced at B, but with worse consequences, since annual costs are four times greater than at B. The underrecovery here is expensive. Here

again, sales integration is needed, first, to recover the unavoidable expenses incurred by the company by making this facility available and, second, to attempt to keep the center operating in the "gravy" area, or the area providing opportunity for marginal pricing, or a combination of both, between the 400- and 500-hour slot.

The situation at center E is also serious and dangerous to the economy of the company. It is like that of center A in that it is overrecovering beyond its maximum capacity and will require a duplication of its facilities, but at a cost nine times greater than for center A. Whereas duplicating center A costs only an extra $8,000 per year, duplicating center E costs $72,000 per year.

(In order not to cloud the issue by sophisticated calculations, a duplication of a facility is added at the same rate as that of maintaining the first facility per year. In actual practice, we know that the cost of the duplicated facility will be somewhat lower than the original because of the reallocation of fixed expenses to a greater number of facilities.)

There is no doubt that the company is headed for trouble. That sales is not supporting the needs of production is obvious. However, more must be known about the product before the proper steps can be taken.

Product-cost Breakdown

The first step is the examination of the cost sheet of each product. This is done in Exhibit 10-3. Here in condensed form are shown all the

EXHIBIT 10-3. CONDENSED COST SHEET (CONDITION A)

Cost item	Product						
	ab	*ac*	*bc*	*cd*	*WW*	*YY*	*ZZ*
Overhead	$ 6,860	$6,450	$11,390	$6,550	$ 2,450	$ 6,126	$2,580
Direct labor	750	360	790	415	795	470	220
Conversion cost	$ 7,610	$6,810	$12,180	$6,965	$13,245	$ 6,590	$2,800
Material cost	11,000	2,000	22,000	2,500	11,000	6,000	200
Total cost	$18,610	$8,810	$34,180	$9,465	$24,245	$12,590	$3,000

Total cost all items = $110,900 × 4 = $443,600 (total cost of product mix)
Net profit 10 per cent = 49,288
Selling price = $492,888

elements of cost: total overhead cost, direct labor cost, plus the material cost. To simplify matters, all the products carry a profit margin of 10 per cent of selling price. The total overhead cost is, of course, the

summation of the production centers entering into the cost of each product. Thus, for product *ab:*

Production center used	No. of hours in use	Hourly cost	Cost
A	240	$ 4	$ 960
B	20	10	200
C	150	30	4,500
D	30	40	1,200
Total overhead cost....			$6,860

When a dollar's worth of a product is sold, it can impact on the company in several ways. Not all sales dollars produce the same amount of economy. (They all do not produce the same amount of profit either, but that is another matter.) In some products, there are more cents devoted to material costs, as in product *bc*. In others, there are more cents devoted to paying the fixed expenses of the company, as in product ZZ. Needless to state, there are infinite shades of variances.

The sales of product *bc,* while the largest of all the products sold, actually harms the company by being so high. First of all, this product plays give-and-take with its raw-material supplier. It has to commit its financial structure to a large inventory in order to meet the material-content needs of the product (see Chapters 12 to 14); it takes risks in holding this inventory for any length of time because of raw-material market fluctuations; it is causing a circumstance demanding the duplication of the $72,000-per-year production facility of center E; and it probably is helping toward the duplication of center A. Center C surely does not need the increased activity, so, on economic grounds alone, why continue to sell product *bc*?

Of course, few companies can discontinue overnight a product that customers demand. But should there not be an attempt to reduce drives on this product in favor of others which will have a more positive effect on the over-all economy?

Obviously, product ZZ recovers more fixed expenses in the sales dollar than any of the rest, and yet on a sales economy-activity basis we were ready to condemn it (see Chapter 8). Increasing the sales drive for product ZZ would aid the recovery of production center B, and especially center D, where it is so desperately needed, and yet without driving center C to uneconomical activity.

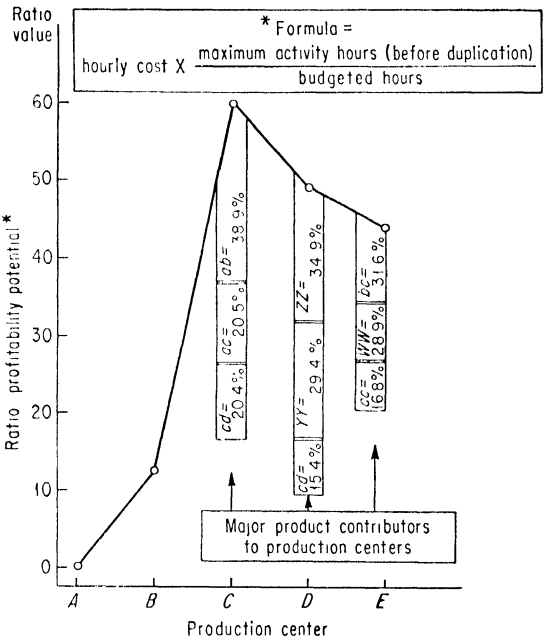
Sales Targets

The reader should now glance at Exhibit 10-4, which shows the profitability potential of each of the five production centers and the

degree that the major products contribute to each. The derivative data for this are shown on Exhibit 10-5. The curve shows that center C offers the greatest potential for contributing profits. This potentiality is a function of the yearly projection and the cost of the center.

The profitability potential ratio (Exhibit 10-4) is obtained by dividing the current budgeted hours into the maximum activity hours available before duplication of the facility is required. This is done on a quarterly basis. Even though center C is not the most expensive center, it has

EXHIBIT 10-4. TARGET FOR SALES: PROFITABILITY POTENTIAL OF PRODUCTION CENTERS



the capacity for operating twice as much as it does presently, and this places it in the forefront with an index of 60.

The major contributors to center C are shown below the mark of the curve. It means that of the six products that use center C's services, product *ab* will use it 38.9 per cent, product *ac* 20.5 per cent, and product *cd* 20.4 per cent, the other three products using up the balance of 20.2 per cent. Center D, which has the next-highest profitability potential—and again, this means profit as a result of activity exceeding budget—uses product ZZ 34.9 per cent, product YY 29.4 per cent, and product *cd* 15.4 per cent.

This curve presents a target for sales, but it is not remedial for the situation depicted in condition A. In other words, after sales activities

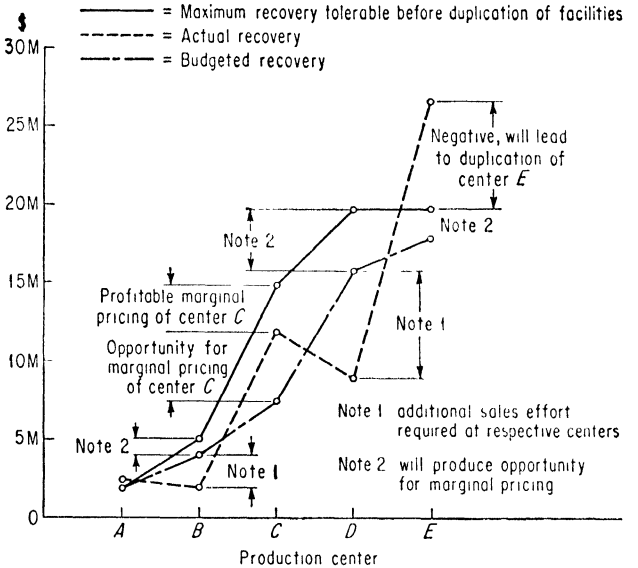
EXHIBIT 10-5. RECOVERY CHARACTERISTICS OF PRODUCTS AND PRODUCTION CENTERS

Product	Production center										Sales dollar
	A		B		C		D		E		
	%	$	%	$	%	$	%	$	%	$	
ab	45 1		6 5		38 9		9 8		—		
		0 141		0 029		0 655		0.175		—	1.00
ac	—		—		20.5		10.4		16.8		
		—		—		0.349		0 186		0 465	1.00
bc	17 9		—		3 9		—		31.6		
		0 056		—		0 066		—		0.878	1 00
cd	—		17 2		20 4		15 4	—	11		
		—		0 076		0 344		0 275		0 305	1 00
WW	10 3		1 8		9 4		—		28 9		
		0 032		0 008		0 157		—		0 803	1 00
YY	16 7		22 1		—		29 4		11 8		
		0 052		0 098		—		0 523		0 327	1.00
ZZ	10		52 5		6.9		34 9		—		
		0.031		0 232		0 116		0 621		—	1.00
Production center usage	100		100		100		100		100		

have been adjusted to provide the needed expense recovery in production, sales effort can then be concentrated elsewhere to bringing in extra profits. A word of caution on the data shown in Exhibits 10-4 and 10-5: because of the content of the respective sales dollar for each of the seven products, it would be fallacious to peg these percentages directly to the sales dollar; they should more properly be pegged to the expense recovery represented in each product sales dollar.

Exhibit 10-6 shows the relationship among the three recovery fig-

EXHIBIT 10-6. ACTUAL VERSUS BUDGETED RECOVERY VERSUS MAXIMUM RECOVERY BEFORE DUPLICATION OF FACILITIES



ures: budgeted, actual, and maximum economic. The budgeted is the *needed* recovery, which the company must obtain in total before it can make a profit.

Product Expense-recovering Ability

Exhibit 10-7 shows a tabulation of the sales of the seven products for condition A and the amount of recovery each product brings. The

EXHIBIT 10-7. PRODUCT RECOVERY ABILITY (CONDITION A)

Product	Sales	Per cent	Total recovery	Per cent of product recovery / total recovery	Recovery ability of product per sales dollar	Per cent of recovery per $7 worth of sales ($1 from each of 7)
ab	$ 20,700	16 8	$ 6,830	13.1	$0.331	9.2
ac	9,792	7.9	6,450	12 3	0 658	18 4
bc	37,900	30 8	11,390	21.7	0 300	8.4
cd	10,500	8 5	6,550	12.5	0 624	17 3
WW	27,000	21.9	12,450	23 8	0 461	12 8
YY	14,000	11 4	6,120	11.7	0 437	12.3
ZZ	3,330	2.7	2,580	4.9	0 775	21.6
Total...	$123,222	100	$52,400	100	$3,586	100

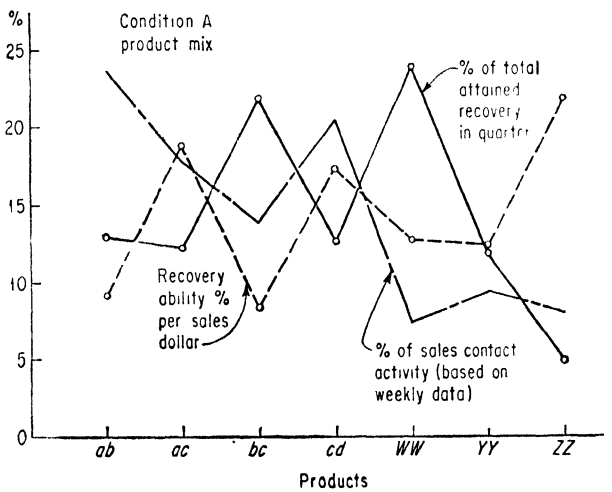
total recovery data come from the data in Exhibit 10-3. The next column is a ratio of the amount of recovery percentage of the total that each product contributes at the sales level shown. The next shows what portion of the sales dollar each product can contribute to expense recovery. The one following then shows what percentage of the total each is.

It is clear right off that there is no coordination. Product ZZ, which can contribute $0.775 out of each of its sales dollars to "paying the freight," or 21.6 per cent of the total of the seven products' capacity, is only contributing 4.9 per cent. Product *bc*, which only has $0.30 of each of its sales dollars to give to the expense cause, or 8.4 per cent of the total of the seven products' capacity, is being made to donate 21.7 per cent—an uneconomically high level, as we have said before.

Needed versus Attained Recovery

Exhibit 10-8 shows the relationship between the recovery ability of each product and that level attained. It is different from Exhibit 10-6 in that the latter shows actual recovery against that needed by each

EXHIBIT 10-8. RECOVERY ABILITY OF PRODUCTS VERSUS RECOVERY ATTAINED BY SALES. DIAGNOSIS: SALES WORKING AT CROSS-PURPOSES WITH PRODUCTION (PRODUCT ZZ HAS LOWEST SALES AND FEWEST SALES CONTACTS WITH THE LARGEST EXPENSE-RECOVERING ABILITY OF ANY OF THE SEVEN PRODUCTS)

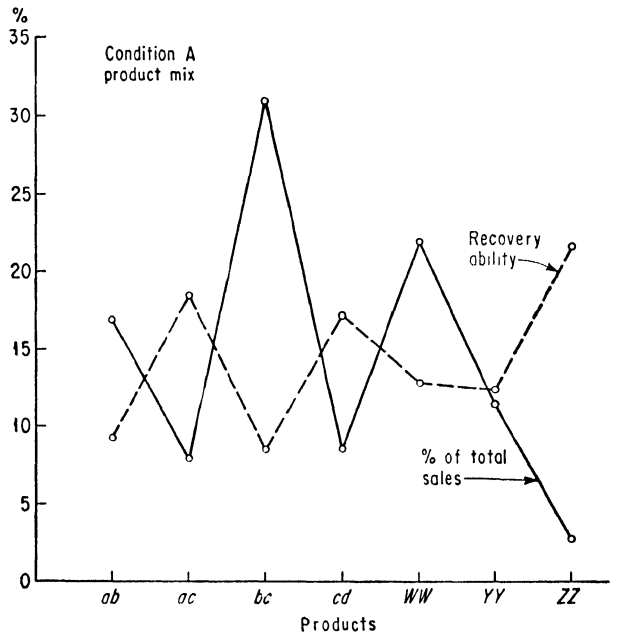


production center, whereas Exhibit 10-8 shows the attained recovery against the potential or latent ability to recover, offered by the seven products. This curve shows that the sales efforts, besides working at

cross-purposes with production-center needs, are also working illogically compared with positive *potential.*

Exhibit 10-9 shows the relationship between the recovery ability of each product and the total product-recovery ability as compared with the percentage of total sales attained by each product. This is based on data from Exhibit 10-7. Even with the influence of the elements of direct labor and materials cost, there is little alignment between the sales effort and the sold product's ability to recover expenses. Of

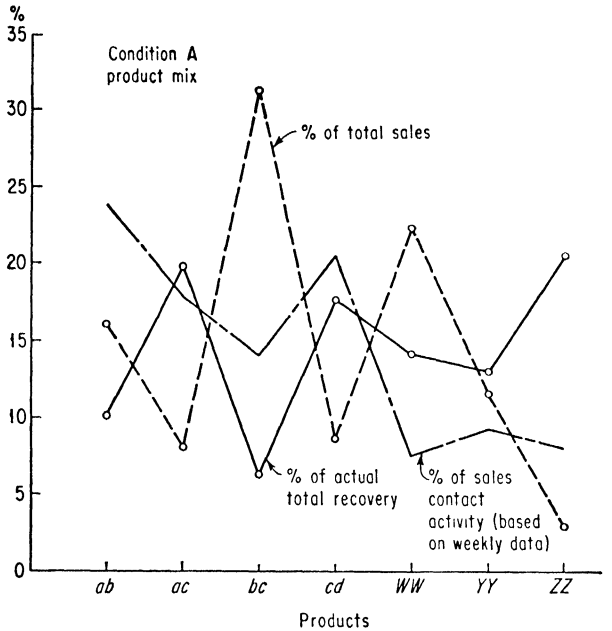
EXHIBIT 10-9. RECOVERY ABILITY OF PRODUCTS VERSUS PRODUCTS' SALES. DIAGNOSIS: SALES NOT SUPPORTING NEEDS OF PRODUCTION RECOVERY (PRODUCT BC'S DECEPTIVELY HIGH SALES RECOVER LEAST)



course, with just the element of cost charged to the respective centers, the lack of alignment is more clearly shown in Exhibit 10-8.

The reader must keep in mind constantly throughout this section the difference between the *need* for recovery (as represented by total cost on the profit and loss statement) and the degree of *ability* the products have inherently. The *need* for recovery is expressed by production centers, since that is the manner in which overhead costs are apportioned, and not by products. The *ability* is a characteristic of a specific product. Besides keying sales effort to production's needs by ensuring that sales fully recover expenses without uneconomical expansion, there

EXHIBIT 10-10. THE INFLUENCE ON RECOVERY OF THE DRIVE FOR COMMISSIONS



is also the desirability of accomplishing this task most efficiently without burdening the capital structure or space occupancy, etc.

Exhibit 10-10, based on the data of Exhibit 10-11, is somewhat similar to Exhibit 10-9. Another interpretation that can be made is that these curves show to some extent the drives for commissions irrespective of

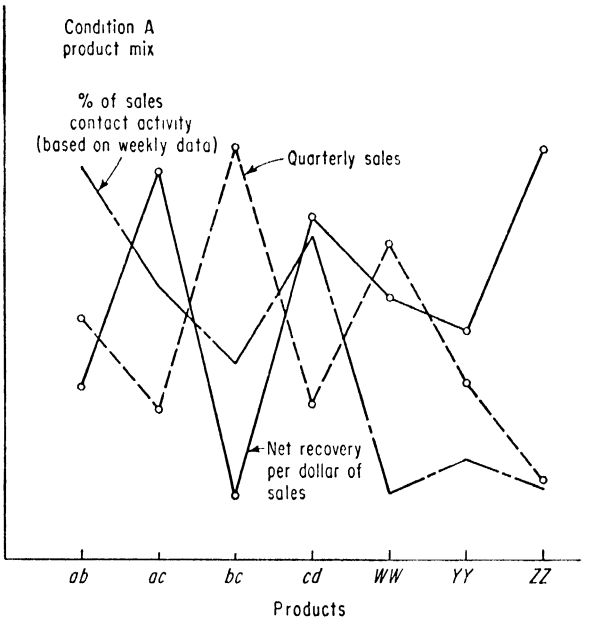
EXHIBIT 10-11. EXPENSE RECOVERY PER DOLLAR OF SALES (CONDITION A)

Production center	Ratio value: $\frac{\text{activity hours} \times \text{hourly OH rate}}{\text{product sales}}$							
	ab	*ac*	*bc*	*cd*	*WW*	*YY*	*ZZ*	Total
A	$0 0491	$.	$0 0169	$ ..	$0 0148	$0.0228	$0 024	$0 1276
B	0 0153		.....	0.0476	0 0037	0 0428	0 21	0.3194
C	0 23	0 23	0.0198	0.214	0 072		0 09	0 8558
D	0 0614	0.123	. ..	0.171		0 228	0 48	1 066
E		0 307	0 264	0.191	0 37	0 143	.	1 275
Total expense recovered per sales dollar.....	$0 3558	$0 66	$0.3007	$0 6236	$0.4605	$0 4366	$0 804	$3 6412
Less: selling expenses/sales dollar	0 04	0 07	0 12	0 091	0 028	0 046	0 184	0 579
Net recovery... .	0 3158	0.59	0 1807	0 5326	0.4325	0 3906	0 620	3 0622
Recovery per cent of total	10	19.4	5 9	17 5	14 1	12 8	20 3	100
Per cent of sales	16	8	31	8.6	22 2	11 5	2 7	100
Per cent of sales contact (based on weekly data). .	23 7	17.7	13 8	20.4	7 3	9 2	7.9	100

needs in production. This can be an added factor in a proper sales compensation plan.

The fact that sales is working at cross-purposes with production is demonstrated clearly in Exhibit 10-12, which shows the sales contact effort, net recovery, and sales.

EXHIBIT 10-12. RECOVERY VERSUS SALES BOOKED VERSUS SALES EFFORT



HOW TO INTEGRATE SALES WITH PRODUCTION

The economical integration of sales and production rests with the way the product mix is cast plus the consistency of the level of sales expenses required to generate that mix. There actually are an infinite number of product mixes in multiproducts manufacturing; that is, it is possible, within the same total-sales-volume boundary, to sell varying proportions of the seven products now under discussion. And each variation has a different state of expense recovery, serves the need of recovery differently, affects the potentiality of profits differently, and earns for each product various margins of profit or loss.

The Impact of Product Mix

As an example, let us consider three products *a*, *b*, and *c* in a company having three production centers, I, II, and III. The sales of products *a*,

b, and *c* of ⅓, ⅓, and ⅓ may not fully recover at center I, overrecovers at center II uneconomically, and evenly recovers at center III. But a proportion of 80:10:10 may overrecover uneconomically at center I, evenly recover at center II, and underrecover at center III. Which is worse depends on the cost of operating the respective production centers and the sales expenses involved in selling the three products. We can also have the proportion of 40:20:20, or 20:20:40, and so on to infinity, each combination causing a different impact on the economy of the company.

Two different combinations can be selected which have almost the identical effect on the cost-recovery needs of the company but whose selling-expense levels are different. Then again, there are differences in profit opportunity under the same product-mix recoveries, and this might influence sales effort in the direction of a somewhat lower production expense-recovery rate in favor of higher profit margins.

This concept of sales profits is not fully appreciated by managements. The fact is that each major department in the company should be considered as a separate profit-making, loss-reducing entity, whichever measure comes easier.

Selling-price Latitude

Not only is the sales effort supposed to perform economically within its own budget of expenses, it should also be charged with maintaining a fair and reasonable profit margin. This usually applies to companies that allow their salesmen a certain amount of latitude in establishing the selling prices. In such situations, without controls, the tendency is to sell the easiest way in order to roll up a large sales figure against which the sales commission would apply. Very often the "easiest" way is to exercise the right of reducing selling prices for the sake of obtaining the sale—and the commission. In a high-material-cost product, the result of this practice places the manufacturer in the position of merchandising the raw materials from his supplier, through his facilities, to his customers, just for the fun of it. Often, even if only 2 per cent is deducted from the selling price, it can be more than the gains from automating the direct labor operations in production, and sometimes more than the entire labor cost in high-materials-cost products.

There are also profit differentials in products because of the traditional price line attached to some products. The determination of the product mix should also consider that this element might likewise have a bearing on how the proportions are selected: whether they are an optimum based on recovery needs, or an optimum based on externals beyond the control of the company, or a combination of both.

New Product Mix Selected

The product mix selected as condition B (Exhibit 10-13) was devised in less than five minutes by looking closely at Exhibit 10-2 and then applying the multiplying factors by which condition A's sales were raised or lowered or left alone. The estimate achieved satisfactory results in terms of recovery, production-center expenses, and no duplication of facilities. No doubt a closer calculation would have provided an even better score.

EXHIBIT 10-13. CONVERSION OF PRODUCT SALES TO PRODUCTION-CENTER ACTIVITY (CONDITION B)

Product	Condition A sales multiplied by:	Quarterly sales	Activity of production center				
			A	B	C	D	E
ab	1	$ 20,700	240	20	150	30	
ac	2	19,584	.....	.....	150	90	150
bc	0.1	3,790	16	.....	2 5	..	25
cd	2	21,000	.....	150	150	90	100
WW	0.33	9,000	33	3	22	..	83
YY	2	28,000	160	120	.....	160	100
ZZ	3	9,990	60	180	30	120	
Total	.. .	$112,064					
Quarterly activity			509	473	504.5	490	458
			×4	×4	×4	×4	×4
Annual activity..			2,036	1,892	2,018	1,960	1,832

Notice that the sales level for condition B is $112,064, whereas for condition A it was $123,222. Yet this lower sales produced far more profits, with every other facet of the company remaining the same as it was for condition A.

The product mix shown in Exhibit 10-13 not only satisfies the needs of production in terms of the budgeted activity, but exceeds the activity (profitability potential) where the budget is below the maximum economical. Thus product *ac* is doubled, product *bc* cut to one-tenth, product *WW* cut to one-third and product ZZ increased three times.

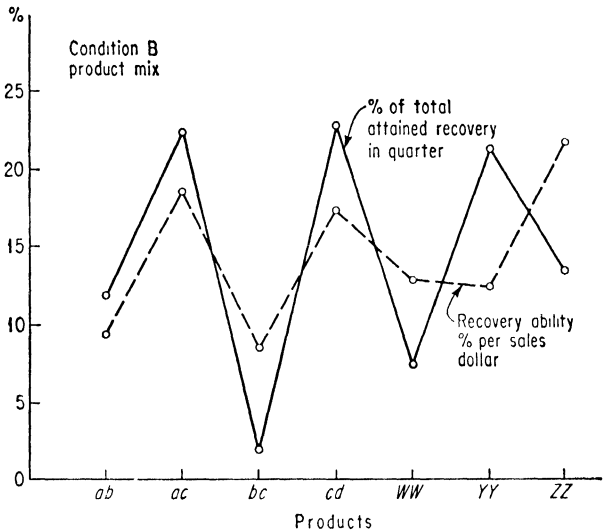
Recovery Ability: Condition B

Exhibit 10-14 is the equivalent of Exhibit 10-5. Exhibit 10-15 shows the relationship between the attained recovery and the product's ability to recover expenses for condition B's product mix. This alignment is

EXHIBIT 10-14. PRODUCT RECOVERY ABILITY (CONDITION B)

Product	Sales	Per cent	Total recovery	Per cent of product recovery / total recovery	Recovery ability of product per sales dollar	Per cent of recovery per $7 worth of sales ($1 from each of 7)
ab	$ 20,700	18.5	$ 6,860	11 8	$0 331	9 2
ac	19,584	17.4	12,900	22 2	0 658	18 4
bc	3,790	3.4	1,139	1.9	0.300	8 4
cd	21,000	18 8	13,100	22.6	0 624	17 3
WW	9,000	8.1	4,150	7 2	0 461	12 8
YY	28,000	25	12,240	21 1	0 437	12 3
ZZ	9,990	8.8	7,740	13 3	0 775	21 6
Total...	$112,064	100	$58,129	100	$3 586	100

EXHIBIT 10-15. DIAGNOSIS: SALES SUPPORTING PRODUCTION ECONOMY. RECOVERY ABILITY OF PRODUCTS VERSUS RECOVERY ATTAINED BY SALES



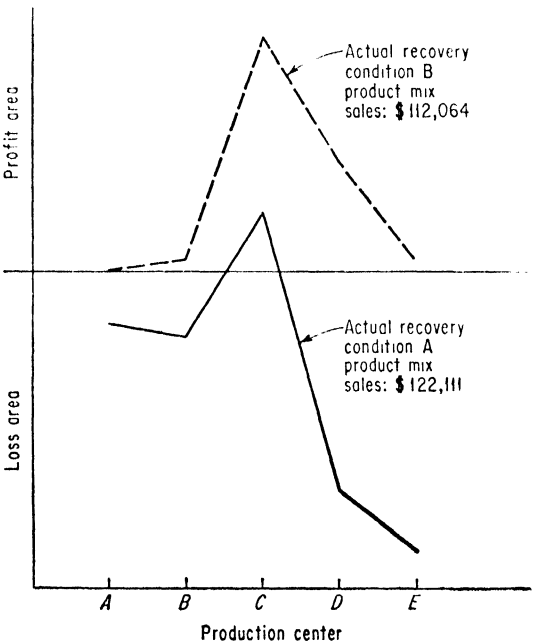
close to what it should be, and so it should be policed regularly. Note that where the two curves go off in different directions, the divergence is not great; therefore the effect is not serious.

Exhibit 10-16 is a summary of the economic effect of both conditions of product mix, on a yearly basis. Under- and overrecovery are expressed on a yearly basis, and the gain or loss on an hourly basis. Exhibit 10-17

EXHIBIT 10-16. ECONOMIC EFFECT OF PRODUCT MIX (YEARLY BASIS)

Production center	Annual cost of facilities	Annual activity	Cost/hour charged	Actual recovery	Over- or (under-) recovery	Gain or (loss) per hour
Condition A						
A	$ 16,000	2,400	$ 4	$ 9,600	$ (6,400)	$ (2 67)
B	16,000	800	10	8,000	(8,000)	(10 00)
C	30,000	1,600	30	48,000	18,000	11.25
D	64,000	900	40	36,000	(28,000)	(31.10)
E	144,000	2,700	40	108,000	(36,000)	(13.32)
					Net = $(60,400)	
Condition B						
A	$ 8,000	2,036	4	$ 8,144	$ 144	$ 0.71
B	16,000	1,892	10	18,920	2,920	1.54
C	30,000	2,018	30	60,540	30,540	15.13
D	64,000	1,960	40	78,400	14,400	7.36
E	72,000	1,832	40	73,280	1,280	0.70
					Net = $49,284	

EXHIBIT 10-17. ECONOMIC EFFECT OF BOTH PRODUCT MIXES

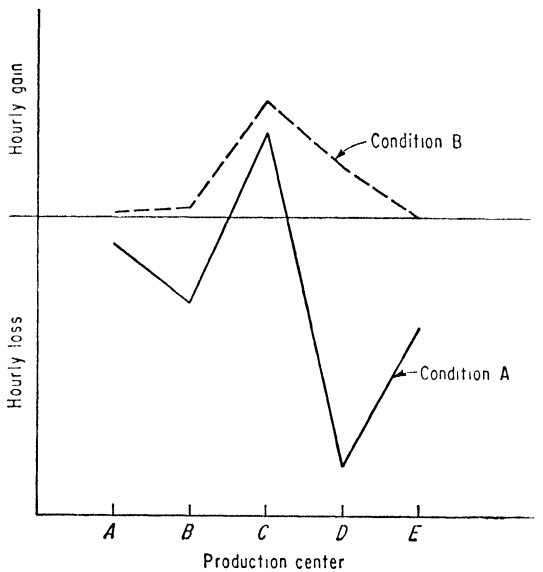


shows both conditions of product mix and their effect on the economy of the company. The graph is constructed to show which centers in conditions A and B operate in the profit or the loss area. As can be seen, no center operates in the "red" for condition B, whereas all except center C run at a loss in condition A. This circumstance leads to the underrecovery of $60,400 for condition A and an overrecovery for condition B, which is added to profit because facility duplication is not necessary.

Hourly Recovery Volatility

On an hourly basis, the same economy under the two conditions is shown in Exhibit 10-18. It is important to show the hourly as well as the

EXHIBIT 10-18. HOURLY EFFECT OF BOTH PRODUCT MIXES

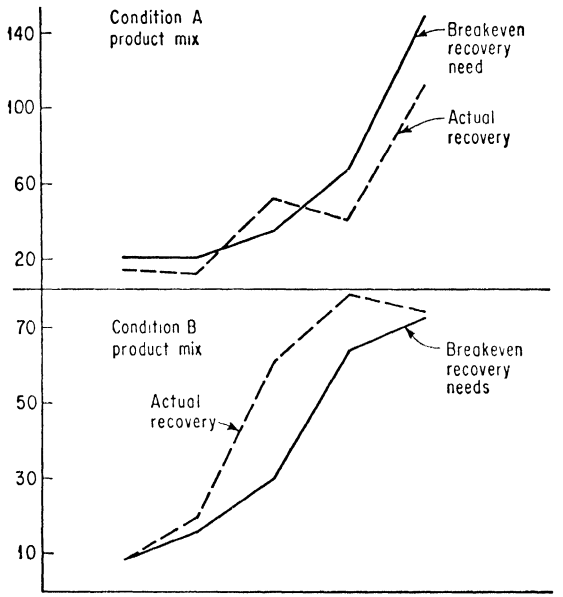


dollar recovery data because one is usually more volatile than the other. Exhibit 10-18 shows that center C's recovery is more responsive to the total recovery than it is to the hourly additive necessary. Where such a difference occurs, it is indicative of the state of profit potentiality, that is, how far away the budgeted activity is from the maximum economic. This is shown vividly in the change in production center E for condition A. It is a signal for the sales department to make an intensive drive to fill up the doubled capacity of center E if the facility has been duplicated. This presents, in fact, the greatest opportunity for expense recovery, once the second facility was purchased.

Production's Needs versus Actual Attainment

Exhibit 10-19 compares the two conditions and their respective break-even recovery needs and the actual recovery. Exhibit 10-19a shows the P&L statement for each mix. Here, then, are the results, and this is the type of data which must be developed frequently; it is the proof of the pudding. Here is a side-by-side condensed profit-and-loss statement of an assumed year's operations under both conditions of product mix. Note that the higher profit was produced with about 10 per cent less

EXHIBIT 10-19. ANNUAL BREAK-EVEN RECOVERY NEEDS VERSUS ACTUAL ATTAINMENT



sales and a higher direct labor figure. Uniform productivity under both conditions is assumed.

The obvious comment sometimes made is that more profit was produced because the materials usage was lower. Certainly, a glance at the statement will show that approximately $65,000 less materials was used. But that's not the answer. Not looking behind P&L statements, or using them solely for managerial control, is fallacious, as we have said throughout the book. The answer is that the product mix selected happened to have material contents which added up to that figure. That is why it is possible to make more profits on lower sales. If the mix had been chosen to equal the material usage of $218,800 for condition B, then the sales would necessarily have been more than that shown.

The important consideration, however, is that irrespective of the materials usage (remember that the materials-usage figure also carries a profit which contributes to the net profit listed), a profit based on more economical usage of the fixed and semifixed expenses would have been much greater. *Don't pay salesmen to sell raw material!*

The real *operating* gains, if profit is incorrect in this context, is the difference between the $270,000 and the $190,000, less the difference in the labor cost—"real" because the profit on the materials should not

EXHIBIT 10-19A. CONDENSED P&L: CONDITIONS A AND B

	Condition A	Condition B
Sales income	$192,888	$448,256
Total overhead costs (all distributed to production centers):		
2 A's	16,000	8,000 (1 A)
1 B	16,000	16,000 (1 B)
1 C	30,000	30,000 (1 C)
1 D	64,000	64,000 (1 D)
2 E's	141,000	72,000 (1 E)
Total	$270,000	$190,000
Direct labor costs	15,200	17,512
Materials costs	218,800	153,868
Total cost	$504,000	$361,380
Net profit or (loss)	$(11,112)	$ 86,876

be credited to operating since that sum came along for the ride, beyond anyone's control.

A Ratio Integrating Production and Sales

The reader is invited to examine the characteristics of his own manufacturing company and then to construct meaningful ratios which will assist him in evaluating the relationship between production and sales. One is given below to stimulate him in this direction.

HIGH-PROFIT-TREND RATIO

$$\text{Productivity attained at prod. center} \times \frac{\text{max. economic activity hr (before duplication)}}{\text{budgeted hours}}$$

In this ratio production productivity is used to give consideration to the fact that worker effort can raise the effective maximum economic activity hours (before duplication), thereby raising the profitability potential as shown on Exhibit 10-4. The projection of production-center activity hours is generally done "at standard," that is, at a predetermined level of output and worker effort. If workers have been properly stimu-

lated by some form of wage incentive, then the output can increase over standard and the ceiling on the maximum economic activity raised.

Therefore, as shown in Exhibit 10-4, it is possible for center E to have a higher profitability trend than center D if center E's productivity is higher than that at center D.

This ratio gives the trend of profitability at each production center and not for each product. In order to get the profitability trend for each product, it is necessary to add up the above-constructed indices for each center involved in the making of the product, weighting each by the percentage of cents in the sales dollar each controls. In Exhibit 10-5, the percentage figures for each product are given.

Productivity Increases Capacity

It must be kept in mind that this ratio does not evaluate the sales effort, and for that reason the author considered placing this discussion in the production MC section. But since this ratio can be tied to sales so easily, it was placed in the sales-production-integration section. The ratio evaluates the opportunity that each center has to exceed its budget, thereby providing an amount of profits in excess of that expected. It has that opportunity by virtue of the amount of hours it can run in excess of the budgeted activity up to the limit of its capacity, or before another facility has to be added, plus the effective capacity liberated by higher worker effort. Then, regardless of the amount sold by each product, but considering only the characteristics of the various products as to their contribution to production-center occupancy, we can arrive at the opportunity that each product has for contributing a profit based on the same two things:

1. Present worker productivity
2. Budgeted-to-maximum *product* activity hours

To illustrate this point, let's take the data of Exhibit 10-5 and arbitrarily assign productivities to the five centers A to E of 60, 70, 80, 100, and 120 per cent, respectively. Let us also use the budgeted or projected hours of Exhibit 10-2 as 500, 400, 250, 400, and 450 hours, respectively. The values for the profit-trend ratio are:

$$\begin{aligned} A &= 0.60 \times 500/500 = 0.60 \\ B &= 0.70 \times 500/400 = 0.875 \\ C &= 0.80 \times 500/250 = 1.60 \\ D &= 1 \quad \times 500/400 = 1.25 \\ E &= 1.2 \quad \times 500/450 = 1.33 \end{aligned}$$

This tabulation shows that center C has the greatest opportunity for adding to the company's budgeted profits. When these indices are then multiplied by the values shown in Exhibit 10-5 and footed across, we

have the conversion of the *production center's* added profitability trend to the *seven products'* added profitability trend.

These data are shown in Exhibit 10-20. The data show that products *ab* and *ZZ* provide the greatest opportunity to add to the company's budgeted profits.

EXHIBIT 10-20. CONVERSION OF PRODUCTION CENTER ADDED PROFITABILITY TO PRODUCTS

Production center..	A	B	C	D	E	Product total index
High-profit trend ratio	0.6 ×	0.875 ×	1.60 ×	1.25 ×	1.33 ×	
Product *ab*	0 451 = 0.27	0 065 = 0 058	0 389 = 0 623	0 098 = 0 123		1 074
Product *ac*			0 205 = 0 328	0 104 = 0 13	0 168 = 0 224	0.682
Product *bc*	0 179 = 0.108		0.039 = 0 062		0 316 = 0.420	0.590
Product *cd*		0.172 = 0.150	0 204 = 0.326	0 151 = 0.193	0.11 = 0.146	0 815
Product *WW*	0.103 = 0.062	0.018 = 0.016	0 094 = 0.15		0.289 = 0 384	0 612
Product *YY*	0.167 = 0 100	0.221 = 0.192		0 294 = 0 368	0.118 = 0.157	0 817
Product *ZZ*	0 10 = 0 06	0.525 = 0 469	0.069 = 0 11	0 349 = 0 437		1 067
Total	0.600	0.876	1.599	1.251	1.331	

EXHIBIT 10-21. SALES CONTACT EFFORT

Product	Contact				Product total
	Jones	Smith	Brown	Greene	
ab	4	14	12	12	42
ac	3	20	8	6	37
bc	10	10	4	2	26
cd	1	0	6	8	15
WW	0	12	2	3	17
YY	0	3	10	8	21
ZZ	0	0	2	6	8
Total	18	59	44	45	166

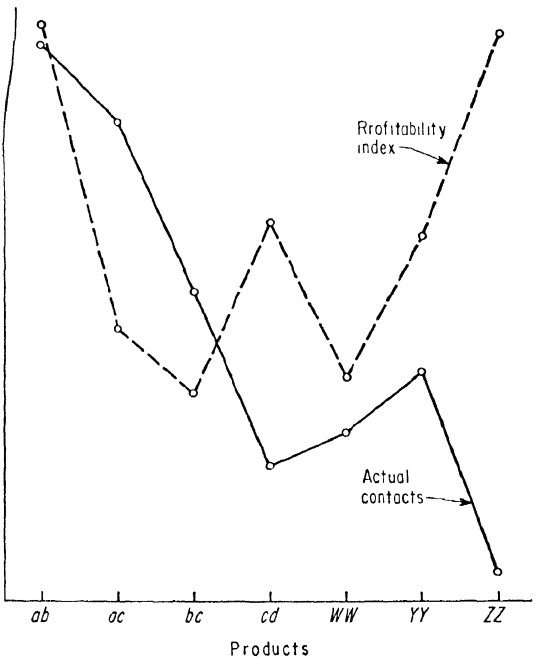
Sales-contact Effort

To see to what extent the sales effort is keyed to this high-profit trend requires the introduction of one of the ratios from the sales chapters dealing with contact effort. Let's assume the data in Exhibit 10-21 to be representative of the effort of the sales department. And Exhibit 10-22 is a comparison of the data in Exhibits 10-20 and 10-21. To emphasize this point, we are equating a high profitability of products

with the effort made by the sales department to sell those products. It is contact effort, and not the results of the contacts, that are used as the sales activity factor. In other words, we are not considering for the moment the sales or quotations produced, but just the directions that the salesmen are given by their management.

Product *ab* seems to correlate well, indicating that it is being fully exploited. The same is true of product *bc*. But now that we know what we do about product *bc*, it would be better to reduce the number

EXHIBIT 10-22. PRODUCTS' PROFITABILITY INDEX VERSUS CONTACT EFFORT



of contacts made on its behalf. Product *WW* appears to be well correlated. The major offender is the lack of contact effort on behalf of *ZZ*. The boat is also being missed on product *ac*, where too much effort is being applied; on *cd*, where too few contacts are being made; and on *YY*, where there is not enough sales effort applied.

An examination of Exhibit 10-21 soon tells which men need counseling. Of course, the real test is the actual sales brought in by each, and the reader is left to make his own tabulations and curves. Since the contact effort is the forerunner of the actual sale, due attention must be given to this curve since it reflects the way in which the men are being directed. From these data, however, if later confirmed by actual dollar sales figures, it would seem that product ZZ is being sacrificed because

of the low volume of sales the typical order for it brings in. This is probably due to the extremely low material cost content in the sales dollar, and therefore when men shy away from pushing this product, it indicates that the men are "gross dollar selling" instead of "recovery and added profitability" selling. The function of these charts and curves is thus served; management should use them to direct its men to support the over-all economic needs of the company.

PROBLEMS

1. Discuss the various ways in which sales and production can work at cross-purposes.
2. Discuss the various ways in which sales and the financial activities of the company can work at cross-purposes.
3. Discuss the various ways that production can operate at cross-purposes with the financial functions.
4. Discuss the role of management in blending harmoniously the efforts of various autonomous functions.
5. Discuss the impact of multiproduct sales on capital and production.
6. What is the difference between a product cost and a facility cost? Give examples.
7. Define product mix, volume mix, customer mix, facilities mix.
8. Discuss the need for managerial coordination with respect to products, facilities, capital.
9. Develop ratios relating production-center costs to production speed and economy of production flow.
10. Integrate product sales of conditions A and B (in text) with capital. Show impact of both mixes on financial structure.
11. Explain how sales of a given product affect expense recovery.
12. Explain maximum economic recovery.
13. What is the difference between actual, maximum-economic, and budgeted recovery?
14. Discuss four aspects of integration occurring between sales and the other functions of the company.
15. Explain why a duplicated facility costs less than double the single-facility annual cost.
16. Develop a ratio relating sales contact activity of a product and its expense-recovery ability.
17. Explain exactly how you would set up a ratio-control program for directing sales efforts, keeping in mind the needs of company economy. How would you set up sales targets using data from your program?
18. If in setting up a sales-control program you found that the best targets for expense-recovery overburden the inventory structure, how would you proceed to select the optimum between recovery and the financial impact?
19. Develop appropriate ratios that would alert management to serious shifts in this optimum.
20. Develop integration ratios between recovery ability of products, contact effort, and material content of products.

CHAPTER 11 *Introduction to Financial Management*

The previous major sections dealt with the evaluation and control of the production and sales efforts and then their integration. As we saw, autonomous decisions made in sales became a lever in the production economy. At times, and accidentally, support was given to the needs of production; at other times the independent action of the sales effort could undermine the production economy. This was, of course, inadvertent. We saw that it was essential that both efforts be measured by the same yardstick so that one standards goal could emerge. This was accomplished by converting the products into terms of the production centers involved in their manufacture, so that when a given product was sold, the effect on the various manufacturing facilities could be instantly evaluated.

Production-Sales Impact on Capital

What has to be considered ultimately is the effect of the production-sales integration on the financial affairs of the company. For what might be deemed a wise move for sales and production might be a weakening factor in the financial state of the company.

For example, a certain product might find favor with production and sales because of its good expense-recovering ability. But also, it might have a high dollar material content (in the sales dollar), and drives to attain a high level of recovery might so overburden the inventory level as either to deprive the company of ready cash or expand its debts beyond what creditors think is safe, and so restrict future credit of the company. Or sales and production might agree on the purchase of a new piece of equipment as being feasible and economical within their joint areas of operation, but this acquisition might involve short- or long-term loans which might place the creditors in the position of having more at stake in the business than the owners.

Actually, there are myriad moves which can validly be made in the

sales-production area which can cause both positive and negative effects in the company's financial state of health. Some of the situations are not as dramatic as the two mentioned above, but when some sales-production decisions are measured in the financial area, their impact may be great enough to reverse a decision. Then again, some decisions may enhance the financial state of health. As a matter of fact, they may have such positive effect in the financial area that production and sales may search for situations where the improvement in the financial structure is enough to justify a move or an act.

Similarly to treatment of the elementary control of production and sales, this section will deal first with the elementary evaluation of the capital structure—the financial health of the company. It will then discuss the evaluation of financial management, i.e., how well people preserve the capital structure in the light of the needs of the production and sales efforts and consistent with the needs to satisfy management, owners, and creditors. The section will then proceed to an advanced evaluation and control of the capital structure and will terminate with the integration of the financial effort with that of sales and production.

The Capital Structure (Balance Sheet)

Profit is the goal and motive of business enterprise; one cannot exist without the other. Profit is an ambiguous word; it means many things, depending on the viewpoint of people. Manufacturing management regards profit as the earnings it makes on sales; the owners view profit as the earnings it makes on their investment; those who look at profit more conservatively regard it as the return on the total resources used in the business, that is, on the total assets. The sales manager sees profits tied to volume. No one function can guarantee profits.

It is possible, and happens often, that what is considered a meager return on sales is an adequate return on the invested funds. As a matter of fact, some owners (stockholders) object to expanding the profits on sales for fear of an effect on the capital structure which might limit the earnings on their investment. At the same time, a high return on sales is not necessarily a guarantee of an adequate return on investment.

The entire complex picture is further compounded by the inflationary speed with which the purchasing power of the dollar is decreased. This leads to burdens of future replacement, using "softer" dollars, and should force a cold realization of the overstated nature of corporate profits. These profits are chameleonlike and change color with variations in the purchasing value of the dollar.

If the company has a balanced capital architecture, that is, balanced to fit its needs today and then controlled so that it can meet the

changed need next week, and if this structure is managed and balanced so that it supports the needs of production-sales consistent with its obligations to others, then the company is in the position of "making hay" out of every event that crosses its path. By "hay" is meant both positive and negative situations. Having control and integration of the total data allows an objective "no" as well as a "yes." Important also is that with the security of these data, executives are freed for wider activities, instead of being shackled by the gnawing doubts of subjective information and the pile of "reports" placed on their desks by, at times, self-seeking subordinates.

The goal of business enterprise should be the continuance of a profit with a continuance of a healthy financial state. The preservation or control of this financial state traditionally has been left to accountants. Yet if company-wide organic decisions are to emerge, there must be a basic understanding of these terms by management.

We are confident that in a short time the uninitiated will understand the meanings of optimizing the current assets in relation to sales; maintenance of proportions between the fixed and circulating capital; velocity of capital flow; state of liquidity; turnover of working capital and net worth; inventory turnover; return on invested capital; alternative choices of financing; etc. All these factors are affected by the bilateral decisions of production and sales.

To understand the capital structure, one must have familiarity with the *balance sheet.* This is a tabulation of the financial state of the company *at one instant.* The moment the balance sheet has been drawn up it is obsoleted by new facts—facts which are always changing, as we shall see later. Exhibit 11-1 presents a simplified and condensed balance sheet. While simplified in form, still it shows the health of the company and will not prevent grasping the MC concept and applying it to a specific plant. Noncurrent liabilities is sometimes called the funded debts, or fixed liabilities.

Exhibit 11-2 is a graphic representation of the capital architecture. In essence, the capital, both owned and borrowed, supports the assets (the total capital employed), which in turn are used in the manufacturing effort which produces sales. The total of the capital is used to finance the assets; therefore all the capital employed is equal to all the assets. That is why the total assets are called the total capital *employed,* because they are employed in all the resources of the company.

While the total capital is equal to the total assets, the components within both these equal parts can exist in different proportions. Furthermore, these proportions are always in a state of flux. As goods are manufactured in production, the inventory level changes. The accounts receivables change as goods are shipped and invoices collected. The

EXHIBIT 11-1. PRIMARY CAPITAL AND FINANCIAL DATA (BALANCE SHEET FORM)

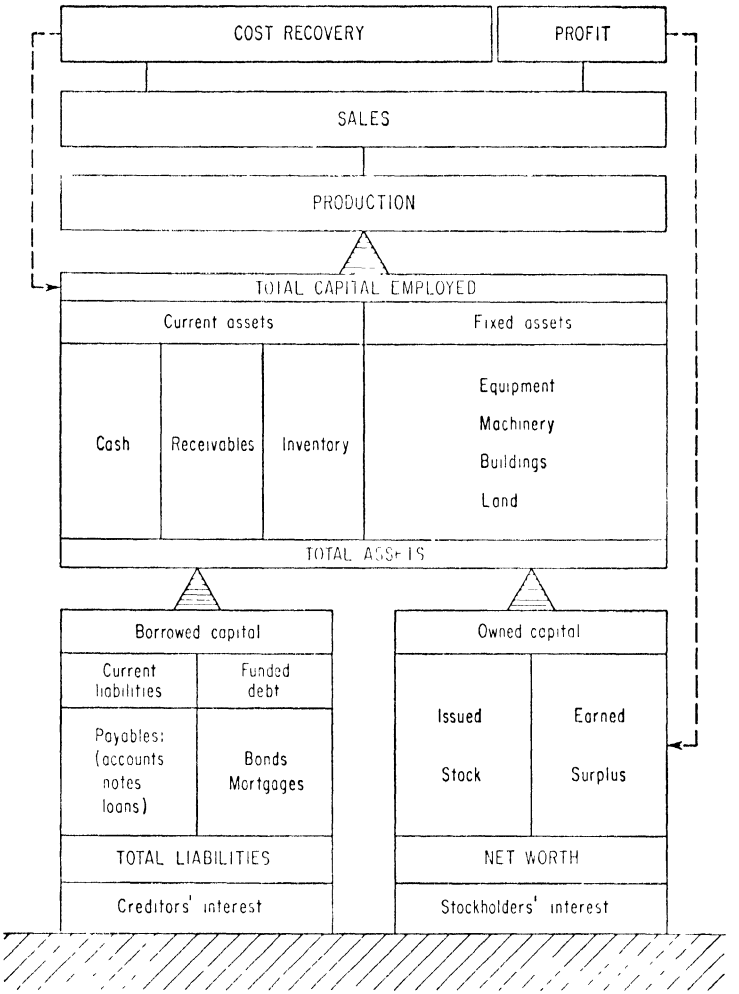
Identifying letters	*Item*
	ASSETS (*the present location of the capital*)
aa	Current (circulating capital)
aa	Cash
ab	Receivables (accounts, notes)
ac	Inventory
ad	Total current assets
	Fixed (fixed capital)
ae	Machinery
af	Land and buildings
ag	Total fixed assets
ah	TOTAL ASSETS
	LIABILITIES (*the source of the capital*) (*borrowed*)
	Current (short-term borrowed capital)
ai	Payables (account notes, loans)
aj	Total current liabilities
	Noncurrent (long-term borrowed capital)
ak	Payables (mortgages, bonds)
al	Total noncurrent fixed liabilities
am	TOTAL LIABILITIES
	NET WORTH (*the source of the capital*) (*owned*)
an	Issued capital stock
ao	Reserves
ap	Retained earnings
aq	TOTAL NET WORTH
ar	TOTAL LIABILITIES AND NET WORTH

Tangible net worth = aq = (an + ao + ap)
Working capital = ad − aj
Total capital employed = total assets = ah or ar
Funded debt = al

fixed property—the equipment—depreciates each second. The capital also changes: creditors are paid for raw materials, additional purchases made on credit, etc.

The total capital consists of two major parts: the owned capital, which is represented by the shares of stock issued, and the borrowed capital, which the company gets in the form of credit from its suppliers (current) and from bank loans for short periods (current) and that which is obtained on a longer term such as mortgages or bonds (funded) for which the company has pledged a portion of its assets. Borrowed capital, either short- or long-term, is termed liabilities. The owned cap-

EXHIBIT 11-2. THE CAPITAL ARCHITECTURE



ital is called the net worth. Since the total assets equal the sum of all the capital, it follows then that the net worth is equal to the total assets minus the liabilities.

Impact of Variations in Identical Capital Levels

It is important for the reader to understand that given the same dollar amount of total capital employed, the state of health can vary from poor to excellent, depending on the internal proportions of the assets and the proportions between the liabilities and the net worth. For ex-

ample, a company with total assets of $1 million might have a balance sheet with these proportions:

Case I:			
Total assets	$1,000,000	Total liabilities	$ 200,000
		Net worth	800,000
	$1,000,000		$1,000,000

Or it might have these proportions:

Case II:			
Total assets	$1,000,000	Total liabilities	$ 800,000
		Net worth	200,000
	$1,000,000		$1,000,000

Obviously, one of the above two conditions has to be better in a given situation than the other. Both have negative and positive aspects if viewed isolatedly, that is, without the production-sales frame of reference, and without considering the specific industry.

Case I shows that the owners "own" the business; that is, the creditors have a small stake in the business compared with the owners' interest. That's a positive aspect. A negative one is that the owners' investment may be too big for the amount of money the company earns; that is, when the profit is compared with the invested capital, it may prove to be lower than what could be obtained from investing in other securities. As this amount grows, a given amount of profits provides a decreasing return on investment.

In case II, the creditors have four times the stake in the business of the owners; thus the business invariably is conducted more for the benefit of the creditors than for the good of the business. There are other considerations also in this simple proportion. If the company can obtain borrowed capital (loans) at interest rates which are below that which the company earns on the total capital employed, then the larger the proportion of total capital borrowed, the greater the return to the owners or stockholders. Again, an optimum has to be struck between the additional return and the added borrowed capital in relation to the safety of the company (see Exhibit 13-12).

Let's now vary the assets side of the balance sheet to expand the two foregoing cases into four:

Case IA:			
Cash	$ 100,000	Current liabilities	$ 200,000
Accounts receivable	600,000	Total liabilities	$ 200,000
Inventory	200,000	Net worth	800,000
Total current assets	$ 900,000		
Fixed assets	100,000		
Total assets	$1,000,000	Total liabilities + net worth	$1,000,000

Case IB:			
Cash	$ 100,000	Current liabilities	$ 200,000
Accounts receivable	100,000	Total liabilities	$ 200,000
Inventory	100,000	Net worth	800,000
Total current assets	$ 300,000		
Fixed assets	700,000		
Total assets	$1,000,000	Total liabilities + net worth	$1,000,000
Case IIA:			
Cash	$ 100,000	Current liabilities	$ 200,000
Accounts receivable	600,000	Noncurrent liabilities	600,000
Inventory	200,000	Total liabilities	$ 800,000
Total current assets	$ 900,000	Net worth	200,000
Fixed assets	100,000		
Total assets	$1,000,000	Total liabilities + net worth	$1,000,000
Case IIB:			
Cash	$ 100,000	Current liabilities	$ 600,000
Accounts receivable	100,000	Noncurrent liabilities	200,000
Inventory	100,000	Total liabilities	$ 800,000
Total current assets	$ 300,000	Net worth	200,000
Fixed assets	700,000		
Total assets	$1,000,000	Total liabilities + net worth	$1,000,000

Now the problems have been compounded. In addition to the need for finding a balance in the company's financing, as mentioned above, we now have to manage the flow of the capital so that it is in the right place at the right time, i.e., so that it won't cripple operations or won't risk the solvency of the company.

In case IA, the division of the fixed and current assets appears sound, unless more equipment is needed in production and the asset tabulation represents an unwarranted frugality. However, in the composition of the current assets, of those assets which are easier to convert into cash if need should arise, two-thirds of them are in accounts receivables. This could be evidence of a poor collection policy or a lack of policing the receivables. As a matter of fact, with a net worth of $800,000 the stockholders' risk is in the hands of the customers; i.e., if the customers do not pay, the effect on the owners' interest is almost in direct proportion.

In case IB, the division of the assets leans heavily in favor of the fixed assets—in machinery, land, building—which cannot readily be converted into cash. This lower current asset level lowers the ability of the company to pay its current debts ($200,000) promptly and will make future creditors wary. And when fixed assets are such a large portion of the net worth, it leaves little opportunity for expansion.

In case IIA, the state of the capital structure with respect to the company's ability to pay its debts promptly is the same as case IA, i.e., $900,000 of current assets to $200,000 of current liabilities. However, because of the laxity of collections, the company was forced to get long-term loans. Obviously, as collections are accelerated, loan interest is saved and the capital structure becomes stronger. Here the creditors' risk is inherent in the worth of the accounts receivable.

In case IIB, the situation is even worse. There is only 50 cents of current assets for every dollar of current liabilities. This might make mandatory the selling of capital equipment with which to pay current bills if the creditors applied pressure.

Variations like the above four are myriad, even within the same $1,000,000 context. And when the variations of sales levels, earnings, expense recovery, and the like, are added, the impacts are considerable and widely different.

Generation of Events

The acts and events which cause changes in the balance sheet or capital structure can be generated from two directions:

1. From the needs in manufacturing: a machine is scrapped, replaced, repaired; sales are accelerated; etc.
2. From the management of the movement of the funds: a lot of inventory is purchased on speculation; a credit policy is established; loans are made to improve the return on invested capital; etc.

Every act in sales, production, or in any other area of the company will have its effect on the company structure. A decision in sales, even though it has been tested as to its effect on production and found to be positive, *can cause a swing in the proportions of the assets in enough of a negative direction* to invalidate the sales decision. The reverse is also true: an autonomous decision in the financial area for the sake of financial security can have unsound impact on production.

Total MC and Capital

In the ultimate, total MC concept (total integration) we are interested in just how the capital structure changes or would change based on decisions made or to be made elsewhere. We are interested in just how the management of money will support or does support these decisions. In the broadest sense, we want to know how decisions in any one of the three major areas affect the other two so that they can be pretested, so that their effect can be predicted in advance.

Unlike the management of production or sales, the management of money in the business has one important difference. In the management of production or sales the effort is internal and fully controllable; that

is, if we are talking about the management of people, then the company's employees are subject to direction, etc. However, in the management of the business funds, if the capital structure is not sound, then the manager finds that "outsiders," over whom he has no control, begin to figure prominently in his table of organization.

These outsiders are the creditors, principally, who in spite of all the manager's operating and sales efficiency might force him to make decisions which are best for the creditors and poorest for his business. Nonmanaging, nonemployee stockholders are also outside the day-to-day pressures of managing; they very often have a limited viewpoint and an inflexible standard of company growth and efficiency. Often their definitions do not fall within the framework of what management considers to be top effectiveness in manufacturing.

A properly designed and maintained capital structure removes these problems, but it must be policed constantly lest it create problems over which management may not have direct control.

The Operating Performance (Profit-and-Loss Statement)

This is a statement of how well management operated its business in the previous period with the resources listed on the balance sheet. This statement surely shows the final result of the effectiveness of operating during a period, but it does not show the contributing reasons for the performance.

All net profits are comprised of gross losses and gross profits, and it is only by seeing them both that we can remedy the losses and act intelligently on the profits. The gross profits, then, are more properly termed the *profit-making factors* and the gross losses labeled the *profit-losing factors.* Both are *opportunities.*

An income statement shows the subtraction of both the above factors; it does not show how much of each was present. Unless management can see the actual profit-factor recipe, it cannot act. And unless the facts are available in time, the action taken will be wasted. The annual or even quarterly income statement is issued too late *after the facts* for objective action.

However, the income statement is valuable for indicating some important *characteristics* of the company, those best evaluated over a longer period. Among them are the elements of fixed and variable charges incurred in the production of sales. As we have shown, the firm with a large fixed element of expense makes a profit over a narrower range of sales and is vulnerable to lowered price levels and recessions! Knowing these company traits allows us to make general evaluations.

Exhibit 11-3 shows a suggested form of income statement which permits an easy glimpse of these two elements.

EXHIBIT 11-3. PRIMARY CAPITAL AND FINANCIAL DATA (P&L FORM)

Identifying letters	*Item*
ba	Net sales
bb	Direct material cost
bc	Direct labor cost
bd	Total indirect labor cost
be	Nonproductive manufacturing labor cost
bf	Maintenance and repair labor cost
bg	Supervisory labor cost
bh	Total nonlabor manufacturing expenses
bi	Machinery and space costs
bj	Power costs
bk	Total stand-by expenses
bl	Depreciation charges
bm	Insurance expenses
bn	Rent and taxes
bo	Cost of goods sold (factory cost)
bp	*Gross profit*
bq	Total variable G&A expenses
br	Management costs
bs	Services and supplies
bt	Total variable selling expenses
bu	Salaries and commissions
bv	Service and supplies
bw	Contact expenses
bx	Total standby expenses
by	Basic business management costs
bz	Basic sales management costs
ca	Depreciation charges
cb	Insurance expenses
cc	Rent and taxes
cd	Interest on loans
ce	Cost of sales (total cost)
cf	*Net profit*

Prime cost = bb + bc
Factory cost = bo
Total cost = ce
Total overhead = bd + bh + bk + bq + bt + bx
Factory overhead = bd + bh + bk
Conversion cost = ce − bb
Fixed charges = bk + bx
Variable expenses = bb + bc + bd + bh + bq + bt
Cost of owning fixed asset = bf + bi + bk
Cost of sales = ce

Fixed and Variable Charges

A truly fixed expense is one which remains at the same level regardless of the sales or production volume. A fixed charge will be the same for zero production as for maximum capacity output. The facilities for which the fixed charges are made are always available for use during the entire period, provided they are below 100 per cent capacity. For this reason, fixed charges are sometimes called stand-by, or period, charges. Variable charges are those which vary directly with production volume.

There are those which are in between, sometimes called semivariable or semifixed. Either is a poor term since the degree of variability or fixedness is not necessarily 50 per cent.

Stand-by charges are depreciation, rent, insurance, etc. Variable expenses are materials, labor, etc. The partially variable expenses are supervisory expenses, advertising, etc.

Break-even Point

One of the basic tools of management is the break-even chart. Much has been written on this, so it will be reviewed here only in the briefest terms. A business will break even when its sales income and total expenses are equal. But because of the presence of the fixed charges which are incurred even at zero income, the income must first absorb the fixed charges before it can go on toward paying for some of the variable charges. The amount of total fixed expense that has to be paid depends on the specific company, and this determines how soon, or at what sales-income level, the company will break even.

The formula is a simple one. It is the total fixed costs/fixed cost ratio. We need two terms; the first produces the second. The first is the variable-cost ratio, which is variable costs/sales; the second is the fixed-cost ratio, which is the variable-cost ratio subtracted from 1.00.

Thus a company with a variable cost of $5 million to sales of $8 million has a variable cost ratio of 0.625 and a fixed cost ratio of $(1 - 0.625) = 0.375$. Now if this business operates with a yearly total fixed cost of $1,800,000, it will break even at $1,800,000/0.375, or at a sales level of $4,800,000, and it makes a profit only in the area from $4,800,000 to $8 million, or on $3,200,000.

But all companies, even in the same industry, do not behave the same way. Take another company doing the same sales volume but with variable costs of $3 million. This produces a fixed cost ratio of $(1 - 0.375)$, or 0.625. If this business operates with yearly total fixed cost of $4 million, it will break even at $4,000,000/0.625, or $6,400,000, and its sales-profitability range will be on just $1,600,000, one-half of the previous example.

Notice the difference. The first company earned a profit on over $3.2 million of sales, and the second on only $1.6 million. The second company is very vulnerable to market price changes. It would take just a 20 per cent drop in prices to start the company working in its loss zone. And if the company was working near maximum capacity, it would require a very drastic redesign of its economy in order to survive. The second company is less elastic.

In the MC technique we are not interested in industry comparisons, but only in guiding management away from serious situations and into optimum channels.

Capacity, Elasticity, Recovery

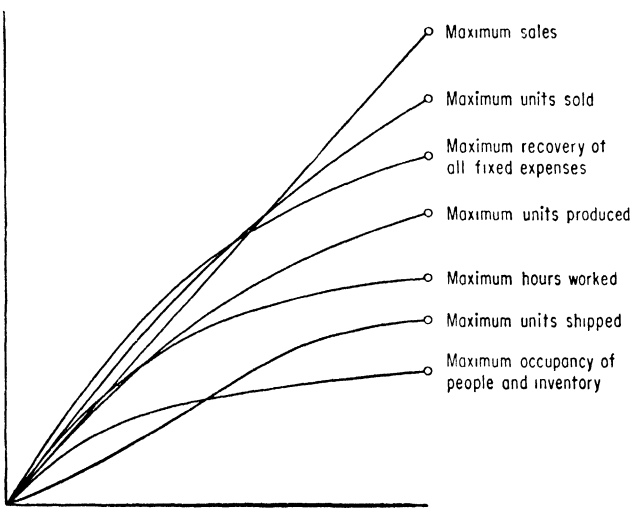
Like the balance sheet, the profit-and-loss statement has internal variations. It also reflects the state of the company's elasticity. The impact of a given state of elasticity is strengthened or weakened by its quality of cost finding; the consistency of its expense recovery. And these are directly related to the company's capacity.

Capacity

What is capacity? More important, what is *maximum* capacity? Does it refer to volume, space occupancy, sales, hours, pounds? How full is full is like asking how good is good and how high is up.

Exhibit 11-4 shows a family of capacity curves for a medium-sized electrical-devices manufacturer. We have quite a wide choice in selecting the unit for measuring *capacity*. Obviously, selecting any one at

EXHIBIT 11-4. UNITS OF CAPACITY: BEWILDERING CONCEPTS



random could distort any calculation we would make if it was not truly representative of capacity, especially if we were attempting to arrive at less-than-maximum-capacity conditions.

In a multiproduct firm, the concept of *maximum sales capacity* is fallacious, for that maximum would be as variable as the changeability of the product mix. In the same type of firm, pegging maximum capacity to the *maximum hours worked* could also be misleading because the same maximum could produce varying levels of sales.

A maximum number of units sold or produced is also misleading as a concept of maximum capacity, since obviously the mix of the units will produce different sales levels, different maximum hours worked, etc. *Maximum number of people* housed in the plant is likewise an incorrect measure of capacity. And so it goes, each industry striving to find the

EXHIBIT 11-5. VARIATIONS IN EXPENSE RECOVERY WITH DIFFERENT PRODUCT MIXES

Product mix	Sales	Fixed expense recovery
A	$1,000,000	$400,000
B	1,000,000	200,000
C	1,500,000	200,000
D	1,500,000	100,000

magic formula by which to measure maximum capacity in an effort to find the right costing formula; the correct depreciation method; etc.

The disturbing part of the glib use of this term is that it is so blithely applied in curves and formulas which help the writer state his point, but which do not materially aid the reader in choosing a direction or making a decision. As soon as the writer changed the base on which he built his capacity figure, all his conclusions and calculations would have to be changed.

The author presents a concept of capacity which is keyed to the conditions and characteristics of the company and which allows proper calculations in the MC concept.

Let's return to the typical *maximum* concepts. We said that in a multiproduct firm, the concept of maximum sales capacity is fallacious because the maximum sales is a function of the particular product mix then existing. However, whatever the sales maximum or whatever the product mix happens to be, both will affect the amount of fixed expenses that will be returned to the company in its selling prices. Exhibit 11-5 shows that the fixed expense recovery is a function of both the sales level and the mix of the products contained in that sales level. We then

said that the maximum hours worked could not be considered as the measure of maximum capacity either, because, obviously, different levels of maximum hours could produce different sales levels. However, the hours worked and the sales made are functions of product mix, and all affect the amount of fixed expenses that is returned to the company. The maximum number of units sold or produced obviously can make varying use of facilities, and this will impact on the level of fixed expenses recovered.

Capacity, if it is used properly, must be considered a *property* of a firm—a rather fixed characteristic. That means it must stand the test of rapid and constant change. Can the capacity of a company be measured *at any one instant* by maximum sales, by maximum hours it can work, by maximum units it can make? Not very well, since these factors are always in a state of flux and require other qualifying factors. However, the one entity that remains fairly constant and changes only by managerial direction is the maximum amount of fixed and stand-by expenses present at any one time. In an operating firm, the level of these expenses will remain fairly constant regardless of wide swings in the sales, in the units sold, in the hours worked, in the space occupied, etc. The concept of *maximum expense recovery for maximum capacity* is the one selected for consideration in the MC technique.

Cost Finding

While the cost system is actually not part of the MC concept of interrelated ratio movements, both the capacity and the recovery concepts vital in the total MC integration are involved intimately in cost finding. It surely would not make sense for management to have all or a portion of the MC system operate side by side with an improper cost system. However, we hasten to point out that where the total MC plan is in effect, deficiencies in cost-estimating systems would be uncovered fast. While this is surely a desirable feature of the MC plan, the existence of a sound cost-estimating system would greatly enhance the operation of the MC system.

For a cost-estimating system to be acceptable, it must cost the product in accordance with the expenses incurred by the product. This is rather simple for materials cost and for direct labor cost, but it gets quite complicated when overhead is allocated to the product.

The cost-estimating system recommended by the author, which solves the knotty problem of assigning overhead to the product, is known as the *machine-hour rate method,* sometimes referred to as the *direct facility costing plan.*[1]

[1] Spencer A. Tucker, *Cost-finding and Control,* Haywood Publishing Co., Chicago, 1961; "The ABC's of Machine-hour Rates," *American Machinist,* May 5,

Cost Recovery

This is a term to which we have made reference in several sections of this book. From the examples and illustrations previously given, it is hoped that the reader got some idea of what is meant by "recovery." It is a simple concept and revolves around the economics of the use of the converting plant's facilities.

Converting manufacturing, that type of enterprise which has high initial investments in facilities, is dependent on the usage of facilities to recover investments. (In effect, it is in the busines of selling machine and plant time.)

A proper portion of this sum must be carried by each product to produce the desired recovery within the sales volume. That is why the magnitude and velocity of expense recovery are direct functions of the product mix.

Product Mix Must Balance Profits with Financial Health

Sometimes a product mix has to be designed to consider the need for recovery, a balanced capital structure, or any combination of either. Sales serving one need can default on the other. The type of product mix which ideally makes the best recovery in production may overburden the inventory levels and hence the capital structure. That mix which is lightest on inventory load can barely touch the recovery needs. Therefore the mix must be chosen which provides the company with a balance between these two areas.

Maximum expense recovery plant-wide is entirely different from the level of expense recovery at each major production center. So whereas the recovery at each production center may vary, the total plant-wide recovery may remain the same. Obviously, this is a function of product mix which affects the level of usage of the production facilities. As the mix favors the more expensive facilities, it would take a smaller level of sales to effect the same recovery, and vice versa.

Exhibit 11-6 shows two conditions of product mix, each producing the same level of recovery with different sales levels. Conversely, the same level of sales can produce varying levels of recovery. That is why with a revision in the product mix, a desirable recovery can be effected. Similarly, a variation in product mix can affect the amount of inven-

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1958; "Planned Profits with Managerial Control," *Fourth Annual Proceedings AIIE*, Seattle, Wash., Apr. 19, 1958; "Facility Costing," *Fourteenth Annual Conference, SPI*, Chicago, Feb. 4, 1959; "Cost-finding vs. Cost-making," *Automatic Machining*, January, 1959; "False Profits," *Automatic Machining*, March, 1959; "How to Develop a M-H-R Estimating System," *Automatic Machining*, series started June, 1959; "Finding Product Costs with Machine-hour Rates," Prentice-Hall Inc., Englewood Cliffs, N. J., 1961.

tory. Obviously, certain products require more material in the sales dollar; other semifinished products remain longer in process in the plant, etc. Thus the level of inventory and the company's working capital position are both affected.

The fluctuating areas of cost recovery in the plant (occurring at individual production centers) within a rather fixed level of maximum expense recovery is what affects the company's total profits. It affects this total to the extent of the profits made on individual products. The type of product sold and its quantity determine which facilities will be

EXHIBIT 11-6. IDENTICAL RECOVERY FROM TWO DIFFERENT SALES LEVELS

Production center	Hourly expenses to maintain	Hourly usage	Recovery
Sales $1,000,000—Mix I			
A	$10	12,000	$120,000
B	20	8,000	160,000
C	50	3,000	150,000
D	80	1,000	80,000
Total recovery.....			$510,000
Sales $800,000—Mix II			
A	10	7,000	$ 70,000
B	20	4,000	80,000
C	50	4,000	200,000
D	80	2,000	160,000
Total recovery. ..			$510,000

used and for how long. This in turn determines the amount of expenses the sales recover. If the product costing is improper, the recovery will not be consistent and the profits are victimized by the type of product mix.

In the MC technique, the state of expense recovery as well as the velocity of that recovery are considered. The velocity is especially important in assessing future conditions and advanced planning.

Profit Elasticity

Many decisions made in a company today have a direct bearing on the difficulty or ease of making profits in the future. Also, several companies in the same industry and operating at about the same sales level might require different increments of sales to make the same profits. Of

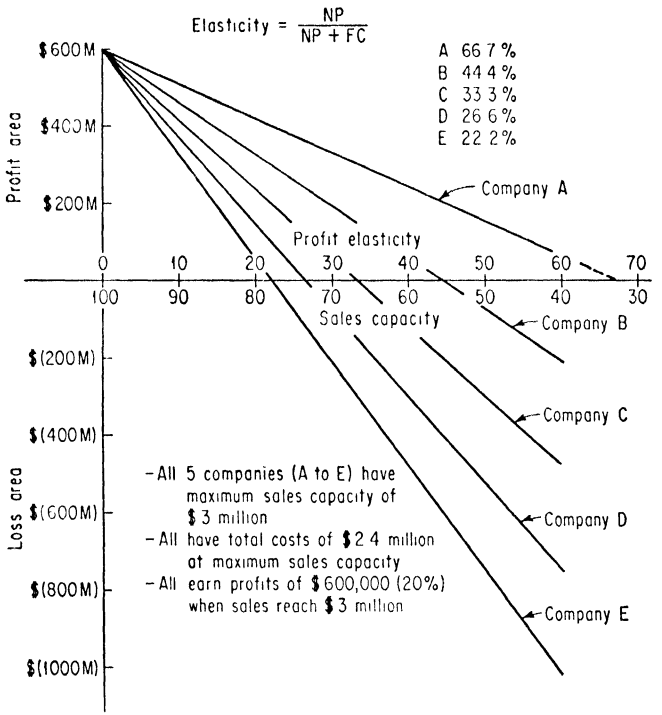
course, this is terribly compounded by the product mix, so that the nature of the sales increment would have to be analyzed. But omitting this consideration for the moment and assuming a fixed product mix, different profits are produced by the same sales increment *or* the same profits are produced by different sales increments, depending on the *elasticity* of the company.

Profit elasticity can be defined in a simple fraction:

$$\text{Elasticity} = \frac{\text{profits}}{\text{profits} + \text{fixed costs}}$$

To better illustrate the effect of elasticity on profits and on management pressures, see Exhibit 11-7. It applies to five companies, all of

EXHIBIT 11-7. IMPACT OF ELASTICITY ON PROFIT MAKING

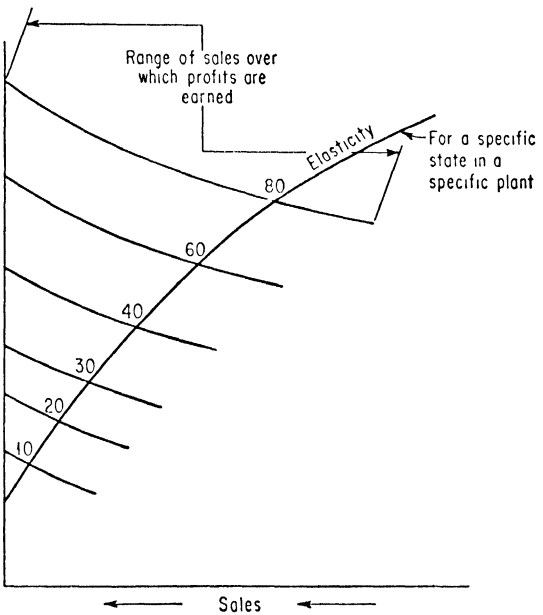


which have a maximum sales capacity of $3 million. Notice that company A has an elasticity of 66⅔ per cent, which means it can operate at a profit over the last two-thirds of its productive capacity. Company B has an elasticity of 44.4 per cent, which means it experiences losses after its sales have dropped to 55.6 per cent of capacity. Company E earns a profit only above 77.8 per cent of its sales capacity. This com-

pany has a low profit elasticity; a small change in sales will cause a large change in profits.

Elasticity determines how vulnerable a company's profits are to the sales or production activity. This same latitude also fixes the cost of remaining in business and therefore is one of the keys to survival or growth. Invariably, a company with a low elasticity experiences considerable impact on its costs as sales change. As sales weaken, pricing can become quite desperate, since fewer production activity hours are called upon to carry the burden of the characteristically higher fixed costs.

EXHIBIT 11-8. DETERMINING PROFIT RANGE



Generally, within the same industry, elasticity excursions from 70 to 10 per cent are not very likely. They may hover around a range of thirty per cent, but this level is the difference between profits and losses, sound or desperate managerial judgment, and the level of the continued pressure of remaining in business. Another way of looking at elasticity and its effect on profits and sales pressure is shown in Exhibit 11-8. Here, without any reference to the magnitude of profits, is shown the sales range over which profits are earned. It is clear that as increases in elasticity are made, the curve intercepts a greater area of the sales; that as a company's elasticity changes, so does its break-even point. As its elasticity increases, its break-even point decreases. And the parallel theorem, especially for the MC concept, should be kept in

mind that as the *quality* of the elasticity changes, so does the *strength* of its capital structure. If the decreasing elasticity is due to expanding the fixed assets, the company will not have much latitude in its current financial management. If the elasticity decreases are due to staffing (or other similar expenses), then the permanent capital structure is not affected, but then financial management has to be nimble in its juggling of the current assets and the relationship it maintains with borrowed levels of capital.

Elasticity is equal therefore to 1 minus the capacity required to break even, or the capacity to break even is equal to 1 minus the elasticity.

Obviously, there is a relationship between the way a company operates and its elasticity or break-even point. The way in which the elasticity curve moves in relation to the activities of the company is a special characteristic of the company and one which the management must be aware of if successful planning is to be done. As events take place in the company, so the curve of elasticity moves. If favorable events occur, such as a better utilization of the fixed expenses due to a better product mix, or higher sales of an existing product mix, the curve of elasticity should be expected to rise, indicating a favorable operating economy. However, changes in the product mix can negatively affect the capital structure of the company, and so tertiary relationships are required which show the realistic progress of the company, all factors being considered. Exhibit 11-9 shows the relationship between product mix, recovery, and inventory.

This tabulation shows five different states of product mix in the same plant for the same maximum capacity, expressed as total fixed expenses of $500,000. Here is a summary of the various mixes:

Mix I	Earns a profit of $25,000 on sales of $825,000 with a material level of $300,000
Mix II	Earns a profit of $50,000 on sales of $1,050,000 with a material level of $500,000
Mix III	Earns a profit of $200,000 on sales of $1,500,000 with a material level of $800,000
Mix IV	Earns a profit of $150,000 on sales of $1,050,000 with a material level of $100,000
Mix V	Earns a profit of $700,000 on sales of $1,500,000 with a material level of $300,000

Obviously, the mix can be any combination of recovery level, profits, sales, and materials usage. Management's object should be the optimizing of all of them so that it makes the maximum profit consistent with the state of health of the company. The reader will notice the exclusion of direct labor from the calculation of profit in each of the mixes. This is a direct variable and affects the requirements of cash

flow. If the direct labor segment of the "other costs" of mix III was $500,000, then the inventory level does not appear so threatening, but the requirements for cash flow to meet the obviously heavy payroll might be a problem. Comparing mix IV with mix III shows that in

EXHIBIT 11-9. IMPACT OF PRODUCT MIX ON EXPENSE RECOVERY

For all 5 mixes, fixed and stand-by expense = $500,000

Item		*Unrecovered fixed expense*
Mix I:		
Recovery	$200,000	$300,000
Material and other costs	300,000	
Total cost	$800,000	
Sales	825,000	
Profit	$ 25,000	
Mix II:		
Recovery	$ 300,000	200,000
Material and other costs	500,000	
Total cost	$1,000,000	
Sales	1,050,000	
Profit	$ 50,000	
Mix III:		
Recovery	$ 400,000	100,000
Material and other costs	800,000	
Total cost	$1,300,000	
Sales	1,500,000	
Profit	$ 200,000	
Mix IV:		
Recovery	$ 400,000	100,000
Material and other costs	400,000	
Total cost	$ 900,000	
Sales	1,050,000	
Profit	$ 150,000	
Mix V:		
Recovery	$ 500,000	0
Material and other costs	300,000	
Total cost	$ 800,000	
Sales	1,500,000	
Profit	$ 700,000	

order for profits to rise another $50,000 the company has to increase its sales $450,000 and must carry a double risk in inventory. Is it worth it? Only full data integration will answer that.

Obviously, mix V was most favorable for the company: it recovered all expenses, provided the most profits, and involved less inventory

risk than any of the others. No full analysis can be made, however, until the nature of the inventory risk is determined. Perhaps a large portion of mix II inventory was becoming obsolete and already set aside and not considered part of the salable inventory. If the same was true of mix III, then it compares favorably with mix IV, especially since it earns more profits and both recover the same expenses.

PROBLEMS

1. Discuss four one-fact managerial decisions that can lead to insolvency.
2. Discuss how a drive for high profits can improve or deteriorate the capital structure.
3. Discuss the effect of events on the division between fixed and circulating capital.
4. Discuss how the selection of a product mix affects the velocity of fixed-charge recovery.
5. List five variable overhead expenses.
6. Discuss how the product mix selected affects the speed of climb toward the company's break-even point.
7. Explain by example a totally integrated decision and the areas it affects.
8. *a.* Explain how a change in product line affects capacity.
   b. Explain how increasing the maximum number of units produced can lower capacity.
   c. Explain under what conditions increasing the number of people employed can reduce the usage of facilities.
9. Of the different units of capacity listed on Exhibit 11-4, which come closest to true maximum capacity in the following industries and explain:
   a. Envelope manufacturer
   b. Wiring-devices plant
   c. Paper-display manufacturer
   d. Drug manufacturer
   e. Cannery
   f. Book bindery
   g. Lithography plant
   h. Plastic-tile manufacturer
   i. Brick manufacturer
10. Explain the difference between cost of products and cost of facilities.
11. Explain the major classification of costs and how they are incurred.
12. Do all high-fixed-cost industries have varying product mixes? Give examples of five that do and five that don't.
13. Do all high-fixed-cost industries make varying use of different pieces of equipment? Give examples of five that do and five that don't.
14. In which industries (name five) does the product mix affect equipment usage? What costing problems does this cause if the equipment used is of several different varieties and the ownership cost of each different?
15. What is meant by product-mix volatility? What causes the volatility? In what industries does it occur where it creates costing problems (name five)?
16. In the type of industry mentioned in Problem 15, how are their fixed costs, which are incurred in "blanket" form, allocated to the product?

17. What is meant by cost recovery? Explain by reference to five industries where consistent cost recovery is threatened by the product mix.
18. How is facility profitability converted into actual period profits? Explain fully, using an industry example.
19. Discuss elasticity in terms of the break-even point.
20. Explain what is meant by the "quality" of elasticity.
21. Develop an executive wage incentive plan for:
    a. An office manager
    b. A chief engineer
    c. A purchasing agent
    d. A comptroller

CHAPTER 12 *Elementary Evaluation of the Capital Structure*

In the previous chapter we noted that the balance sheet and the income statement are composed of various segments. These segments in themselves are meaningless unless contained in some frame of reference. As was done for the production and sales sections of this book, we shall develop ratios which relate one segment with another. Ratios from elements on the balance sheet will be developed, and ratios which relate items in the balance sheet with items in the income statement will also be constructed.

Financial Ratios

In general, the traditional ratios have been able to assess the level of profits, areas of over- or underinvestment, lack of capital, and trends toward insolvency. These ratios have varied, depending on the type of industry involved. Thus one could expect to find a high proportion of the total assets in equipment for a machine-tool or chemical-processing plant and a low proportion for the radio-assembly plant that uses little fixed assets.

Those ratios are not absolute measures: what's good for one plant may spell disaster for another. The fixed assets to the net worth of a corrugated-container plant at 60 per cent may be considered satisfactory, but apply that to a manufacturer of men's suits and the company is dead. These ratios are indicators only, and rough indicators at that.

Since the ratios are approximate, there is a wide latitude of values within which similar companies operate, and in that range there exists a powerful leverage for increased profits and growth. A few percentage points difference in some ratios hold the clue to perhaps as much or more profit percentage points.

Events Vary Ratio Values

In the MC technique, we recognize that some of these ratios move faster than others. That means that events in production and sales have

varying effects on these ratios. Also, one ratio will have an effect upon another. What remains to be discussed is the significance of these movements, so that proper evaluations can be determined and acted upon.

Some companies use ratios in order to find out how well they are doing in their industry. In such cases, the ratios are used so that a company can compare its figures with those of competitors and get some measure of self-appraisal.

While this practice has merit, it has elements of inequity too. To appraise a company fairly, the probability of survival has to be integrated with its growth potential and the likely speed of attainment. The traditional financial and operating ratios are concerned with what *is* or what *should be*. In this section we are concerned with *why* they are, *what causes* them to be. We consider their movements with respect to each other as a key to some other circumstance which can be controlled. Some of the ratios shown will be of the traditional type; others will be new, developed especially for the MC technique.

Ratio Movements

This point must be emphasized: the isolated value of a ratio is not given as much importance as its movement from period to period and its interrelation with other ratios. Consider that, like all other matter, the business effort has dimensions, even a fourth dimension. The balance sheet is a report on the state of health of the business at any given moment, and actually it is obsoleted the second it is drawn, because new balance sheet *data*, as yet unwritten, are born to take its place.

The balance sheet, which is a report on the capital structure of the company and the result of financial management, is in a constant state of flux. People cause the facts on the financial statement to *happen* and to *change*. A change in a ratio is the result of the way people acted and affects the capital structure. How the financial function operates to obtain the greatest gain for the company from these effects is the subject of this chapter.

Not all events cause the same volatility of change. Fixed assets in relation to total assets do not change as fast, usually, as the direct labor cost to sales does or the circulating capital changes in relation to sales.

Ratio Data

Ratios are constructed from balance sheet items and from those items that involve balance sheet and operating data. In the balance sheet grouping, we have those which are a measure of monetary management and those which appraise the structure of capital financing.

Not all ratios mean the same thing when different companies are considered. The author's thesis is that each company has its own spe-

cial characteristics, its distinctive personality, which in fact is a composite of the personalities of the individuals contributing to its management and control. This is evident when analogies are made for the profit-and-loss statement, which reports results from the operating, and the balance sheet, which reports the financial state of health, at any one instant.

The operating statement can be likened to an athlete and his performance; the balance sheet to his health before, during, or after his performance. A high performance in an athlete's feat may show a drastic before-to-after change in his health. In fact, the feat may kill him, thus nullifying the continuance of his performances. Analogously, because of poorly managed money, a company goes out of business in spite of a high profit on sales. In contrast to this are companies that earn a meager profit on sales, which, however, is adequate when measured as a return on investment. Neither maximization should be the goal to the exclusion of all other objectives. Rather, control must be exercised to promote the maximum profits within a healthy framework with due regard for stockholders' interest—an optimum.

But let's get back to our athlete and the difference in the same ratio for different companies because of their special way of doing business. Two athletes can accomplish the same feat at the same level of performance. Yet they can be of different height, age, and weight. Their *before, after,* and *during* "balance sheets" can show marked differences in respiration, blood pressure, glandular functions, etc. Conversely, a pair of athletes presenting the same "balance sheet" data can perform quite differently. As a matter of fact, irrespective of performance, when these latter similar athletes have a change in their physical state, the changes do not occur in the same way.

The same is true of manufacturing concerns.

It is not the author's purpose to dwell on financial theory. There are many textbooks on that subject for those who are interested in going into further technical details. The primary purpose here is to remove the mystery which seems to enshroud this area and to lay the groundwork for the understanding of the evaluation and control ratios presented later. Essentially, this is a book on managerial control, control which must integrate all areas if each is to act as part of an organic whole instead of as separate autonomous parts.

Application of Ratios

The typical and traditional financial ratios are effective in getting fast appraisals of the capital status. When ratios involve financial and operating data, trends are seen, especially as regards the productivity of capital and the coordination between the controller, the plant man-

ager, and those who do the purchasing. Sometimes seemingly negative-acting ratio results are desirable from the over-all company standpoint if they are more than compensated for elsewhere positively. Perhaps a large inventory is part of a plan to use heretofore unused capacity, the expense recovery from which will more than offset inventory risks.

But ratios are not only used for decision making, they are used for balanced evaluators of conditions. The ratios act as watchdogs. Functioning with valid and balanced judgment, they furnish a device or standard against which decisions can be tested.

For example, it is obvious that sales can be boosted by lowering the costs and the selling prices, or by increased market demand, or because of the price policies of competitors, or by increased efficiency, or by plentifulness of the raw materials necessary, or by any of these, in various proportion. Management's task of providing adequate earnings must take all these factors into consideration. Accordingly, it might be led to increase or reduce output or prices or to tolerate lower worker productivity. To minimize or maximize in any of these areas is not the answer. Management's decision must be based on some appraisal as to the interaction of these factors and the final effect on earnings. Families of ratios allow these variables to interact "on paper" in advance of the decision. With some manipulation of the curves, an optimum path for each can be prescribed.

The maximum profits to be earned on the total capital employed is the result of the balanced and optimum levels or movements in the areas of pricing keyed to the market; costing for maximum expense recovery; facility utilization; the productivity of the capital structure; and the balancing of sources of investment.

Ratio Not Absolute

In the MC concept we are not interested in testing where a particular company ranks against an arbitrary average set up for its industry by various organizations. This does not mean that such standards do not serve a purpose. They do, for purposes of deciding whether or not creditors should sell materials to the company or whether a bank should lend money to a company. For internal control, however, they are not necessarily valid and can be misleading. The author has seen, time after time, situations where the management took pains to keep certain of their ratios within the limits established for their particular industry by impartial organizations and wound up in serious financial difficulty.

For example, a manufacturer always tried to tie his sales and inventory together in a relationship that would be "normal" for his industry. If his industry called for an inventory turnover of 6 (sales/in-

ventory), then as his sales rose, he permitted the level of his inventory to rise in the proportion that always yielded a turnover of 6. What was happening elsewhere in his capital structure was that the amount of capital tied up in inventory was getting too excessive for the net worth of the company, irrespective of its relationship to sales. When this ratio of sales to inventory is not tied to some other factor in the company, like net worth, then the increase in sales can force the company into bankruptcy.

This would seem to indicate that the capital structure cannot be evaluated by the single traditional ratio, but of necessity several must be cast into a composite ratio for a more complete evaluation. However, before such composite ratios can be designed and understood, the elementary type must be constructed and explained. The balance of this chapter is devoted to simple ratios, some of which are of the traditional variety and some of which have been developed to support the MC concept.

DESCRIPTION OF ELEMENTARY RATIOS

Exhibit 12-1 is a tabulation of elementary ratios involving balance sheet and operating data. The formula terms utilize the coded data of Exhibits 11-1 and 11-3. Both the typical and the specially constructed ratios are shown, some of which are described below.

RATIO F1: NET WORTH TURNOVER

$$\frac{\text{Net sales}}{\text{Net worth}} = \frac{ba}{aq}$$

This ratio has different meaning for different classes of interests. From the commercial point of view, it indicates overtrading if it is too large or insufficient volume if too low. From the financial viewpoint, it measures the velocity of the turnover of the invested capital. From the economic angle, it measures the activity of the money which the stockholders have put up as risk. From the investors' standpoint, the higher the ratio, the better the risk.

Most financial people use this ratio to judge whether overtrading or undertrading is present. Overtrading refers to a high level of sales for the capital invested, which invariably requires higher credit, to the point where the creditors have more capital at stake than the owners. As the ratio of liabilities to net worth increases, the creditors' margin of safety is reduced and the company may be in serious difficulty, with a drop in earnings or a general trend toward price reduction.

Obviously, overtrading is reduced by the introduction of additional capital from the owners.

Actually, a better ratio for the MC technique would be cost of sales to net worth = ce/aq, in which the fluctuating profit margin is eliminated. The advantage of doing this also is the determination of whether or not the high ratio is being produced as a result of a high degree of

EXHIBIT 12-1. ELEMENTARY FINANCIAL AND CAPITAL RATIOS

Ratio no.	Ratio title	Abbreviation	Formula
FI	Net worth turnover*	NS/NW	ba/aq
FII	Inventory turnover*	NS/INV	ba/ac
FIII	Return on invested capital*	NP/NW	cf/aq
FIV	Return on total resources*	NP/TCE	cf/ah
FV	Total asset productivity*	NS/TA	ba/ah
FVI	Asset balance index*	NP/WC	cf/(ad − aj)
FVII	Turnover of working capital*	NS/WC	bb/(ad − aj)
FVIII	Sales-liability index	TL/NS	am/ba
FIX	Collection effectiveness	NS/REC	ba/ab
FX	Net profit	NP/NS	cf/ba
FXI	Fixed-asset productivity*	NS/FA	ba/ag
FXII	The current ratio*	CA/CL	ad/aj
FXIII	Inventory–net worth index	INV/NW	ac/aq
FXIV	Owned capital index*	NW/TCE	aq/ah
FXV	Inventory-asset index*	INV/CA	ac/ad
FXVI	Owned–long-term borrowed capital index	NW/FL	aq/al
FXVII	Working capital density*	INV/WC	ac/(ad − aj)
FXVIII	Borrowed–owned capital balance*	CL/NW	aj/aq
FXIX	Fixed capital utilization*	FA/NW	ag/aq
FXX	Fixed-asset index*	FA/TA	ag/ah
FXXI	Working capital–funded debt balance	FL/WC	al/(ad − aj)
FXXII	Lenders' safety factor	FL/FA	al/ag
FXXIII	Owned working capital	WC/CA	(ad − aj)/ad
FXXIV	Borrowed–owned total capital balance*	TL/NW	am/ar
FXXV	Inventory-capital index*	INV/CL	ac/aj
FXXVI	Inventory-receivables balance*	INV/REC	ac/ab

* Described in text.

productivity in the plant. The difference between the two ratios would indicate this immediately.

Undertrading, in a sense, implies idleness of some of the capital or a low average utilization of all the capital. If the money is not needed, it should be withdrawn and invested elsewhere for its earning power. If it is left in the business, it must be made productive. The solution to this requires an increase in sales, sales effort, production speed, etc.

Undertrading is a more prevalent practice than overtrading and is usually a reflection on management.

This ratio is useful in relationships to sales effort and recovery ratios.

RATIO FII: INVENTORY TURNOVER

$$\frac{\text{Net sales}}{\text{Inventory}} = \frac{ba}{ac}$$

This ratio relates the size of the inventory to the sales. Obviously, as the sales are increased, more inventory is needed for support. In addition, however, this ratio evaluates the existence of obsolescence in inventory. If inventories are kept too large, then there is too much capital tied up for the sales being done. A better test would be one which eliminated the distortion of profits. The ratio would be modified to cost of sales to inventory = ce/ac.

The ratio measures the judgment used in the purchase of materials. This judgment should be guided by financial limits and should take into consideration the production characteristics of the particular firm and the need to maintain proportion between the raw materials, work-in-process, and the finished goods. The length of the production cycle and the availability of inventory also figure in this appraisal.

This ratio evaluates many factors. The selection of the proper inventory in relation to sales is not only a function of all the above elements, it also must satisfy those elements within the limits of a sound state of health. This is another way of saying that the financial architecture of the company is designed in part by the characteristics of the production cycle, the segmentation of the elements of the inventory, and the nature and availability of the inventory. For example, the raw inventory required by an industrial bakery which uses flour, obtainable at will, is quite different from what a cotton mill requires, which is bought when the cotton crop is available. Then again, it takes a short time to bake a loaf of bread, but the manufacturer of ladies' cotton dresses begins his production months in advance of scheduled delivery. This shows how the proportions of inventory in process will vary.

As with finished inventory, surely there is a difference between moving the finished loaves of bread and holding on to the finished inventory of industrial diamond tools in a rising market.

From the capital structure point of view, if the company has both a high inventory and heavy liabilities, pressure from creditors is bound to result before something can be done about the inventory. A contributing cause of financial difficulties attributable to inventory is the tendency for management to gamble or speculate on a lot which it believes will increase or become in short supply soon or because it is a bargain,

etc. Management is better advised to vent its gambling tendencies at the race track or the stock market, but not with a vital gear of the business machinery.

This ratio is a valuable one in the MC technique. For example, where a company maintains a low turnover of inventory (ratio value low) and where the inventory is a high percentage of the working capital, it is sensitive to changes in prices; that is, if there is a positive shift in prices in the product or industry, then the excessive inventory shows high profits. But in the case of sliding prices, the results are just the opposite. This condition may be likened to that of elasticity, in this case an elasticity of inventory or the range of pricing trend over which profits can be earned. Unlike a low financial elasticity because of fixed charges, the situation with respect to inventory is more easily corrected. Maximization in this ratio is not necessarily desirable unless other matters like net profits on sales, prompt payment of current obligations, etc., are maintained on a sound level. Very often this ratio can increase and show a negative effect. That occurs when sales are accelerated because products are inadvertently sold at a minimum profit or none at all.

The drive for fixed expense recovery must be interrelated with the cost of carrying inventory and the effect it has on the financial structure.

RATIO FIII: RETURN ON INVESTED CAPITAL

$$\frac{\text{Net profits}}{\text{Tangible net worth}} = \frac{\text{cf}}{\text{aq}}$$

This ratio measures the return on investment, that is, the productivity of the owners' invested capital. It is often confused with the return on capital employed, which assesses the over-all effectiveness of management and compares earnings with total assets. From the owners' standpoint, return on invested capital shows the success of the business and the effectiveness with which it invested its money compared with probable returns from investment in other securities.

If one wishes to find *one* ratio which most closely indicates the level of protection to the creditors of the business and insurance against insolvency, this ratio fills the bill. As long as the return is satisfactory, these guarantees are in effect.

All invested capital, if properly managed, is entitled to a reasonable return. What this return should be varies with the industry and with the composite personality operating the specific company. However, if the return is less than what could be earned in gilt-edged securities, the management should spend its time in the stockbroker's office. All business enterprises take risks. The return should be in proportion to those

risks and should be great enough to provide something over and above the return for risk, namely, the incentive.

This ratio is the confirmation of the net profit to sales ratio. There are many companies which earn a high rate of profit on sales but which yield a low return on invested capital. This might seem like an anomaly, but it really is not. It simply means that the sales level is low for the amount of capital invested. This would also be confirmed by a glance at the ratio of net profits to total capital employed.

Many businessmen do not comment on operating results until they have seen the return on invested capital. If it is low, with a high net profit on sales, you can be sure that the current assets are too high, that is, the chances are that the bank balance or the inventory level is being maintained at too high a level.

There is no doubt of the relationship of the operating effectiveness to this ratio: carrying excessive inventory for the amount of sales (an indication of low sales) and/or poor judgment in the inventory balance affects this ratio since the interest costs on the additional borrowings needed are a charge against profit. Or there may be a lack of policing collections of the accounts receivable, which may require additional borrowing and a consequent charge to earnings.

In companies of decreasing elasticity, the increase in sales must be faster lest the expenses of maintenance, repairs, depreciation insurance, etc., make the return on investment drop faster than the profit on sales.

This ratio is important to new and fast-growing companies looking for additional capital. For investors to take a bigger risk over well-established companies, they must have the rationale of a higher return. If this is matched with an adequate profit on sales, the additional capital is attracted and the company can expand. When a company underutilizes its facilities, it must price itself out of its market and shows poorly in profit on sales and net worth.

It is worth stressing that a small profit on sales does not necessarily mean a small return on the investment. For example, it takes about six times as long in the coal companies for the sales to equal the total capital employed as it does in the meat-packing industry, yet both can earn a satisfactory rate on investment.

RATIO FIV: RETURN ON TOTAL RESOURCES

$$\frac{\text{Net profits}}{\text{Total capital employed}} = \frac{cb}{ah}$$

This is a ratio between the net profits earned on sales and the total assets of the business. It shows how many asset dollars are required to produce a dollar's worth of profit. Since this ratio is a generalized type,

like the current ratio, it does not pinpoint the contributing factors leading to its value. This ratio is helpful in assessing, in general, the profit-asset relationship for different lines of products. In particular, it is most revealing in rating similar plants in a multiplant operation.

The ratio expresses the profitability on the use of all the resources of the business and is often mistaken for the return on investment ratio. It measures the effectiveness of management, but is not suitable for investors' evaluation. It shows the return on the total capital employed regardless of its source.

Net profits on sales are the result of operating regardless of the capital structure of the company. For the same profit and sales, companies will make more or less use of borrowed capital: their investment segment may be different; some will leave more of the profit in the business. Thus the same net profit on sales will show differently against net worth but not on total capital employed, since the total capital employed is a total within which the net worth can fluctuate considerably.

If a company earns a higher profit on total capital employed than the interest it has to pay on borrowed capital, then as the borrowed capital becomes a larger segment of the total capital employed, the greater is the return to stockholders. The decision as to how far to carry this calls for a proper balancing between owned and borrowed capital, consistent with a sound current ratio.

RATIO FV: TOTAL ASSET PRODUCTIVITY

$$\frac{\text{Net sales}}{\text{Total assets}} = \frac{ba}{ah}$$

This ratio provides a general evaluation of how well the resources of the firm are being used. It rates the over-all effectiveness of the business and the productivity of its total assets. However, this ratio's usefulness in the MC technique is to observe what happens when it is subdivided into the major elements of fixed assets and inventories in relation to sales.

Because of the varying composition of the total assets, their turnover can be the result of many factors. Obviously, two firms can have the same total assets and net sales and yet one will have 70 per cent in fixed assets and 30 per cent in current assets; the other can have the reverse. Let's call these two firms Jones & Co. and Brown & Co., respectively. Jones makes machine tools, and Brown collates radio parts for the sale of kits. Now Jones's current assets will have to turn over 3.33 times and Brown's 1.43 times in order to make their total assets turn over once. This difference shows up in the different profit margins

both must earn to yield the same amount of profits. Obviously, the ratio of this ability is 3.33/1.43; that is, Jones will have to have a profit margin 2.31 times that of Brown's to earn the same profits.

It should be apparent, then, that as the percentage of fixed capital rises in the total asset structure, the current assets must be called upon to do more work faster in order to support the fixed assets. This again gets back to the concept of elasticity and the fact that Brown & Co. won't be as susceptible to the effects of depressions and will be able to earn a profit over a greater range of sales.

RATIO FVI: ASSET BALANCE INDEX

$$\frac{\text{Net profits}}{\text{Net working capital}} = \frac{\text{cf}}{\text{ad} - \text{aj}}$$

This ratio is valuable for determining certain trends which otherwise are not revealed by other ratios. For example, it is intimately related to net profit to sales. When it is divided by this latter ratio, the result is sales to working capital, ba/(ad — aj); when divided by net profit to net worth, the result is net worth to working capital, aq/(ad — aj). When it climbs, it is an indication that fixed assets are restricting the level of current assets required to carry the large volume of sales. (When sales climb, turnover of net worth increases, and hence the ratio increases.) The speed of the climb or rate of change is dependent on the incremental change in fixed assets.

RATIO FVII: TURNOVER OF WORKING CAPITAL

$$\frac{\text{Net sales}}{\text{Net working capital}} = \frac{\text{ba}}{\text{ad} - \text{aj}}$$

This ratio measures the effectiveness of the working capital as a confirming health check on the turnover of net worth. While the latter may be acceptable, the presence of a high level of fixed assets may show the working capital to be low, and hence there will be a high value or turnover for this ratio. The ratio net worth to working capital confirms this. In the event of the lack of working capital, additional sums will have to be raised by borrowing rather than ownership because of the large residual magnitude of the owned capital. This would show up as a high ratio or turnover in the above ratio.

In the event of too low a turnover (low value for ratio), it would mean that the sales are not high enough for the level of working capital. If the sales are satisfactory, then this ratio would show how much of an excess exists in the working capital. This then would call for a sell-off of inventory or a draining off of cash to be placed where it can be more fruitful in the way of interest, dividends, or other returns.

This ratio can also be considered a general evaluation of the vigor with which the working capital is utilized. The more vigorous, the higher its use, since it evaluates the efforts of the sales department as well as the effectiveness of financial management.

Of all the balance sheet items, the net working capital is one of the most sensitive to sales volume. As a company does more volume, the working capital must increase to handle the amount of business. This ratio shows a gradual climb with sales as opposed to one between sales and fixed assets, which usually moves very slowly and then in large steps as additional equipment is added. The sales to working capital problem is especially critical for the smaller company when it encounters good times. For in this case, the sales outgrow the working capital quickly and the company has to find rapid financing.

RATIO FXI: FIXED-ASSET PRODUCTIVITY

$$\frac{\text{Net sales}}{\text{Fixed assets}} = \frac{ba}{ag}$$

This ratio indicates the power, virility, and productivity of the equipment and the other capital investments. It is one of the most significant ratios in the MC technique. It also gives indication of the elasticity of the business, which shows how broad or restricted the range is in which sales are made at a profit.

If the ratio is high, the stand-by, or period, expenses are low, the break-even point is low, and there is opportunity for profit to be made over a wider range of sales. As the ratio decreases, it could be an indication of insufficient sales, even with a balanced fixed asset–net worth structure; or if the sales level is acceptable, it could be that the level of fixed assets is too high for what the sales effort can reasonably produce and/or too high in comparison with net worth. In the latter case it produces a low elasticity and a consequent lower range of sales over which profits can be earned.

Unfortunately, not only is the range narrower, it takes place only at the upper levels of the sales-capacity relationship, and management's control must be very close. This type of company gets into difficulty at the very start of recessions since the slight drop in sales (depending on the exact nature of the company's inelasticity) might place the company in a loss area.

This ratio, together with the *elasticity ratio* (Chapter 11), shows the effect of adding equipment in terms of the additional sales required to restore the previous economy. At times, pretesting the effect of this ratio may lead the company to select the leasing, instead of purchasing it, of equipment. The company must be better able to absorb the leas-

ing charges in preference to lowering its elasticity, decreasing its current ratio, and causing other possible disturbances in its capital structure.

This ratio is not suitable for company-to-company comparison because of the age, usage, and present market resale value of the equipment, plus the fact that since equipment is purchased over a period of time, the acquisition prices might have been different. This is compounded further by inflationary effects and the costs of *economic* depreciation. However, as an MC ratio, this one is excellent for pretesting decisions, and when related to other movements of the company's economy, it proves to be significant, as we shall see later.

This ratio can be termed "turnover of net fixed assets," for it shows how much fixed assets is required for each dollar of sales. The author likes to refer to it as the "desperation ratio." The manufacturer who realizes a high rate of turnover on his investment in property is always less desperate than his competitor, who has to use most of the income from sales to sustain the company's body and soul. With a low fixed asset level and high elasticity, the manufacturer with a high fixed asset turnover can do much to help himself in depression times. He can lay off people as sales fall off and thus reduce his stand-by, or period, expenses. The company that has a considerable sum tied up in fixed assets *must* find business for its facilities, even if only to pay for its fixed charges. It cannot help itself very much unless it sells off its capital equipment and thus reduces the stand-by charges. Such companies are inflexible in their ability to adjust expenses to the declining market.

The decision to expand equipment must be tested in this ratio, in the *elasticity ratio*, and in the fixed asset to net worth ratio. Obviously, the decision to expand must also integrate, conservatively, the expected sales over the period in which the proposed capital equipment will be depreciated.

Variations of this ratio pinpoint more of the company's operating and financial policy. First is the cost of sales to fixed assets = ce/ag, which eliminates the influence of profit on the ratio. Second is cost of goods sold to fixed assets = bo/ag, which compares the factory recovery to the fixed assets without the usually high segment of the general, administrative, and selling expenses prevalent in the medium-sized industry.

This ratio is excellent in testing the expected productivity of the additional fixed assets and shows the impact on this productivity when bq, bt, and bx are added. As a matter of fact, managements sometimes are misled by the net sales to fixed asset ratio, when deciding on the level of additional general, administrative, and selling expenses, to tolerate for an expected increase in sales, in the proposed fixed asset expansion. This is because it is hidden or averaged out in the above ratio.

To pinpoint the requested general, administrative, and selling increase by itself, construct the ratio of $(bq + bt + bx)/ag$ for the present set-up and for the proposed expansion.

RATIO FXII: THE CURRENT RATIO

$$\frac{\text{Current assets}}{\text{Current liabilities}} = \frac{ad}{aj}$$

This ratio appraises the ability of the company to meet its current debts promptly. In an average sense it shows the degree of liquidity. The ratio is not a particularly accurate barometer because of the varying proportions of cash, accounts receivable, and inventory that comprise the current assets; that is, the cash, the most liquid of those assets, may be low, the inventory may be large and somewhat obsolete, and the accounts receivable old.

This ratio is not particularly accurate since it needs further analysis of its composition. It does have industry characteristics because it reflects the specific nature of the business. Lumber would have a high ratio, about 3.5 : 4, because of the obviously high inventory it must keep on hand, either for air- and kiln-drying plus the typically high inventory-in-process, if a millwork operation is also involved. On the other hand, building construction averages around 1.5 : 1.8 because of the lack of long-term inventory. Paper and paper products occupy about the middle range because of the higher state of flux in their inventory (mills) compared with lumber. In converting (paper boxes) the ratio is a bit higher, especially in the corrugated-carton and folding-carton segments of that industry.

It should be borne in mind that two companies can both have the same current ratio, one on stable ground, the other about to collapse. To make the ratio a bit more meaningful, the inventories are removed and the formula becomes $(ad - ac)/aj$, which is called the "acid-test ratio." This ratio can also be misleading because of the influence of the accounts receivable, a large portion of which may be considerably past due. Removing the accounts receivable from the inventory gives the formula aa/aj, which is called the "cash-position ratio." The use of this ratio in making an appraisal of liquidity is the most conservative.

Generally, an acceptably low value occurs in companies which have rapid turnovers of their inventories and accounts receivable. High and low aren't to be taken in absolute terms, only in relative terms.

RATIO FXIV: OWNED CAPITAL INDEX

$$\frac{\text{Net worth}}{\text{Total assets}} = \frac{aq}{ah}$$

This ratio shows how much of the business is owned by the stockholders. It is the cornerstone of the capital structure, for it clearly shows the respective interests of the owned and borrowed capital. Therefore, to see what percentage of the business is not owned by the owners, the ratio of total liabilities over total assets, am/ah, would apply.

Obviously, it is desirable to keep this ratio as high as possible, for it indicates a strong financial architecture, one which the creditors regard favorably, since it shows a lower level of borrowed capital or a higher level of owner-contributed funds. Invariably, a high ratio is a bulwark against the high losses experienced in depressions and the continuance of the ability of the company to get credit or pay cash for materials.

In essence, this ratio inversely reports on risk to the creditors. The higher the ratio, the lower the risk, since the creditors are protected by the safety factor that the assets must shrink considerably before the stockholders' equity is eliminated and the creditors start losing.

As the ratio becomes smaller, interest charges on borrowed capital increase. It may be economical to use as much borrowed capital as practical, within limits, if it can be obtained at a lower interest rate than the company earns on its total assets.

This ratio is interrelated with NP/NW and NP/TCE:

$$\frac{NW}{TCE} = \frac{NP}{TCE} \div \frac{NP}{NW}$$

(*Note:* Total assets = total capital employed.)

RATIO FXV: INVENTORY-ASSET INDEX

$$\frac{\text{Inventory}}{\text{Current assets}} = \frac{ac}{ad}$$

This is a basic and simple ratio used for measuring the liquidity of the current assets on the theory that the greater the proportion of inventory in the circulating capital, the less the liquidity *level* of that capital. Of course, this depends on the nature and freshness of the inventory. In some industries, a low level of obsolete inventory could be more serious than a higher level of resalable or utilizable materials.

The effective way to measure the practical percentage of liquidity in the current assets would be to consider both the inventory character as well as the accounts receivable. If the doubtful accounts are weeded out of the latter and a percentage of collection probability is applied, and if an inventory segregation between raw, in-process, and finished with respective evaluations is made, then the ratio $(ab + ac)/ad$ would be far more realistic.

RATIO FXVII: WORKING CAPITAL DENSITY

$$\frac{\text{Inventory}}{\text{Net working capital}} = \frac{ac}{ad - aj}$$

This ratio appraises management's judgment in proportioning its net working capital to the least liquid or densest segment of that capital. Obviously, if it invests too much in inventory, it not only limits the liquidity of the working capital, it may be indicative of poor judgment in balancing stocking and selling.

This ratio was created because of the tendency of some managements to control inventory on the basis of sales alone. Actually, while sales do increase, inventory need not increase in proportion if the turnover of inventory is fast enough. If inventory were to follow sales linearly, then, because of the slower rise of the net working capital and tangible net worth, a sudden devaluation of the market for that inventory could place the company in a serious position. The net working capital is not as volatile as sales, and therefore the tendency for management to let inventory follow sales will be lessened when the effect of this increased inventory is equated against the working capital.

RATIO FXVIII: BORROWED–OWNED CAPITAL BALANCE

$$\frac{\text{Current liabilities}}{\text{Tangible net worth}} = \frac{aj}{aq}$$

This ratio shows the proportion between the creditors' working capital in relation to the investment of the owners. Or, expressed in terms of time, this ratio relates the short-term borrowed capital to the owned capital. It evaluates the protection offered to its creditors by the owners. The owners' investment acts as a cushion for the short-term creditors: the greater this investment is in relationship to the current liabilities, the more protection is afforded the creditors. A ratio of 1 : 4 shows that there is $4 of investment capital for every $1 of creditors' capital, which is said to be satisfactory in financial circles, although this author believes that an acceptable level is a direct function of the characteristics of the specific company and the nature of the industry.

Management must take this ratio into consideration when planning moves, for its distortion may seriously affect the ability to obtain credit. Whereas a company may have a large ratio of total liabilities to tangible net worth, short-term creditors will view as a better credit risk situations in which there is a smaller current debt and a larger noncurrent or funded debt. Therefore this ratio should be compared with one relating total liabilities to tangible net worth, am/aq.

As liabilities climb, a point is reached where management must consider the reactions and attitude of its creditors. When the debts reach a certain high point, the company has serious difficulty in meeting its bills on time and banks become more and more involved and may demand additional security to protect their stake in the company. These can range anywhere from the assignment of the firm's accounts receivable to the assignment of the cash surrender value of the life insurance policies on the lives of the officers. Heavy liabilities not only cripple the company, they also impair the *judgment of management* in its day-to-day affairs. If liabilities continue to soar, judgment is further disturbed by involuntary bankruptcy petitionings from groups of creditors, and this in spite of high sales, adequate profits on sales, and a wide product acceptance!

The author has encountered many young aggressive companies, often owned and managed by engineers with horribly unbalanced capital structures, who had available to them and used almost unrestrictedly the liberal credit extended by their suppliers. Invariably, these companies had a level of sales much too large for their net working capital. As the owners sold one large account after another, they drew upon more credit, duplicating one supplier after another. For after all, didn't they have a large sales volume? Yet their constant complaint was lack of capital, and so they had assigned their receivables to their bank. Unfortunately, because of the nature of the product, expensive raw materials were tied up in technical processing for a long period, and while they booked the high sales and ordered material and started processing to support the high booked sales, the billings were coming out of the other end at a much smaller rate of speed and creditors were not getting paid.

Without proper guidance, this firm would have been forced into bankruptcy in a matter of weeks, much to the amazement of the sales representatives who were enjoying such prestige in the market as a result of the performance and acceptance of the product. It was obvious that the management was unconsciously seeking approval as engineers and knew nothing about functioning as businessmen.

RATIO FXIX: FIXED CAPITAL UTILIZATION

$$\frac{\text{Fixed assets}}{\text{Tangible net worth}} = \frac{ag}{aq}$$

This ratio shows the relationship of the owned capital to the investment in productive facilities. It also measures the utilization of the owned capital in current assets.

Creditors are interested in this ratio also, for as it increases, they have less protection. If this ratio exceeds unity, it means that some of the fixed capital is being supplied by creditors. This is an undesirable condition which indicates the need for additional equity capital.

Usually, when this ratio is high, so are the depreciation and maintenance costs. Current obligations become harder to meet. When the ratio increases because borrowed money is used to buy capital equipment, those borrowings can be repaid only out of earnings or by raising additional equity capital. This creates a pressure situation, especially as it pertains to current payables.

When this ratio is low, the net worth is more liquid and the owner's capital is then more effective as creditors' liquidating protection.

A low ratio produces a desirable elasticity, which is excellent protection in depression periods. Generally, this ratio decreases slowly from year to year as the company adds some profits to its net worth and as the fixed assets are decreased via depreciation.

This ratio is valuable in confirming the drives to obtain maximum utilization of capacity after expansions. The larger the manufacturing company, the greater the need to police this ratio and tie it into the speed of expense recovery. This is especially important because of the sky-rocketing depreciation and maintenance costs with increases in fixed assets. And this becomes particularly critical in costing, where, in effect, machine and plant time are being sold.

Where costing makes no provision for the possible devaluation of purchasing power, a large value in this ratio measures the jolting impact that future equipment replacements will have on the capital structure.

RATIO FXX: FIXED-ASSET INDEX

$$\frac{\text{Fixed assets}}{\text{Total assets}} = \frac{ag}{ah}$$

This ratio shows the direction of potential productivity in which the firm is headed. It is especially valuable in the MC technique. Generally, as we see from the relationship between the fixed assets and the sales, the fixed assets are either working at their maximum or optimum productivity or not. There can be many reasons: sales direction is poor; sales effort is low; the condition of the capital equipment is below par. In short, there are degrees of vigor possessed by the fixed assets.

If the fixed assets are vigorous and this productivity can be sold at a profit, the company might consider expanding its equipment, taking due note first of the effect of so doing on the above ratio. For obviously, if the ratio increases within the same total capital employed, it means that the current assets have to shrink to accommodate this change.

A reduction in current assets may be proper if the qualified current ratio does not decrease below the point that management and creditors feel is acceptable. This can come about from selling off some sluggish inventory in order to finance the machinery purchases.

What this comes down to is a transfer of some current assets to fixed assets. The criterion for the move is determining where the capital will be most productive. Keep in mind that expanding productive facilities usually call for a higher rate of materials usage, which in turn involves inventory levels. Therefore it might be proper to finance the purchase of equipment via long-term obligations, making sure to calculate into any gains from the higher plant output the interest charges against such obligations.

Another point to remember is that productivity can be identified with the ownership of lands and buildings. Another advantage, then, in adding equipment where machinery productivity has been established and where the existing lands are buildings do not need to be expanded to support the equipment is the faster recovery of the fixed charges of these assets.

RATIO FXXIV: BORROWED–OWNED TOTAL CAPITAL BALANCE

$$\frac{\text{Total liabilities}}{\text{Tangible net worth}} = \frac{\text{am}}{\text{ar}}$$

This ratio shows the proportion of the creditors' capital to the total capital. Therefore it shows the relative interests of the stockholders and the creditors, which of course should be in reasonable proportion. If this ratio had a value of unity, it would mean that the creditors supplied $1 for every $1 contributed by the owners.

When this ratio gets high, not only does the creditors' stake increase, which may cause them to restrict credit, but also the interest charges on the debts may threaten the firm's earnings. But the mixture of total liabilities is peculiar to the state of affairs of the company at any one time. Just as the current ratio is unfair as an absolute measure because of the varying amounts and nature of its mix of cash, inventory, and accounts receivable, so the total liabilities has the mix of current and noncurrent liabilities.

A ratio of the same value at two different times for the same company may have very different meanings. If the content of the current segment is low, there is a much better chance for credit and there is less pressure on it to meet some of its obligations. Similarly, a higher ratio is tolerable in comparison with a lower one if the former has enough deferred liabilities in relation to the time it needs to accelerate the input of capital.

RATIO FXXV: INVENTORY-CAPITAL INDEX

$$\frac{\text{Inventory}}{\text{Current liabilities}} = \frac{ac}{aj}$$

This ratio is a comparison between obligations which require quick payment and the least liquid of the assets. Since inventory cannot be considered as payment for current debt, this ratio dramatizes the need for an adequate balance among the current assets and also indicates the need for additional working capital that should be supplied by the owners.

This ratio is valuable in the MC concept even though it is not generally used in financial circles. In management's drive for the recovery of its fixed expenses, it may direct its salesmen to sell certain products which occupy more of the expensive facilities. It may marginally price these products or offer special incentives to salesmen as a means of accelerating this type of business.

However, if the products of recovery have a characteristically high level of material content in the total-cost dollar, this ratio will rise and fall, affected by speed of production and collections.

If cash is converted into additional inventory as more work is placed in process, the above ratio increases. This is fine if the cash position is not negatively affected. But if short-term credit is used for the inventory, then, depending on the mix of the current liabilities, this ratio may rise too high, indicating either a large percentage increase in inventory, a small increase in current liabilities (if accounts payable constitutes a small portion thereof), or any combination in between.

RATIO FXXVI: INVENTORY-RECEIVABLES BALANCE

$$\frac{\text{Inventory}}{\text{Receivables}} = \frac{ac}{ab}$$

This ratio measures the balance between the two least liquid of the current assets. What appears in inventory eventually finds its way into the receivable status. First, the inventory must go through the manufacturing cycle and must be sold before it can appear as a receivable. Where there is a lag due to production conversion, but with sufficient sales booked, the ratio will rise because inventory will climb. When there is a lag due to lack of sales but with constantly applied production pressure, the ratio will rise because of the decrease of accounts receivable.

When things are "normal," a rise in this ratio could mean no policing of receivables. But generally in companies having a definite character-

istic for their production, sales, and collection cycles, an optimum relationship can be found between inventory and receivables.

In the MC technique this is the type of ratio that is plotted from period to period and related to other factors. For example, a drive for fixed expense recovery in production might not be followed up with a solid collection procedure. A high ratio here would tend to indicate this. Then again, cancellations of past-due orders might be the result of insufficient inventory, and this would make the ratio go down. So we cannot say that up or down is desirable until comparison is made with other events. As for insufficient inventory, it might be the result of poor planning and purchasing policies. Or it might be due to an unfavorable current ratio which is limiting credit.

PROBLEMS

1. Explain how a 1 per cent change in fixed assets to total assets can effect a 20 per cent change in profits.
2. Indicate how the following events affect balance sheet data:
   a. A machine is purchased and financed by a three-year bank loan.
   b. A lot of raw material is bought for cash.
   c. Work-in-process is delayed in production.
   d. Rejected merchandise is received from a customer.
   e. Productivity increases in production.
   f. Down time in production increases.
   g. Sales are made for low-expense-recovery products.
3. Relate one of the elementary financial ratios to one in production.
4. Relate as many of the financial ratios in column A to production ratios in column B and explain their use:

Column A	*Column B*
Ratio FVII	Ratio XXXIX
Ratio FIV	Ratio XLVI
Ratio FII	Ratio B′
Ratio FXI	Ratio K′
Ratio FXX	Ratio M′
Ratio FXXIII	Tertiary Ratio LL
	Tertiary Ratio DD

5. Relate as many of the financial ratios in column A to sales ratios in column B and explain their use:

Column A	*Column B*	
Ratio FVII	Ratio SXXI	Ratio SF
Ratio FIV	Ratio SXXVI	Ratio SK
Ratio FII	Ratio SXLIV	Tertiary Ratio SAA
Ratio FXI	Ratio SPXLVI	Tertiary Ratio SEE
Ratio FXX	Ratio SPLXXIII	Tertiary Ratio SNN
Ratio FXXIII	Ratio SA	

6. *a.* Outline two conditions under which increasing Ratio FXXVI is positive.
   b. Outline two conditions under which decreasing Ratio FXXVI is positive.
   c. Outline two conditions under which increasing Ratio FXXVI is negative.
   d. Outline two conditions under which decreasing Ratio FXXVI is negative.
7. *a.* Outline two conditions under which increasing Ratio FXXIV is positive.
   b. Outline two conditions under which decreasing Ratio FXXIV is positive.
   c. Outline two conditions under which increasing Ratio FXXIV is negative.
   d. Outline two conditions under which decreasing Ratio FXXIV is negative.
8. *a.* Outline two conditions under which increasing Ratio FXV is positive.
   b. Outline two conditions under which decreasing Ratio FXV is positive.
   c. Outline two conditions under which increasing Ratio FXV is negative.
   d. Outline two conditions under which decreasing Ratio FXV is negative.

CHAPTER 13 *Elementary Evaluation of Financial Management*

It is worth repeating here that in the MC technique we are not concerned with how well companies adhere to so-called industry standard ratios. There are companies whose ratios conform well to certain of these averages but whose earnings are unsatisfactory and/or who are too inflexible to grow, etc.

All Acts Affect Balance Sheet Data

Every act causes changes throughout the company. These changes would be reflected in the balance sheet as of the instant they happened if a new balance sheet were made out each second of the day. Of course this is impractical, but the concept in the capital MC is that acts should be thought of as affecting some as yet unwritten balance sheet. This can be done in the form of projections. If the company knows it has to go to the bank in order to support some drive for expense recovery, the effect can be projected and the ratios developed.

Response Is an Individual Company Matter

Not all companies, not even those in the same industry, respond to the same events in the same way.

For example, Exhibit 13-1 shows a history of the relationship between the current ratio and the recovery of fixed expenses in production. Note that the recovery increases as the current ratio decreases up to a point, indicating possibly that collections are not keeping pace with higher output. (And in this area, inventory could be going down to an unsafe level, with the accounts receivable high enough to cause the higher total current assets.) Or it could be that the company has obtained more credit in the purchase of its raw materials.

Exhibit 13-2 shows the period relationship of the current ratio and

the aforementioned recovery. Notice the time zone which gave the optimum relationship between the current ratio and the recovery. These curves are those of a folding-carton plant. All folding-carton plants will not necessarily show curves like that, even if they are of the same size. And if the ownership of that plant changes hands, a new set of

EXHIBIT 13-1. RELATIONSHIP: CURRENT RATIO VERSUS FIXED EXPENSE RECOVERY

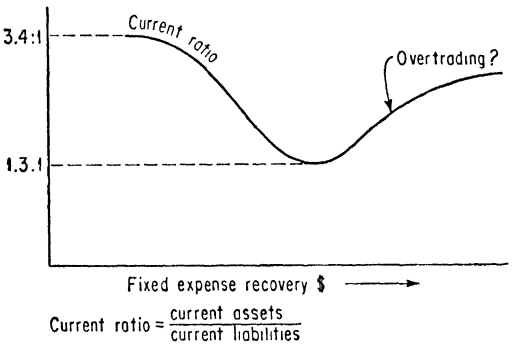
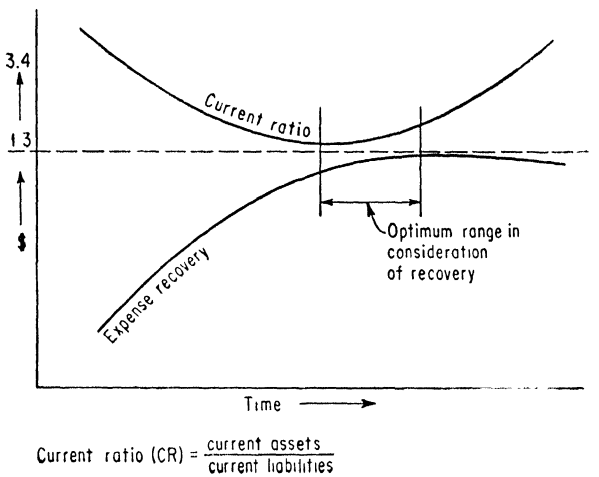


EXHIBIT 13-2. OPTIMUM RELATIONSHIP: FOLDING-CARTON PLANT'S CURRENT RATIO AND RECOVERY



curves will show up. Each of the pet ideas, prejudices, and management and financial orientation of the individual causes different proportions in the elements of the balance sheet. Each plant and management regards each area differently. However, there are best or optimum relationships which exist, and they supersede individual notions. These emerge in the MC technique.

Traditional Financial Managing

A favorite and classic balance sheet ratio is the current ratio, or the turnover of working capital. Standardizing on what this type of ratio should be for a company of a certain size in a certain industry may be acceptable for credit purposes, but it is no true measure of the economic state of the company nor of its reactive characteristics in the face of operating movements. Granted that this ratio has a valid range for specific industries, it is not a base for decision making.

First, the width of the range allows a tremendous latitude in profit-making opportunity and longevity. Second, and most important, these ratios tend to engender a "oneness" of evaluation; that is, in the case of the manufacturer who held on to his inventory turnover ratio regardless of the increase in sales, he failed to notice negative effects in his working capital and net worth positions. The author has found many managers who have preferences for one or two of these traditional ratios to the exclusion of all others.

Trite Conclusions after the Facts

A balance sheet can be analyzed to determine the state of the capital architecture and/or the effectiveness with which the money has been managed. All too often, the evaluations sound something like this: poor cash position; investment too heavy in equipment; creditors have higher stake than owners; low activity of invested capital; low productivity of fixed assets; too low an inventory turnover; earnings below conservative return from invested capital; etc. These are reports of what happened after it happened, and generally there are very few trace lines back to the causes. It is possible and probable that in such recitations of the obvious negative points of the balance sheet, there exist clues to many a positive condition.

Just as the profit-and-loss statement is a recitation of the *afterfacts* and an averaging of the contributing cost elements, so the balance sheet is a reflection of the averaging of all the acts brought to bear on the company's life. In between any two periods, the surges of movement within the balance sheet as in the profit-and-loss statement can be violent or calm, each surge being a mirror of the events preceding it.

Purpose of MC Ratios

What is regarded as important in these evaluations, whether of the capital structure or of the financial management, is the movement of the ratios with respect to one another so that the change in one or more can be instantly seen in the others. In the tertiary ratios, the MC idea evaluates the integrated or total changes in the economy.

Since the isolated ratio in itself can be misleading, tertiary ratios, those combining the simpler ratios, are constructed. Each tertiary ratio evaluates another major segment of the capital structure. When these ratios are plotted as curves, management can determine as often as it wishes in what direction it is heading for the particular area under control.

Then, as we shall see in Chapter 15 when these ratios are integrated with the production-sales data, a total decision can be made.

EXHIBIT 13-2A. LEGEND OF CAPITAL AND FINANCIAL TERMS

Abbreviation	Name	LOCATION P & L or Balance Sheet
ACP	Average Collection Period	--
AR	Accounts Receivable	BS
CA	Current Assets	BS
CL	Current Liabilities	BS
CR	Current Ratio	BS
CS	Cost of Sales (Total Cost)	PL
DEP	Depreciation Expense	PL
FA	Fixed Assets	BS
FC	Fixed Costs	PL
FL	Fixed Liabilities (Non-Current, Funded Debt)	BS
INT	Interest Expense	PL
INV	Inventory (new, in-process, finished)	BS
NP	Net Profit	PL
NS	Net Sales (Gross Sales less credits)	PL
NW	Net Worth (Tangible)	BS
OH	Overhead Expense (Burden Costs)	PL
REC	Recovery (Amount of Expenses Recovered in Sales)	--
TA	Total Assets = Total Capital Employed	BS
TCE	Total Capital Employed = Total Assets	BS
TL	Total Liabilities	BS
TO	Turnover	--
VC	Variable Costs	PL
WC	Working Capital (Net)	BS

Before going on to the ratio movements, it should be pointed out that the basic ratios are interrelated, particularly those between the balance sheet and the income statement. For example, net profit on net sales is a relationship between the net worth, the total capital employed, and the fixed assets, namely (see legend of abbreviations in Exhibit 13-2a):

$$(a) \qquad \frac{NP}{NS} = \frac{(NP/NW) \times (NW/TCE)}{(FA/TCE) \times (NS/FA)} = \frac{NP}{NS}$$

But this is not the only combination of ratios which will yield the NP/NS result. Let's see how this works for the inventory turnover ratio:

$$(b) \qquad \frac{NS}{INV} = \frac{NS/REC}{INV/REC} = \frac{NS}{INV}$$

Or it can relate other factors to get the same result:

$$(c) \qquad \frac{NS}{INV} = \frac{(NS/FA) \times (FA/NW)}{INV/NW} = \frac{NS}{INV}$$

But don't think that because certain terms cancel out they do not have effect. Take the ratio for the return on invested capital:

$$(d) \qquad \frac{NP}{NW} = \frac{NP}{TCE} \times \frac{TCE}{NW}$$

This would appear to show that a change in the TCE would not affect the return on invested capital. This could not be for the same condition, for if the TCE changes and since TCE = TL + NW, any change in the NW changes the return for the same level of profits.

Other typical interrelationships are:

$$(e) \qquad \frac{NP}{TCE} = \frac{NP}{NS} \times \frac{NS}{TCE}$$

$$(f) \qquad \frac{NS}{NW} = \frac{NS}{INV} \times \frac{INV}{NW}$$

or

$$(g) \qquad \frac{NS}{NW} = \frac{NS}{TCE} \div \frac{NW}{TCE} = \frac{NS}{TCE} \times \frac{TCE}{NW}$$

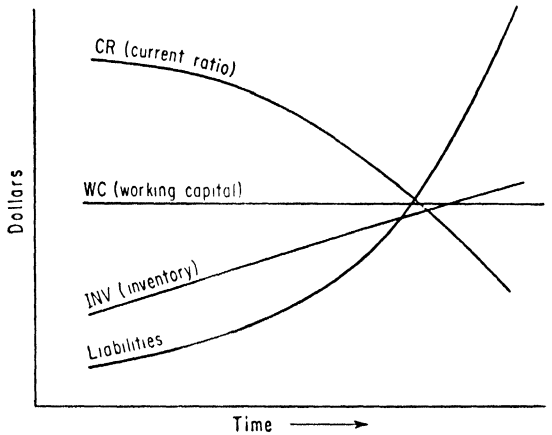
Movements of Ratios

Before the tertiary ratios can be developed, it is necessary first to see how the more elementary forms of ratios are related to each other. From even this simple examination of movement it is possible to draw some conclusions about the characteristics of the capital structure. And keep in mind that the same change in a ratio in another company, having a different capital structure, will affect the other movements differently; that is, a deterioration in the current ratio by, say, 20 per cent will affect the capital segments of different companies in different ways.

A simple set of movements is given in Exhibit 13-3. It shows the effect of a top-heavy inventory. As inventory increases faster than it is converted into cash, it becomes necessary to finance additional inventory in the form of additional credit from suppliers. This raises the liabilities and decreases the current ratio. The reasons are manifold. Maybe a slow collection trait exists in the receivables which makes the inventory increases critical. Maybe there are bottlenecks in production.

At any rate, the slope and relationships of the curves show how sensitive they are to changes in other ratios or data. For example, not all companies would show such a sharp decline in the current ratio with the increase in inventories. This might indicate that the current ratio was close to the critical point anyway. For example, both the current assets and current liabilities might increase by the same exact amount and yet the current ratio will be different. This is simple arithmetic. Suppose before any change was made that the CA was $100,000 and the CL $50,000. The CR is then 2:1. But if they are both increased $100,000, the CA is $200,000 and the CL $150,000 and the CR drops down to 1.33:1, which might react negatively on creditors and might force the

EXHIBIT 13-3. EFFECT OF TOP-HEAVY INVENTORY



company to change its previous course of action. Note also that the WC still remains at $50,000.

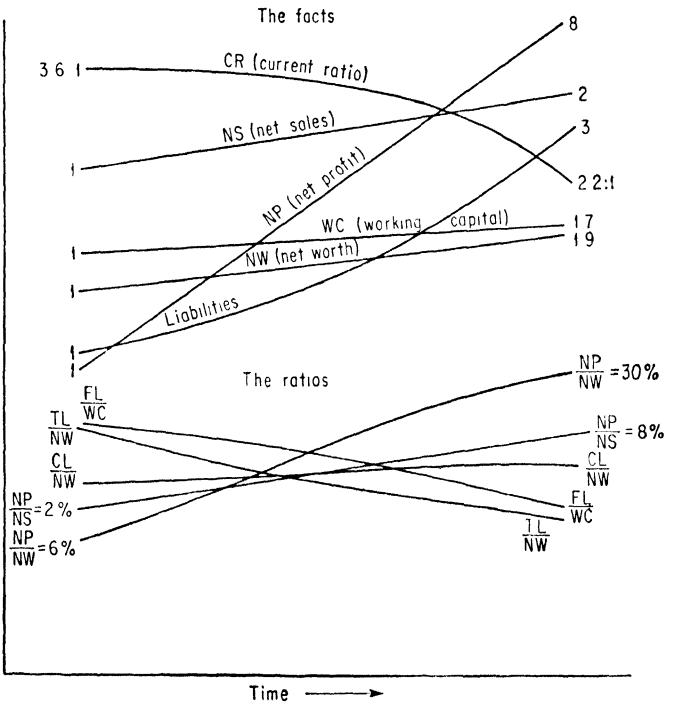
While these curves are not diagnostic, they do show the interplay of the variables which is necessary in visualizing effect. We shall have more of these multimovement curves, but first it will be instructive to show the difference between the changes of the actual balance sheet elements and the changes they cause in some of the ratios. This was seen in the example, just previously, where the working capital remained the same, the increase in the current assets and current liabilities remained the same, but yet many ratios changed.

In Exhibit 13-4 the top of the chart shows a family of curves of the actual balance sheet values and the lower half the movement of the ratios it caused. This chart happens to depict the events in the life of a company making machined parts. An outstanding fact in this period is a doubling of sales with an 8:1 increase in profits. The circumstance that liabilities rose three times might indicate the advantageous use of credit

—advantageous only if it didn't place the company in a dangerous financial position. A glance at the current ratio tells us that while there was a drop in the ratio due to the liabilities, it did not seriously affect the company's ability to meet its current obligations promptly.

Observing the ratios at the bottom of the chart shows a more rapid increment of the return on investment (NP/NW) as compared with the profit on sales (NP/NS). This is due to the fact that the company's

EXHIBIT 13-4. MOVEMENT OF PRIMARY DATA VERSUS ELEMENTARY RATIOS



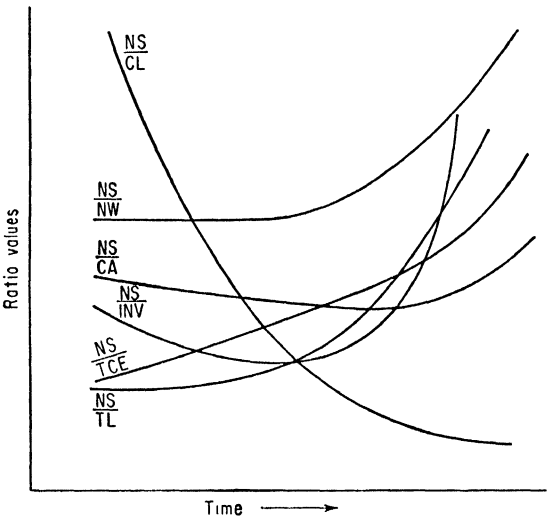
fixed assets did not change appreciably with a doubling of sales, indicating a more productive use of equipment; that is, the same fixed assets permitted a doubling of sales. Note that (in this company) as the spread widens between these two profit curves, an increasing use of available capacity is indicated. So before adding equipment, it is well to test out the effect as shown on this type of chart. Notice that the CL/NW ratio did not rise appreciably in spite of the sharper increase in the liabilities shown on the upper portion. This means that the rise in the liabilities was proper in comparison with the net worth, that is, proper for this particular company.

As was seen in Chapter 12, one balance sheet factor can be compared

with many other elements, each of which assesses another portion of the structure or of financial management. So in the previous case, while the CL/NW looks favorable, the ratio of CL to some other factor may not. Let's then consider the data in Exhibit 13-5, which refer *to the same company.*

In this chart, net sales was compared with other proper balance sheet elements. The curves apply to the same time period as that shown in Exhibit 13-4. The reader should observe that the movements are not linear and surely quite different from each other at different

EXHIBIT 13-5. VARIATIONS BETWEEN SALES AND FINANCIAL ELEMENTS



CA = current assets
TCE = total capital employed
TL = total liabilities
INV = inventory

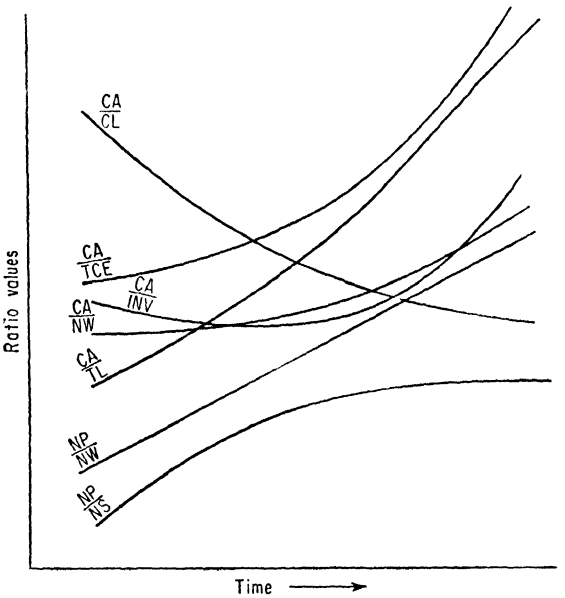
times. A factor that the company should concern itself with is the tendency for a rapid increase in current liabilities with an increase in sales. This rise is not linear, and if accounts receivable begin to lag and inventory expands as work-in-process accumulates in production, then a small rise in sales can rapidly put the current ratio below the safe limits.

Glance once more at the slope of the end of the liabilities curve (upper portion of Exhibit 13-4) and see how a small increase in sales will cause a large rise in liabilities. It is also seen in the rapidity with which the CR line decreases. These are not characteristics of all companies—just this one. Not all companies will respond to changes in the

data the way this one does. In Exhibit 13-5, the tendency for insolvency rests with the slope of the NS/CL curve.

In Exhibit 13-6 current assets are compared with various balance sheet items. In this chart we see that even though there was an 8:1 increase in profits for the doubling of sales (see Exhibit 13-4), the incremental profits started to fall off long before the upper sales level was reached. This shows that when the NP/NS curve heads downward, the company is reaching its point of maximum sales expansion.

EXHIBIT 13-6. VARIATIONS BETWEEN CURRENT ASSETS AND OTHER FINANCIAL ELEMENTS



CL = current liabilities

However, knowing what we do about the company's sensitive current liabilities reaction, we conclude that it is better off not approaching this maximum sales point. No doubt, from the trend of the CL curves, it will be insolvent at that point. The company is better advised to stay within that range of sales where the expanding inventory does not imperil the current liabilities; the level of profits is still a high. The company should be directed toward a more careful selection of its product mix with due consideration for the expense-recovering needs in production. This will allow a more rapid absorption of the expenses of carrying the fixed assets and a higher margin of profit. But we are getting a little ahead of ourselves; this concerns total integration, the subject of Chapter 15.

TYPICAL MOVEMENTS AND RATIO INDICATIONS

Top-heavy Inventory

Exhibit 13-3 shows the effect of a top-heavy inventory that occurred in a *specific* company. Again it must be emphasized that the presence of a large inventory does not necessarily produce this family of curves in all companies. Not only will it look different because of industry differences, but even for companies within the same industry, a top-heavy inventory will have various effects. This is due to the way each particular company is run. And the "way it is run" is a function of the composite of the personalities involved in its operation plus the tempering by the local market and source characteristics.

Even though two companies may make plastic sink tops, it does not mean that their customers' habits will be the same; it doesn't follow that the quantity and location of their suppliers will be the same; it surely doesn't mean that they police their receivables with the same degree of effectiveness. The families of curves then are not standards; they mirror the behaviorisms of the economic segments of the company, which usually have trends. By watching these trends, it is possible to predict the effect of changes.

The reader may add other curves to Exhibit 13-3. He may add a sales line or an NP/NS line or a WC/NW curve to see at what point inventory stocking should end. The inventory overstocking might be symptomatic of other conditions. Maybe what seems to be overstocking is actually a bottlenecking in production. Could it be that rejects are great or that there is insufficient indirect labor support? Could it be a sales problem? Is the sales department experiencing customer resistance? Is it due to price level, quality, delivery? Or aren't the salesmen pushing the product sufficiently? What effect has this got on expense recovery? Again we are getting into the total integration concept, but the author doesn't wish the reader to overlook the fact that these charts are empirical: any curves can be constructed as long as they represent existing, valid relationships.

Inventory Turnover

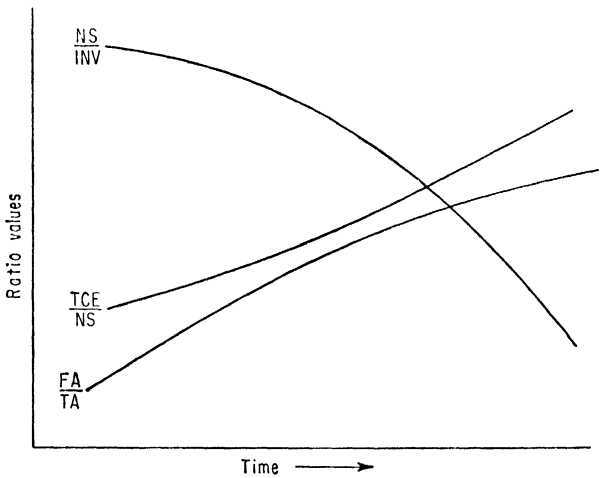
Exhibit 13-7 is a typical relationship between inventory turnover and the amount of total capital necessary to support each sales dollar. This condition is compounded by the amount of total assets which is tied up in equipment. Again, this is a specific family of curves for one company, over a specific period.

The most volatile curve, by industry, is TCE/NS. In some industries it takes several dollars of total capital employed to bring in a sales dollar; in others, pennies. Generally, the larger the amount of fixed as-

sets, the more total capital it takes to generate the sales dollar. For example, in the ladies' garment industry, it takes about $0.20 to $0.30 of capital per sales dollar, whereas in the process industries it might run as high as $2.

Curves of this nature alert management to the trend of the amount of capital necessary to produce a dollar's worth of sales. When sales lag, not only has part of the resources been wasted but the profit earned on the total capital employed usually takes a nose dive. As far as the connections between the ratio and the company's state of health is concerned, an increase in the fixed assets or the total assets, with a fixed

EXHIBIT 13-7. THE IMPACT OF INVENTORY TURNOVER



FA = fixed assets
TA = total assets = TCE (total capital employed)

level of sales, can do the same as a lag in sales, with the level of the assets maintained at about the same magnitude. With the increase in fixed assets within the same TCE, the effect will be to reduce the current assets; this will affect the current ratio—the creditors' yardstick. And with increases in fixed assets go interest charges if *borrowed* capital is used to do the financing of the fixed assets. If more *owned* capital is obtained, then a decreased profit, due to the full expense recovery of these additional facilities plus the then larger portion of invested capital with which it is compared, makes for a poor return on the invested capital.

As in all matters, the company must guard against creeping change. Before the company is aware of it, it has lost some elasticity, cannot expand easily, cannot show a satisfactory earning record from the

stockholders' viewpoint, and as a consequence cannot obtain new capital. Creditors begin to shy away, and the company is frustrated in its attempts to grow. The author has seen these things happen with relatively small changes in the movements of the family of curves.

EXHIBIT 13-8. THE TURNOVER OF CAPITAL EMPLOYED, PROFITS, AND RETURN ON INVESTMENT

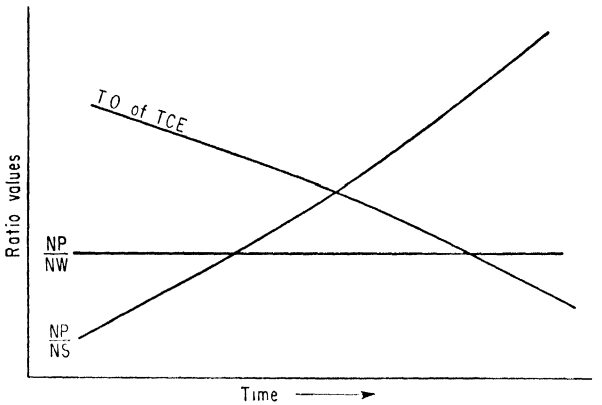
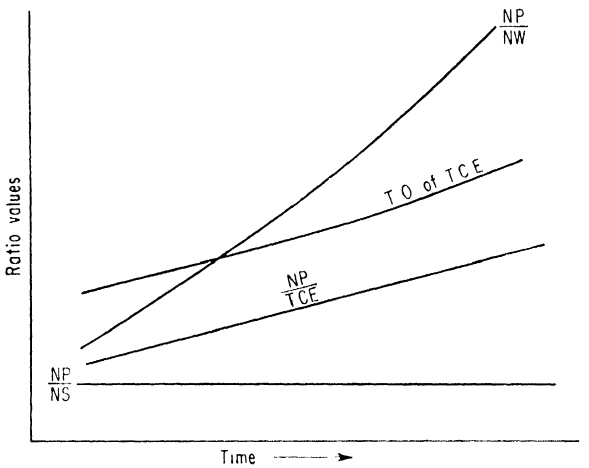


EXHIBIT 13-9. VARIATIONS BETWEEN PROFITS AND CAPITAL ELEMENTS



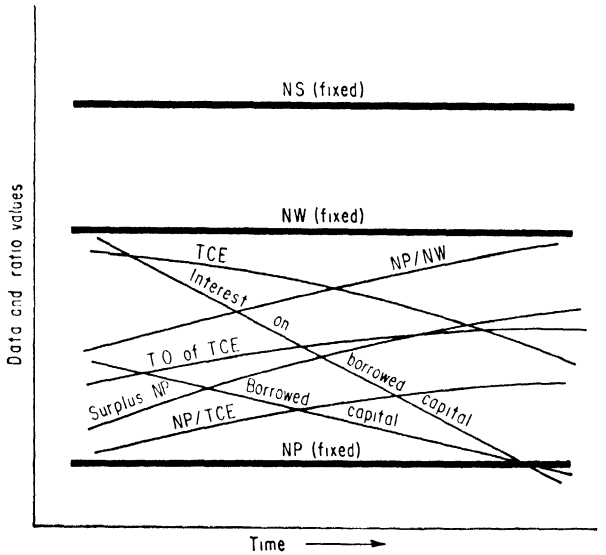
Creeping change is one of the most insidious diseases of management. The answer: plot and police the data and have an integrated picture of the *movement* of the company as an organic whole, constantly.

Exhibits 13-8 and 13-9 show typical movements between the NP/NS, the NP/NW, and the TCE/NS. The lower the turnover of the total capital employed, the greater the NP/NS must be in order to show the

desired return on investment. In Exhibit 13-8 the NP/NW is held constant, and in Exhibit 13-9 the NP/NS is held constant, and the curves show an improvement in the TCE/NS. The sharp rise of the NP/NW is due to a higher turnover of inventory, accounts receivable, and fixed assets (NS/FA); that is to say, a given fixed TCE/NS can show different NP/NW and NP/TCE, depending on the content of the TCE. A proper balance and vigor among the assets which are held at a given level will produce different profits (see formula *c*, page 310).

Finally, in this introduction to ratio movements, Exhibit 13-10 shows other facets of the capital structure. Sales, net worth, and net profit

EXHIBIT 13-10. VARIATIONS IN ELEMENTS OF CAPITAL FOR FIXED SALES, PROFITS, AND NET WORTH



are held fixed from period to period. It is clear to see how the other financial elements can gyrate one to the other within the same sales, net worth, and net profit levels; that is, different variations of the turnover of the TCE, the level of borrowed capital, etc., can result in the same profits, with sales and net worth held at the same magnitude. However, what this family of curves does not show is the *optimum* relationship of these capital elements, which provides the best production efficiency.

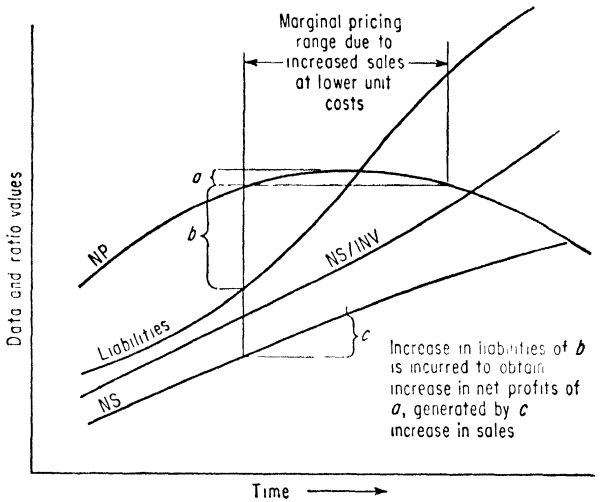
To make the point clearer, even though many other capital elements can vary without changing the net profits, there is one combination which is best for the company. This is the subject for Chapter 15, on integration.

Managerial Determinations from Ratio Movements

Having explored how the ratios move and what a movement indicates, let us turn our attention to selecting an optimum relationship in these ratios for stability and financial health.

Exhibit 13-11 shows a relationship between the net profit, liabilities, inventory turnover, and sales. The inventory turnover is too high and causes a sharp increase in liabilities. The additional borrowed capital causes interest charges to accumulate, a charge against profits. This is shown by a leveling off of the net profits. The increment in sales is

EXHIBIT 13-11. DETERMINING THE OPTIMUM BETWEEN SALES, LIABILITIES, AND PROFITS



slow and gradual compared with the other curves, a characteristic of the company and not necessarily true for all manufacturers. What it means is that a small increase in sales causes a large increase in the liabilities.

There is a plateau in the net profit range within which a lower sales level will reduce the inventory turnover and the liabilities. It should be management's job to select the optimum between liabilities and net profit, i.e., determine what point in the net profit range optimizes liabilities and sales.

From the behavior of the net profit, it seems that the added recovery is not offsetting the cost of the borrowed capital, but this cannot be determined until the recovery is integrated into the charted data. Another factor which is worth interrelating into the data is *capacity;* that

is, it may be entirely possible that this net profit plateau concurrent with the surging liabilities may be occurring at a level considerably below the capacity of the plant. This would indeed be unfortunate and points clearly to the original design of the capital structure and/or the way it has been permitted to change and deteriorate.

Usually, the only way out of this dilemma is a critical selling of the type of product mix that accomplishes a fast expense recovery with a minimum increment in liabilities. Isn't it ironic that a plant can get into this type of difficulty? The author has been consulted by companies that were experiencing this type of characteristic at 55 per cent of capacity. These plants had available capacity and could get the sales to absorb it. But if they had taken advantage of the extra capacity and added sales, they would have been insolvent; it would have caused a poor relationship between current assets and current liabilities, a cessation of credit, pressures from creditors, and an inability to finance operations.

This is monster building and is responsible for failures of companies who have aggressive sales policies, a fine line of products, consumer acceptance, etc., but no financial orientation or management.

Optimizing Borrowed Capital

In an earlier chapter, we touched on the feasibility of using more of borrowed capital where the cost of obtaining this capital was less than company earnings on its total assets. In this way, the investors get a greater return on their money but the creditors' stake or interest in the company grows. At a certain point, creditors will make the financial decisions and the management will be working for the creditors, who have more interest in protecting their own capital than they do in the life, health, or longevity of the company.

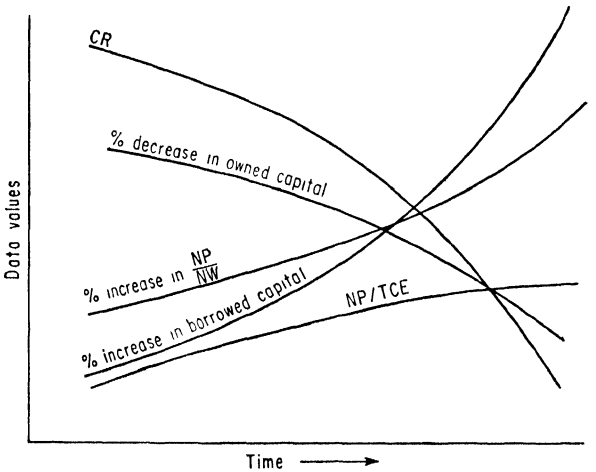
Exhibit 13-12 shows the relationship between the increase in borrowed capital and the increase in the return on the owners' capital versus the decrease in owned capital, the earnings on the total capital employed, and the effect on the current ratio. For any company, there is an area in which there is an optimum relationship between earnings on investment, creditors' interest, and the state of health of the company. In the chart, it is clear where this area occurs.

Obviously, if one motive is stressed to the exclusion of all others, the company will invariably contract some type of disease. If management just wants to maximize the NP/NW, then it is obvious that a small increase in this ratio causes a larger increase in borrowed capital and at maximum NP/NW the creditors own the business and the company cannot meet its current obligations because of the severe drop in the current ratio. Conversely, if the management lives solely by the CR

and wants to keep it high at any cost, then it will occur (in this instance) at minimum NP/TCE and with borrowed capital kept at a minimum. This means a large net worth, or stockholders' investment, for the sales, with a consequent low return on the stockholders' capital. Obviously, there is an optimum for every company.

Again, we must enter into the integration question because we cannot operate solely in a financial ivory tower. We just mentioned that there is an *area of optimum relationship* between these variables. Which point in that area will we accept as best?

EXHIBIT 13-12. OPTIMIZING BORROWED CAPITAL, FINANCIAL HEALTH, AND RETURN ON INVESTMENT



As we shall see in Chapter 15, there is considerable production volatility working within narrow balance sheet areas. Often a great benefit in the production area will justify a slight shift in the financial optimum point.

Exhibit 13-13 considers a somewhat similar problem, that of obtaining long-term borrowings at a lower interest rate than that earned on the TCE. Here the borrowed capital is plotted from 10 to 90 per cent of the TCE. The TCE is not a spectacular performer in earning profits, since the increase in the return on invested capital moves at a considerably slower rate than the increase in borrowed capital. And since the CR is so volatile in response to these types of movements, it is clear that the company concerned should not go too far in obtaining borrowed capital.

Exhibit 13-14 is a most interesting tabulation. Once having the above data, a company should plot this set of curves to determine what por-

tion of its total capital should be borrowed, based on the difference in interest and earning rates.

Here's how it works. The horizontal lines are marked with percentage values representing the difference between the NP/TCE and the interest

EXHIBIT 13-13. EFFECT OF BORROWED CAPITAL SEGMENT OF TOTAL CAPITAL EMPLOYED

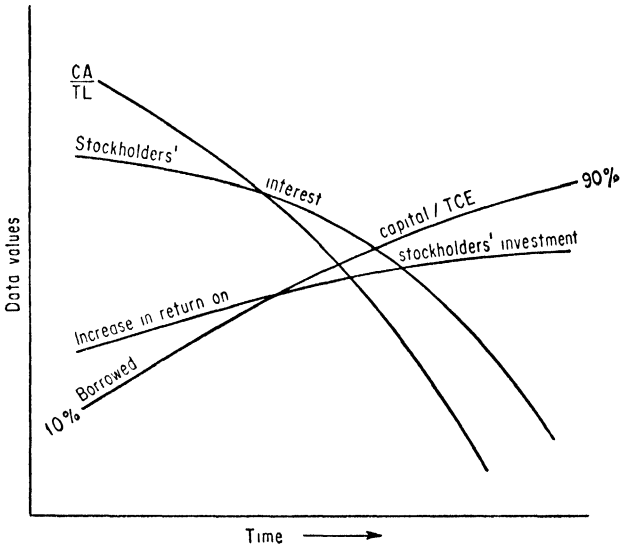
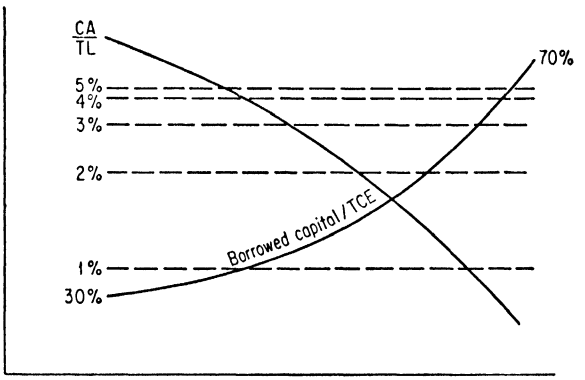


EXHIBIT 13-14. DETERMINING THE PROPER LEVEL OF BORROWED CAPITAL



rate on borrowed capital; the separation between the percentage lines being a function of the particular company, reflecting its TCE composition and its NP/TCE.

One glance will show the reader that as the difference between the earnings and interest rate increases, management has a greater oppor-

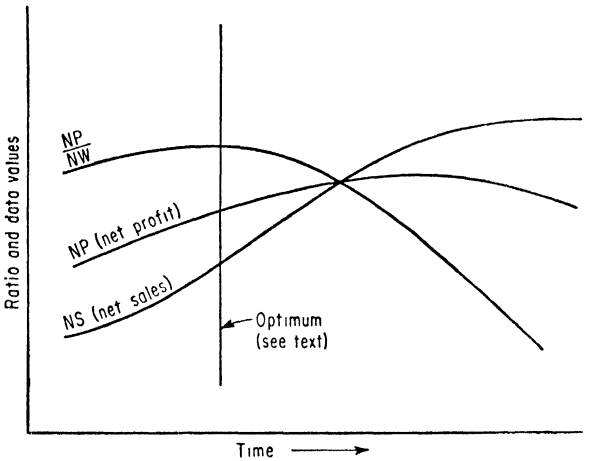
tunity to provide a higher rate of return to its investors. This, up to some point, justifies higher levels of borrowed capital; that is, as the difference between earnings and interest charges becomes higher, the more tempting it is to increase the percentage of borrowed capital to total capital. But as this occurs, the CR drops. What the slopes of these various curves are depends on the specifics in a company; where the curves cross is a rough guide to the level of borrowed capital.

DIAGNOSING MOVEMENTS IN FAMILIES OF RATIOS

Uneconomical Expansion

Exhibit 13-15 shows the effect of expanding beyond the economical point, in a rather narrow facet of the economy. As the curves show,

EXHIBIT 13-15. DIAGNOSIS: EXPANSION BEYOND ECONOMICAL POINT



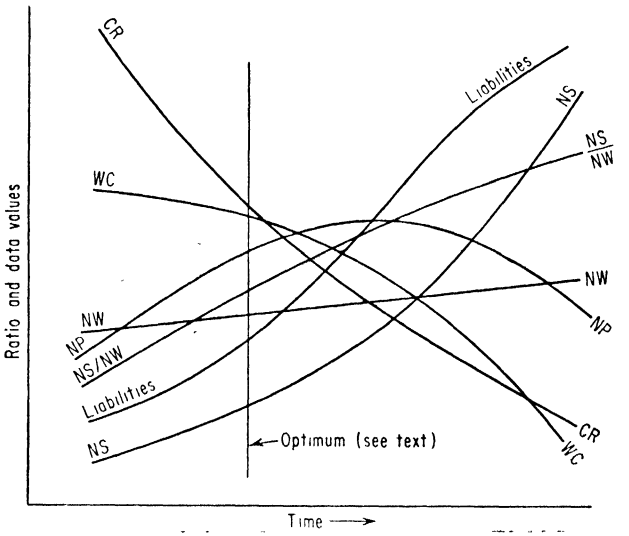
there is only a tiny rise in the NP/NW as the sales start rising. After the sales start to rise faster, there is a rapid fall-off in the NP/NW. That doesn't mean that the profit dollars are decreasing; the NP/NW is a ratio. Evidently, the net worth is increasing faster than the net profit. On the other hand, the profit curve rises ever so slowly with the spurt in sales and begins to fall off at the maximum sales point.

What happened here was an acquisition of additional capital equipment, the expenses of which were not fully absorbed (see Chapter 10). The light vertical line shows what is probably an optimum between the sales, profits, and the return on the invested capital. If the company had plotted the effect of its expansion by use of this simple relationship, it would have been obvious that its anticipated move was not a wise one.

Effects of Overtrading

Exhibit 13-16 shows the effects of overtrading (see Chapters 11 and 12). As the sales become too great for the company's net worth, the liabilities surge and this drops the current ratio. Then, because of the increased interest expenses, which are a charge against profits, the profits begin to level off, so that it becomes uneconomical to increase sales unless more invested capital is attracted. The optimum point is in the area of the light vertical line. If the company has this kind of relationship as a guide, it knows how far to go or when to stop.

EXHIBIT 13-16. DIAGNOSIS: OVERTRADING



Besides the lack of economy produced by overtrading, the creditors acquire increasingly greater financial interest because of the company's excessive use of credit, and management is faced with either reducing sales, increasing prices, or investing more capital. If it cannot do any of this, then it should maintain a low level of *active* inventory and police with vigor the accounts receivable. At least the company is then in as liquid a position as possible to counteract its vulnerability to the high level of liabilities.

So many companies, particularly those started by salesmen, are sales-oriented: if a little is good, more must be better, and the sky is the limit. This starts the overtrading cycle. These individuals just cannot turn down increased sales. Unfortunately, they also do not understand that as sales increase over the proper proportion for its net worth, there is expansion in other areas, which will soon overshadow the posi-

tive effects of the sales increase. And eventually these expansions will smother the company, even as sales are still increasing.

These expansions which take place in the inventory are usually financed by the current liabilities. And as we saw previously, both the current assets and current liabilities can expand by the same amount, but the current ratio drops. Then, as the inventory swells, the company faces an increased problem of obsolescence and the risks from market devaluations.

In addition, the entire economy becomes sensitive to production delays and to any small retardation in the collection activity. It becomes very vulnerable to pressures, and the structure becomes shaky. Again, we're interested in the signs which point to overtrading rather than differences in overtrading tendencies between various industries.

The curves shown in Exhibit 13-16 apply to a young precision electronics company. The company was started and managed by two electrical engineers. Capital was advanced by the young men's relatives, who impressed on them that plenty of sales was protection and cure against anything. In addition to carrying out that concept to the *n*th degree, they also were preoccupied with engineering problems and neglected the managerial aspects of business. Productivity and shipments were slow, manufacturing costs high. What a combination! Add to that the fact that the nature of the product required it to remain in process for a long time, because of testing and aging required. And as if that wasn't enough, the raw material inventory had to be heavy to take care of their needs. Furthermore, no one policed the receivables. The principals felt it was below them to contact their customers for payment.

The company subcontracted for large corporations who were doing vital government work. The company did no nondefense work. The principals booked as much sales as possible. As more sales were booked, orders were placed for raw material, items which would remain on the company's premises, in some form or other, for nine months.

At the end of their first year in business, the company had almost $3 in inventory for every $1 of net worth—an almost unheard of level. Since it was doing so well saleswise, it paid itself fat salaries and weakened its working capital position further. It had to factor its receivables, pledge its assets. It survived another year, finally gave up, and was absorbed by a large company. However, because of the excellence of its product, its trade name is still being used.

Not all examples of the dangers of overtrading are so dramatic, but unless the movements are policed, changes will creep in. By watching the movement and the interrelationships, it is possible to exercise controls: inventories are carefully stocked and pruned, collections policed,

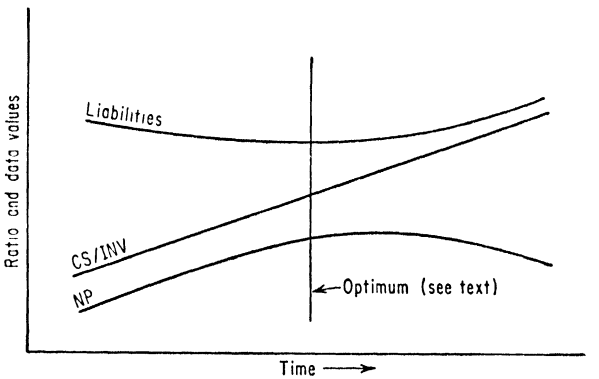
and selective selling done with more emphasis on expense recovery than on the sheer volume of sales.

Some companies, particularly those that sell machine time (machine shops, lumber millwork, boxboard containers, large printers, etc.), who don't police the growth of their fixed assets, cannot back off on their sales in an effort to avoid overtrading. There is the continuing high level of their period, or stand-by, expenses, which, if not recovered, could rapidly lead to large losses. The solution for those companies, once this state has been reached, is the investment of additional capital to liquidate some of the liabilities and to increase the working capital. If capital cannot be obtained, then it will take extremely sharp and competent management to rescue such a company. The manager will need every control possible; his decisions must be weighted and balanced and designed to provide every advantage to the economy of the company.

Uneconomically High Inventory Turnover

Exhibit 13-16a shows the effects of increasing the inventory turnover beyond the economical point. Instead of the NS/INV typical ratio for

EXHIBIT 13-16A. SELECTING OPTIMUM INVENTORY TURNOVER

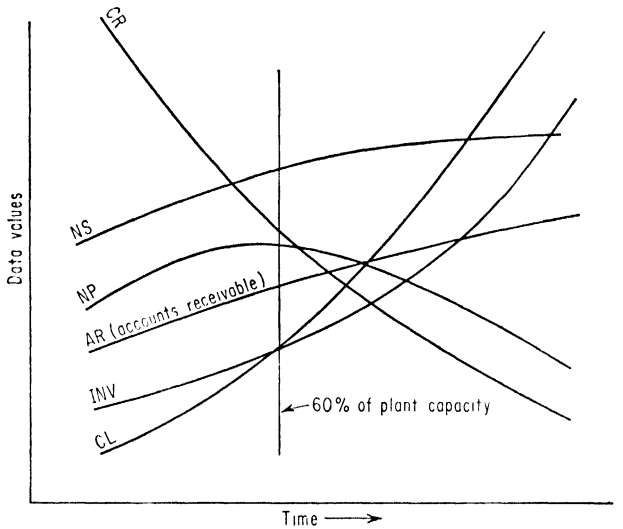


expressing this turnover, the cost of sales to inventory is used, which eliminates the distortions of the profit margin. As the chart shows, up to a point (the vertical optimum line), as the sales are increased, the inventory also increases, but not so fast. Yet the amount by which the inventory is increased is enough to cause an increase in liabilities above a certain point, and a little beyond this point the net profit plateau is reached and then starts to fall off. A somewhat similar practice is maintaining the inventory turnover at the same level and increasing it in direct proportion to sales. This can be disastrous.

A Road to Insolvency

Exhibit 13-17 shows the ratio movements in a company headed for insolvency via sales increases. Here we have a steady increase in sales which, after a time, becomes too great for the capital structure to support. The nature of the business requires high inventory levels, and unfortunately, the collection policy was not tailored to this characteristic. As a result, the CR dropped rapidly because of the increase in the current liabilities, which was financing the inventory.

EXHIBIT 13-17. THE ROAD TO INSOLVENCY WITH SALES INCREASING



The tragedy in this company was that the net profits began to fall off at about 60 per cent of the plant capacity. In other words, the company was restricted from the full use of its space, facilities, and obtainable sales by the design of the capital structure, which introduced disastrous consequences above 60 per cent of its capacity. This occurred in a malleable- and gray-iron foundry.

In other types of industry, in meat packing for example, where the fixed assets are not as "fixed" as they are in a foundry, this is an indication of the lack of policing of the composition of the fixed assets. In a company making office furniture, this was indication that the products were not tailored to the characteristics of the capital structure. And the reader should keep in mind that an optimum between product, customer, capacity, capital solidity, and profits *can be found.*

In one company, the management attracted products which made

fuller use of its capacity without affecting its inventory. It subcontracted and sold its machine time by the hour; the contractor furnished the materials and agreed to pay on delivery. While the accounts receivable did not change appreciably (for they still applied to the company's proprietary sales), the total assets increased because of the influx of cash; the current ratio dropped. And because of the additional recovery of fixed expenses of the facilities which had remained dormant, the company experienced a rise in profits.

In making the original contact for the sale of facilities time, and in order to make it attractive to the contractor, the company priced the facility-hour a little below its cost. Since the largest portion of the machine-hour rate was fixed expenses, the slight selling below cost did not fully recover all the expenses of the idle facilities, but recovery was far greater than if the 40 per cent had lain idle. Besides that economic gain, the company began to improve its solvency state by increasing the liquid portion of its assets without having to increase its inventory or accounts receivable.

This example should indicate to the reader that maximization for its own sake can be dangerous. And if further emphasis is needed, it can almost be said that the percentage increase of the creeping change becomes increasingly more difficult to correct. It is amazing at times to observe businessmen who study their financial statements from period to period trying to find out why they were so *solvent and unprofitable* at one time and almost *insolvent and highly profitable* at another. Or sometimes they saw the point where a sound capital structure and a high profit coincided, but yet were terribly insecure as to what direction to turn next in facing some important decision.

If such businessmen knew their companies' own characteristics, the reasons and the moves to take would become obvious. The capital structure is comprised of many triggers, all of which control barrels of varying calibers. Pulling the .22-cal. trigger will cause a different reaction at one time than at another. Comparing the capital structure to one's own make-up may be helpful in conveying this idea: not all events cause the same disturbance in the human personality. It depends on the individual's general ability to cope with disturbances and also how the person felt when the particular disturbance occurred. At different times, the same disturbance is not even apparent to the same person. However, if the individual is well integrated, he knows what is disturbing to him and takes steps to avoid it. Another person may welcome it. Or a person knows that at times he may even find enjoyment in what was disturbing to him under other circumstances.

The condition of Exhibit 13-17 occurred in a lumber-millwork plant because the owner was convinced that he should make decorative

melamine plastic tabletops. Normally, his inventory was high because of a yard full of lumber which was air-drying. But yet the market was ready for tabletops; it was a current fad, and he was convinced that if he got in on the ground floor he would be a rich man. He also rationalized that since tabletops were made principally from plywood, it was a correct product to adopt.

His inventory to working capital was high to start with, and the plastic laminates cost him more per square foot than the plywood. The plastic companies insisted that he had to take "sets of designs" in the plastic sheets, and this boosted inventory sky-high. Then, since designs were involved, some of this inventory became obsoleted.

The market he served with these tabletops was of a different type entirely from the millwork market he had been serving. He sold tops directly to retail outlets. His production runs had to be small because of design changeovers. Collections from these outlets were extremely slow. It should also be pointed out that he invested a considerable sum in woodworking machinery for shaping the tops and in electronic curing presses for the lamination of the plastic to the plywood base. He also allotted a large portion of his plant to this effort, space formerly occupied by his millwork facilities.

Here's what happened. His receivables rose because of the slow payment for the tabletops; inventory surged because of the stocking of the plastic and plywood and rose at a much faster rate than the sales. His money was tied up in inventory, accounts receivable, and in the additional fixed assets. His liabilities rose frighteningly, his current ratio fell off a cliff, and he was being pressed for voluntary bankruptcy proceedings by the creditors' group.

Here was an old-line established millwork firm that just did not test the effect of the decision. All the factors, down to even finding out how fast the retail outlets pay their bills, could have been evaluated and plotted. One glance at the type of relationship shown in Exhibit 13-17 would have done the trick. Eighteen months from the time it started this fiasco the company was in the hands of the creditors.

Granted that the results described were the consequences of a big decision. But don't let this be misleading. The combination of many different *creeping changes* over a comparatively short period can be almost as catastrophic.

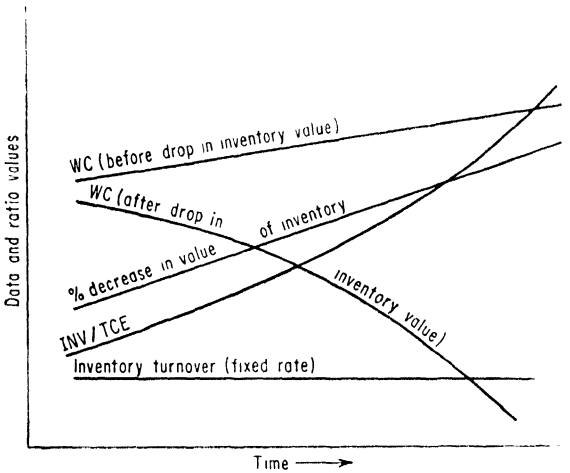
Fixed Inventory Turnover Rate—One-fact Managing

Some businessmen still function at emotional levels, just as did the principal of the previous example. Others remain impressed by some one fact in the operation of business. Maybe they acquired this from their fathers or from respected members of trade associations.

The author recalls being retained by a trade association that wanted to sell forcibly to its members the "fixedness" of the inventory turnover. Its industry typically had a fairly large degree of inventory obsolescence in addition to a fairly high volatility of inventory prices. Nevertheless, it felt that because of its industry characteristics, everything would be fine if it just kept its inventory turnover fairly fixed.

The author presented his viewpoint at the next general membership meeting with the help of the data shown in Exhibit 13-18. The executive secretary was not too happy about this turn of events; this was the Bible rewritten! It did serve to alert the members to the dangers of the

EXHIBIT 13-18. DANGERS OF MAINTAINING FIXED INVENTORY RATE OF TURNOVER



one-factor evaluation. As a matter of fact, one member came up after the meeting to say that up until the meeting he had wondered why his capital structure and profits were weakening while his sales and inventory were rising in proportion.

Let's spend a little time with this chart to see what is happening. The lowest line shows that the inventory turnover remained constant throughout the period. This means that as sales increased, the inventory increased in the same proportion. This rising inventory in comparison with the total assets is shown in the curve INV/TCE. It is the key to the fallaciousness of the fixed-inventory-turnover concept. Curve INV/WC is another hint as to the effect on the capital structure. This type of curve shows that the inventory is becoming excessive for the size of the business.

Now let's say that because of the obsolescence of the inventory in

this type of business and the capriciousness of the market, the entire inventory experiences a drop in value. This is shown by the curve "percentage decrease in value of inventory." As this curve rises, that is, as the drop in inventory value becomes greater, the working capital decreases sharply as shown by the curve "WC after drop in inventory value." If no drop takes place, then the curve "WC before drop in value" applies. This shows quite dramatically that the level of working capital can vary quite widely for the same inventory turnover. And as the working capital drops, so the company's ability to meet current obligations decreases rapidly.

Ironic as it may seem, a steady increase in sales with a corresponding increase in inventory can cause bankruptcy.

As we have said repeatedly, we are interested in controlling the trends in these and other characteristics of the company so that the company knows how to operate most effectively within the framework of its limitations and can simultaneously assess its future acts.

Preoccupation with Production

Another interesting and typical condition is depicted in Exhibit 13-19, which shows what can happen when the accounts receivable are permitted to become larger than justified by sales or the current position. This can be the result of poorly designed selling terms or ineffective collection procedures. In addition, the inventory is rising out of proportion to sales and collections. This may be a clue to an obsoleted portion of the inventory and is shown by the turnover of inventory curve. The level of sales is also insufficient in comparison with the fixed assets. Undoubtedly, the liabilities are rising, and the company may soon be in serious difficulty.

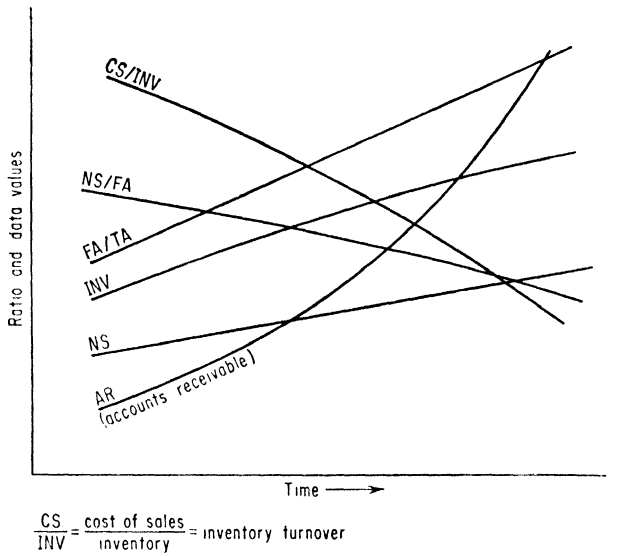
This set of curves is typical of managements that concentrate on the production aspects without evaluating the effect in the financial and sales functions. The general manager of this particular company was, for many years prior to his association with his present company, the manufacturing superintendent of one of the large plants of one of the most prominent multiplant manufacturers of electrical apparatus in the United States. He knew production efficiency, labor relations, tooling, production scheduling, etc. Finance and sales were strangers to him.

In his former association, as sales were made by the sales division (1,500 miles away), he received his authority to manufacture and was allowed a production budget within which to operate. He was expected to get the products out on time with a minimum amount of rejects, at minimum cost, with a minimum of wear on equipment, and maintaining harmonious relations with labor and the community. He did not have to worry about the method by which sales were reaching him,

nor did he have to police the sales effort. His bills were paid by the budget, and he did not have to worry about his financial health (centralized finance, decentralized line management).

It is small wonder that he let the present company get into the fix it found itself in. He later admitted that the slope of the sales curve in Exhibit 13-19 looked like the peak season sales *increase* of his previous employer. No wonder he didn't bother with it. As a matter of fact, he let both the controller and the sales manager be entirely autonomous.

EXHIBIT 13-19. DIAGNOSIS: PREOCCUPATION WITH MANAGEMENT OF PRODUCTION



$$\frac{CS}{INV} = \frac{\text{cost of sales}}{\text{inventory}} = \text{inventory turnover}$$

Wasn't the fact that he was being constantly called in by them to settle interfunctional disputes enough of a clue to him as to what was happening?

The controller complained about the lack of vigor of the fixed assets; i.e., he felt that there was not enough sales for the level of fixed assets maintained. On the other hand, the sales manager stoutly said of the products he believed *most accepted and best to sell* that the area was saturated with them and he could not increase the level. There was the *crux* of the matter, and both men were right in their respective contentions. But they didn't go far enough.

There was no coordination from the general manager, who should have determined the proper balance among the products sold and equated sales efforts accordingly so that the fixed assets could have be-

come more functional. As we saw in Chapter 10 on sales integration, products were considered best when they satisfied the economic needs of the company.

When sales at this company finally rose after a shift in product mix and a study of the economic radii of sales and delivery penetration, the company became more elastic and more solvent. The obsoleted portion of the inventory was sold off, the collections accelerated, and the company resumed its health.

However, if the general manager had simple controls, the situation would have been called to his attention months before the condition occurred. By the way, it took twelve full months to put the company back on its feet, during which it was operating at a loss and credit restrictions were operating against them.

SOME SPECIFIC COMPANY SITUATIONS AND RATIO CLUES (BRIEF FINANCIAL CASE HISTORIES)

To validate some of the theses expressed in this book, the following review of past experiences with various clients is presented. In each case the state of financial affairs for a period before consultation was sought is described. Only that portion of the assignment which touched on the capital structure and the financial management will be discussed.

Increasing Sales: Solvency and Losses

Exhibit 13-20 shows the movement of various financial factors for a period leading up to the time when the author became involved in this company's affairs. Management couldn't understand why it was experiencing losses in the face of sharply rising sales (what, again?). The company was a small manufacturer of wiring devices, connectors, and fittings. The office manager had prepared a tabulation of the current ratio. The tabulation showed an excellent state of solvency. The current ratio had *increased* faster than the rise in sales, a most unusual condition. It also boasted an increase in its working capital, which was of course part and parcel of the fine current ratio.

Why, then, the losses? The inventory was not increasing in proportion to the sales increases.

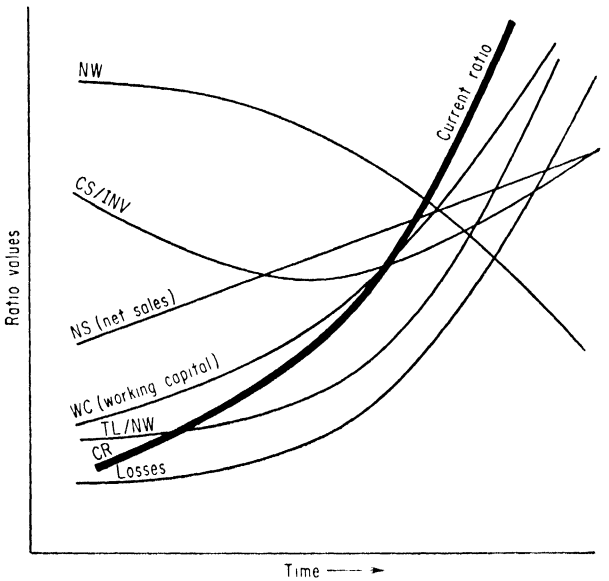
One major reason for the losses was the way the company managed in production. Another reason was the way it managed its finances.

Management was deceived not by one factor, but by several. It was self-deceptive to consider that increase in sales, CR, and WC was license to become complacent. These factors do not critically evaluate the capital structure. If management had gone a step further and used the TL/NW ratio, it would have found both an increase in noncurrent

liabilities (in the form of a large three-year bank loan with interest charges that cut heavily into profits) plus a decrease in net worth because of previous period losses.

Plotting this curve revealed the severe effect of this ratio on the state of that particular company. The same rate of change would not necessarily have affected the same company in the same way if it had occurred at a different time. Had the bank loan been for less than a year, then, in conformity with accounting practices, the loan would have been shown in the current liabilities, the current ratio would have

EXHIBIT 13-20. HIGH SOLVENCY AND LOSSES



looked very sad, and no one would have been deceived by the ratios. Putting this in different terms, if the balance sheet had been drawn by a conservative businessman, he would have put the three-year loan in current liabilities and all financial complacency would have vanished long before the consultation was held.

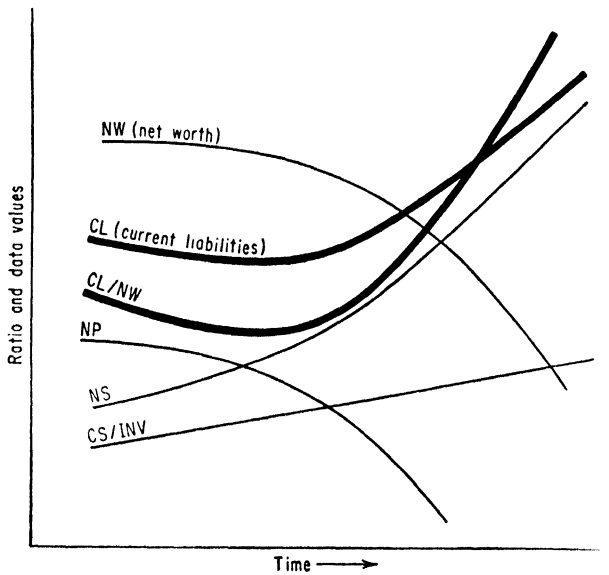
Poor Quality Control; Long-cycle Manufacturing

Exhibit 13-21 shows the recent financial movements within a company that did both the rebuilding of large machinery and the contract construction of large specialized machinery. The outstanding production characteristic of this company is its long production cycle. The family of curves again showed rising sales accompanied by decreasing profits. Note the sharp rise in the current liabilities and the decrease in

the net worth. Then the ratio CL/NW was plotted and the key was found.

Digging into manufacturing affairs soon showed that there was a complete lack of quality control during the long production cycle. Customers' rejections called for reprocessing and rework, which resulted in labor excesses. This tied up the finished goods inventory for a long period and prevented any billings. The company had to continue operating, and even though it could not transfer finished goods into accounts receivable, it had to keep buying materials for other work

EXHIBIT 13-21. EFFECT OF POOR QUALITY CONTROL IN LONG-CYCLE PRODUCTION



previously contracted for, plus payments for labor, supervision, and administration. This raised the current liabilities because of the bank loans required, which in turn caused large interest charges to bite into profits.

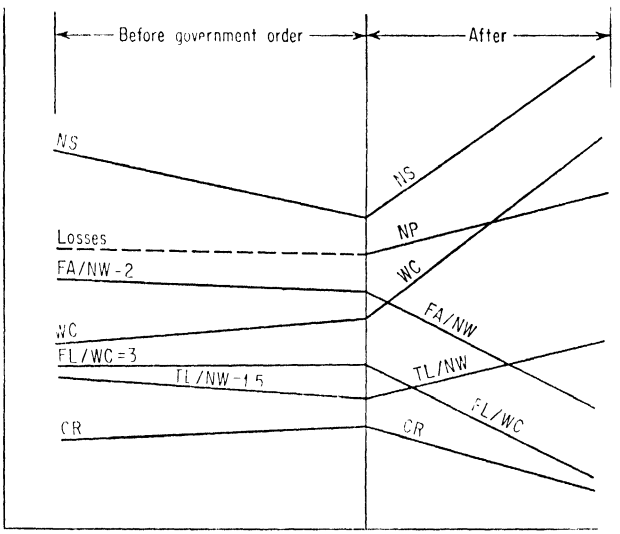
Interestingly enough, the profits were most sensitive to the increased interest charges. This showed two things: first, that the profits were a function of financial management and, second, that they were so small as to be affected by an expense such as an interest charge. Clearly, a lack of profit-making ability existed in the manufacturing division. Ordinarily, for the level of fixed assets normally employed in an operation like this—if kept active—there is more than enough of a cushion in expense budgeting to take care of interest charges on short-term ob-

ligations. This unnatural relationship was shown by the diametrically opposed slopes of the CL/NW and the NP curves.

Saved by Uncle Sam

Exhibit 13-22 is typical of some companies that were saved by a timely government contract. This particular company was a large reinforced-plastic concern. It had a line of proprietary products and reserved some of its capacity for special contract work. Before the government order was obtained, the conditions of a recent period were those shown in the left portion of the chart.

EXHIBIT 13-22. SAVED BY UNCLE SAM—NOT BY EFFECTIVE FINANCIAL MANAGEMENT



Sales were decreasing, and the company was losing money, but at a decreasing rate because of increased economy it was getting in its plant. But it was inelastic; it had $2 tied up in fixed assets for every dollar of net worth. No doubt the sales were a leveling off for the size of the net worth rather than for fixed assets; that is, the company had too much fixed assets for the size of the business and the unrecovered costs of the idle facilities was the loss-causing factor. However, the working capital position was good, and the company could meet its bills.

With a good working capital position and idle capacity, this situation was a natural for increased sales, and *it would have been worth heavy sales expenses* to bring it in. Added sales would have meant increasing current liabilities which the company could easily have tolerated. It

would have meant also that no additional funds would have to be spent for facilities. This company was owned by an engineer and a lazy salesman.

Then suddenly the company found itself the proud possessor of a government contract. The next period showed substantial profits. But had the capital structure been properly designed? This is another way of saying that if the structure was policed to spot and eradicate the creeping change, the company could have made as much profits on a lower level of sales increment. Now that the company appeared refreshed, a consultation was called to find what means could be taken to ensure continued health and profits and to prevent the conditions of the past.

A program was designed calling for a liberal budget for the maintenance and acceleration of sales (up to a predetermined point, of course), a gradual reduction in total liabilities, and no increase in the fixed assets (any temptation in this direction to be resisted like the plague).

This meant a reexamination of the proprietary products; market studies for products which could utilize the existing facilities; and then sales effort keyed to both the market and to the company's most expensive facilities. This action squeezed out the potential profitability residual in the company equipment, and money was spent in product and sales promotion.

After the end of the government contract and for the next three years, the company attained a sales level of 3½ times the original level, with each successive sales increase producing successive increments in profits. And this was done with a proper CR. The NW rose also, and the FA became about 57 per cent of the NW.

The government contract gave that company a lifesaver; but it was no lifetime solution; that had to come and did come from proper management.

Excessive Sales—below Production Capacity

Exhibit 13-23 is the record of a manufacturer of mechanical apparatus. In a short period management had boosted sales, with an accompanying fantastic increase in profits. It was young and aggressive and wanted to make sure that it was headed in the right direction. All it had to look at was the curve of INV/NW for the answer. The inventory exceeded the net worth by better than 2:1 at the end of the period. Its fixed asset level was satisfactory, and there was no doubt that the company was recovering every cent of its expenses and doing so consistently.

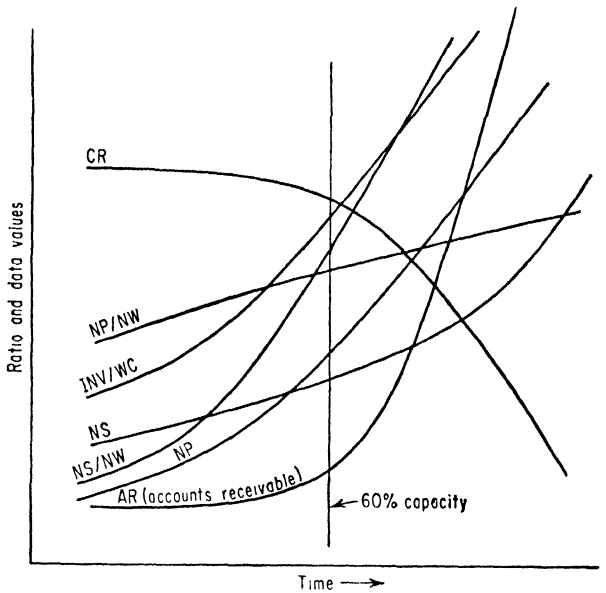
However, it was on shaky financial ground. Actually, the sales in-

creases were stressing the capital structure. Just as sales increases can go beyond the point of maximum economy in production, the safety factor in the financial structure can also be undermined.

Sales is the link between operating and finance. The maximum sales must be guided by whichever weakness occurs first. In this case, the capital structure was affected before maximum operating capacity was reached, and management should have deferred to it.

First, the company was overtrading, as seen by the curve of NS/NW, and such overtrading occurred at about 60 per cent of capacity. Toward

EXHIBIT 13-23. DIAGNOSIS: SALES LIMITED BY FINANCIAL STRUCTURE



the end of this period the inventories swelled and the liabilities increased out of proportion to sales increases. The drop in the CR was caused by a sudden increase in current assets and current liabilities of about the same magnitude.

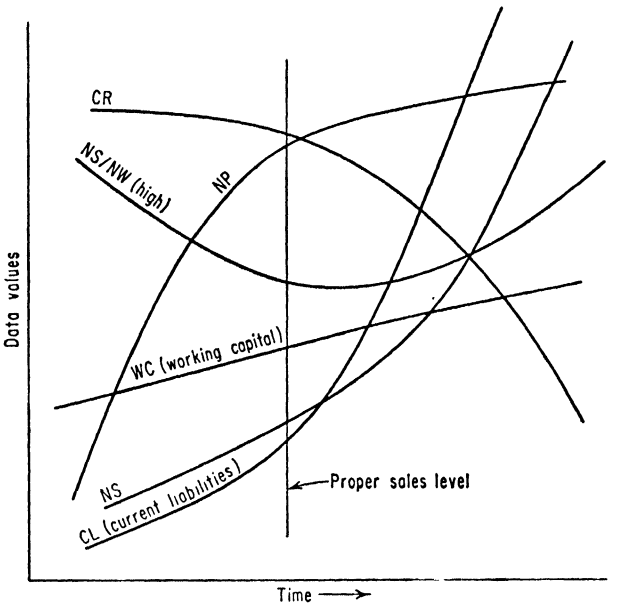
There was no doubt that the profit was very attractive. And with the net worth as low as it was, the return on investment was fantastically high. So is a 20:1 shot at the race track. In effect, the company was gambling; the slightest ill wind would have blown it away. Even the stockholders were agreeable to a lower return on their investment, once they knew the true state of financial stability. Everyone was interested in survival and longevity and believed he could get it only by a good state of health, even if it meant reducing profits.

Because of the high elasticity of the company, it was possible to reduce sales to a level which wouldn't burden the inventory and the CL, with the profit reduced almost in proportion. This would not have been possible had the company been inelastic, with profits sensitive to the slightest change in sales. In a company with a *10 per cent lower elasticity,* the reduction advised in sales would have wiped out all profits and some other method for alleviating the condition would have had to be found.

Pegging Sales to Financial Health

Exhibit 13-24 shows a company operating a business subject to great seasonal and style fluctuations. This company enjoyed large sales and

EXHIBIT 13-24. OPTIMIZING SALES LEVEL WITH FINANCIAL HEALTH



profit increases but was overtrading, as shown by the curves. The net worth and the working capital were too small to sustain the higher sales and the large surges in inventory, especially at the height of the season. Add to that the effects of style on the obsolescence of inventory, and an idea is had of the risks involved. Naturally, the liabilities always rise under such conditions, and in this case there is a monumental increase in liabilities and high interest charges which began to level off the profits.

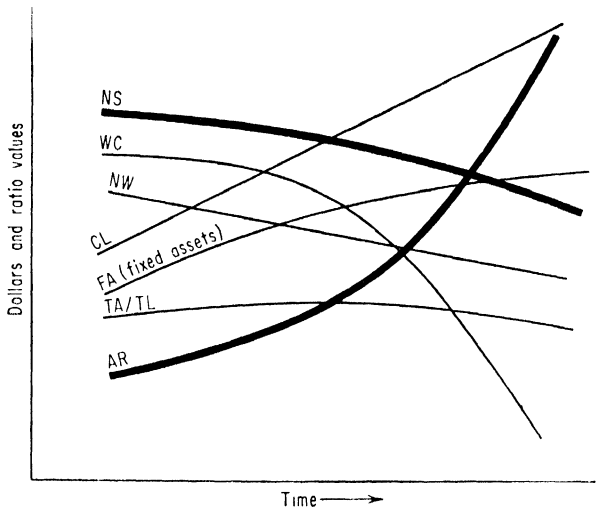
A little study of the curves would indicate that there was an optimum point of operation. If sales were budgeted around the level indicated by the light vertical line, then all the factors would come into line. Obviously, above this point management gets more sales with more grief. The only effect of the dropping sales is a slight decrease in the return on invested capital. When the issue was put squarely to the owners, it was agreed that the slight increase in return to them was not worth the health and safety of the company. Sales were then pegged at the point indicated.

It is time to mention once again that the family of curves shown is for one specific company having very specific characteristics. And even though the effects of seasonal and style business might be evident in competitor companies, the shape of the curves and the speed with which they change with respect to one another would be a reflection of the differences in operating methods, personal favor and prejudices, abilities, etc., and so might look altogether different.

The Road to Ruin

Exhibit 13-25 shows the data of a small company of the size that most small firms become after a few years of steady but slow growth.

EXHIBIT 13-25. USING ADDED EQUIPMENT AS A PANACEA



Sales were decreasing, and large losses were developing. This had been the case for quite a while. The owners were equipment-oriented and believed that earnings should go into new equipment. They felt that

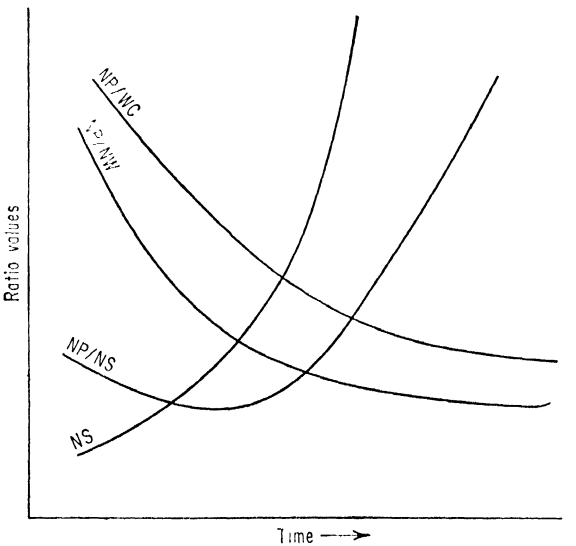
that was the way to make the business grow; with more equipment they could schedule work better, complete orders faster, and so please their customers.

But no more sales came in. They were stuck with heavy fixed assets. As they were having trouble meeting the payments for the machinery, this required a bank loan and a boost in CL. At the end of the period, their CR was unmentionable. When it rains it pours—their receivables were rising as sales decreased. This could only mean that the owners' attention was focused on production and neglected both sales and the policing of the accounts receivable. Had just these two curves been plotted, it could have alerted them. At the end of this period, spectacular sales increases were required to validate the high level of fixed assets, to liquidate some of the current liabilities, and to provide working capital.

Expanding before Testing Effects

Exhibit 13-26 depicts a situation so typical whose expansion is introduced before the effects are tested. Here, with a rapid increase in sales,

EXHIBIT 13-26. EXPANDING BEFORE TESTING EFFECTS



the profits surged, but the net profit on sales was at odds with the return on the invested capital. Why? Because the increase in fixed assets which were required to support the sales spurts were not paying off. More on this point, in following chapters.

PROBLEMS

1. What are the factors causing volatility in circulating capital?
2. Show by example and discussion how several negative conditions can occur by maximizing the current ratio. The inventory turnover.
3. Represent a company in a multiproduct industry by its balance sheet and previous six months' operating data. Develop an analysis of its products and find its optimum range in the current ratio that considers fixed expense recovery. Include the characteristics of the company typical for its industry.
4. Do the same as for Problem 3, but consider its inventory turnover as well as its CR.
5. Following the pattern of Exhibit 13-3, show a set of curves that depict the effects of a top-heavy inventory but coexistent with a fast collection policy and continuous production pressure.
6. Show the effects of a top-heavy inventory, impeded production flow, and a sluggish collection policy (by means of curves similar to Exhibit 13-3) in the following industries:
   a. Foundry
   b. Chemical processing
   c. Men's clothing
   d. Food processing
   e. Contract screw machine shop
   f. Commercial bakery
   g. Neon sign shop
   h. Corrugated-sheet plant
   i. Electronic-component manufacturer
7. Develop ratios that would be quick to reveal the conditions of Problem 6 in industries selected from 6*a* to *i*. (Be sure to include the factors of inventory, production flow, and collections in these ratios.)
8. Show how the following ratios are related arithmetically to "other ratios" and explain the use of the "other ratios":
   a. Ratio FV
   b. Ratio FVIII
   c. Ratio FXII
   d. Ratio FXV
   e. Ratio FXVIII
   f. Ratio FXXIII
9. *a.* Referring to Exhibit 13-5, if you had known in advance that the condition represented by the curves would eventuate, what preventive action would you have taken?
   b. Set up ratios that would have alerted management.
   c. What remedial action will you take now to correct this condition?
10. Define fully "maximum sales expansion."
11. *a.* How can expanding inventory weaken the capital structure?
    b. What events will counterbalance this weakening?
12. Discuss fully all the areas affected by:
    a. A lag in sales effort
    b. A lag in production flow
    c. Sales efforts on wrong products
    d. High productivity on high-material-content products

13. *a.* What do you consider a fair and equitable basis for marginal pricing?
    b. How would you decide when to use this type of pricing?
14. Show by curves of ratio movements the effect of:
    a. A "make" decision
    b. A "buy" decision
15. Explain fully how far you would go in obtaining credit for the purpose of supporting:
    a. Increased sales
    b. Increased profits
16. Explain how the following can coexist:
    a. Unprofitableness and solvency
    b. High profitability and insolvency

CHAPTER 14 *Advanced Evaluation and Control of Capital Function*

The previous chapters dealt with the development of simple ratios, what causes their special movements, and how they move with respect to each other. We see that a single ratio evaluates a segment of the capital structure but is unreliable for assessing the structure as a whole. It is dangerous to aim for maximization in single factors which we prefer to see rise rather than fall. For as they rise above certain limits, other factors previously remaining within satisfactory limits begin to go haywire and threaten the foundation of the company.

What should management do about it? How can it get simple, believable data from which to appraise its company? Frequent appraisals are necessary in a highly competitive economy: this is a truism. But more important, the manager must have the appraisal-making data so that the things he wants to do in his company can be reflected in the data. These data should be condensed for his convenience so that he can quickly grasp the direction in which his company is heading and can extract the factors most responsible.

Tertiary Ratios Needed

As was done in production MC, tertiary ratios are developed which integrate various capital effects so that a valid appraisal of movement can be made. Tertiary ratios combine the elementary ratios so that a condensed picture of the total movement can be ascertained. Most of the tertiary ratios developed here report on major segments of the capital structure; some assess the total capital improvement or regression; and some evaluate total company performance, including the results of operating.

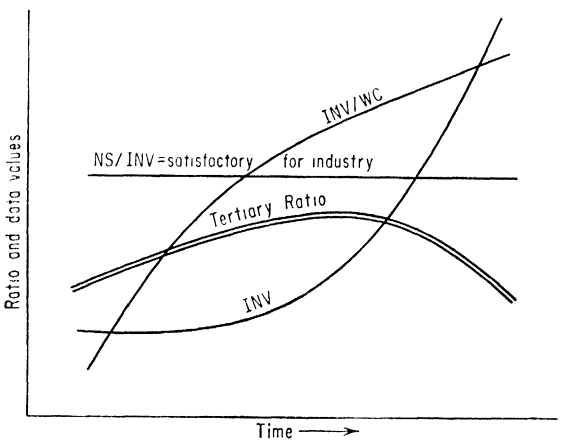
Let's see what tertiary ratios are all about. In the case of our friend in an earlier chapter who held on to his inventory turnover figure no matter what, it is clear that if he had included some modification in

this ratio for the effect on the CR or NW, he would have stopped his inflexible practice. A tertiary ratio which may help is NS/INV divided by CL/NW. A simpler one would be (NS/INV) × (INV/WC), in which an increase in the ratio is considered negative.

Effect of Typical Practices

Exhibit 14-1 shows the relationships for the ostensibly positive factor of a satisfactory ratio for an industry. This rate is held fixed at a high inventory level and at large ratio of inventory to working capital. The large inventory is a sign that sales must be increasing because of the fixed inventory turnover curve, and this is good. But at the same time,

EXHIBIT 14-1. EFFECTS OF MAINTAINING FIXED LEVELS OF TRADITIONAL RATIOS: COMPARISON BETWEEN ELEMENTARY AND TERTIARY RATIOS



the inventory is large with respect to the working capital, which shows the current reliability of the company in meeting its current obligations.

This situation is satisfactory, and all the factors are positive, up to a point. However, beyond this point, the inventory becomes too large for the size of the business and the general capital structure begins to weaken. This is shown by first a rise in the tertiary ratio (appropriate for the particular manufacturing) and then a quite rapid decrease as the financial vulnerability becomes more serious.

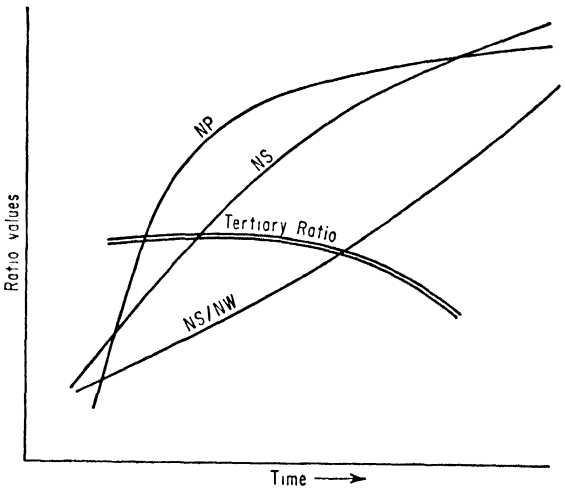
There are many practices of this type. Some managers cling to the fixedness of a ratio, while some try to increase the magnitude of the ostensibly favorable ratios and then run into trouble by failing to see the danger signs early enough.

Exhibit 14-2 is a perfect example of the latter tendency. Here is a fast and steady climb in the sales, a fast profit rise followed by a grad-

ual slowness. There was also a steady rise in the sales to net worth ratio. All these factors appear to be positive, and when viewed alone, without any other backdrop, they are truly positive. For after all, what is better than increasing sales to infinity, if no harm is done? And similarly, since profits are the motive of business enterprise, what is wrong with higher and higher profits, if nothing adverse happens?

That's the crux of the entire matter. Nothing *is* wrong with increasing these positive factors if nothing *negative* occurs. That's why they cannot be viewed as separate and isolated movements. When their

EXHIBIT 14-2. EFFECTS OF HOLDING ONTO RATIOS SHOWING FAVORABLE MOVEMENTS: COMPARISON BETWEEN ELEMENTARY AND TERTIARY RATIO



movements are evaluated as part of an entire capital structure, their increases are proper up to a point. Beyond this, further increases in these positive factors can cause negations serious enough to weaken the structure—and possibly a weakening that cannot be justified by the level of profits earned.

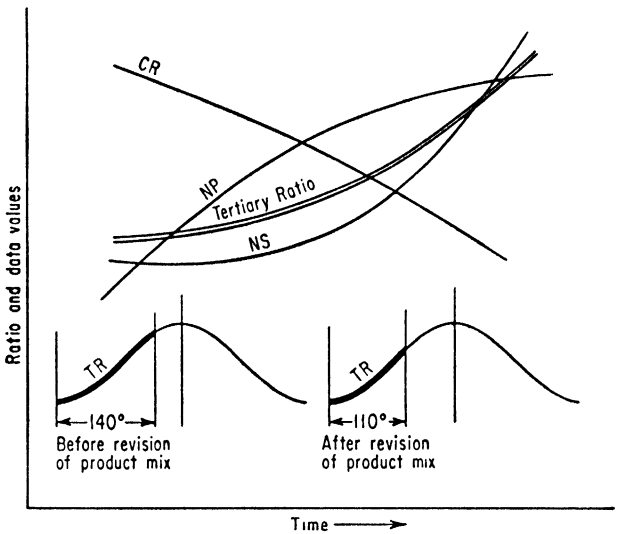
The company shown in Exhibit 14-2 was overtrading; i.e., its sales were too great for its net worth; and as seen in the NS/NW curve, this condition was worsening. As a result, the particular tertiary ratio describing this major segment of the capital structure decreased slowly, and then picked up speed as the capital foundation crumbled at a rapid rate. However, because of the difference in the industry between the company shown in Exhibits 14-1 and 14-2, the same tertiary ratio was not used. More will be said later on this point.

Management by the Current Ratio Misleading

Some companies unknowingly manage their capital structure on the basis of the current ratio. This is a valid ratio, but it is not an all-inclusive managerial evaluator. As a matter of fact, very successful operation can still occur when this ratio drops. Therefore this condition should be reflected in tertiary ratios.

For example, in Exhibit 14-3 we have a company which had an adequate current ratio to start with, but surely had overconservative financial management. There were no sales drives; the fixed assets were not

EXHIBIT 14-3. PROFITS AND GROWTH LIMITED BY HIGH CURRENT RATIO; TENDENCY REVEALED BY TERTIARY RATIO



really vigorous. The company never tried to prod its salesmen or stimulate its factory workers; it never even had any figures on the saturation and potential of the markets and territories it served. It went along from year to year on a modest return to its stockholders; paid its bills promptly; was a pillar of the community; and worshiped the current ratio.

After the death of the general manager and major stockholders, a professional manager was recruited from the outside. The curves show the period of the one year for which he was engaged. He launched a sales drive based on expanded *worker* capacity in the shop which he got from wage incentives and directed, stimulated, and rewarded the sales staff to sell the now even greater capacity. He watched the cur-

rent ratio very carefully; since he not only knew its meaning, he also was aware of how sacred it was to the beneficiaries of the deceased.

With the smallest rise in sales, the profits soared but the CR dropped. However, the CR never got below 2:1, which was adequate for that particular industry. The ratio CL/NW remained satisfactory, and this tested the impact of the CR drop (in this specific instance). This is the picturization of a point where the company produced enough justification for the drop in the CR. The FA did not increase one iota during this year, but the NS/FA soared as the fixed assets became more vigorous. Notice the rapid rise in the special tertiary ratio constructed for this company.

A projection of the future goals and operations of the company was then made, together with an extrapolation of the future tertiary ratio's value. This is valid long-range planning and indicated the upper limit of sales of the current product mix. This level was limited by the velocity of the dropping current ratio and the added risks of inventory and overtrading. That portion of the tertiary ratio shown was evaluated to be about 140 degrees of a sine wave. In other words, they were about 40 degrees away from a leveling off of the tertiary ratio.

Then another projection was made. This dealt with how to get more profits out of the optimum sales maximum and/or how to lessen the weakening effect of increasing sales on the capital structure. The answer was found in the balance between *product mix and the amount of committed inventory to carry,* consistent with *product mix and the needs for fixed expense recovery in production.* When this was found, the previous optimum sales maximum provided more profits and the new sales optimum was pegged at a somewhat higher level, with still further increases in profits. But the program was not undertaken until the effects were pretested with tertiary ratios. In the improved product-mix case, the tertiary curve shown became about 110 degrees of the *same-size* sine wave, providing management with about 70 degrees more of economical tertiary ratio movement. The sine waves are shown at the bottom of the chart.

Ratios Are Relative, Not Absolute, Indicators

As we have said frequently throughout this book, no ratios of any type have absolute value. In the MC concept they are not supposed to have absoluteness; that would invalidate the concept immediately. When some fact or event is evaluated on the basis of one ratio, that is almost as narrow as evaluating it on the basis of the value of the event, such as cash in the bank, tractors shipped, customers booked, etc.

Evaluation on the basis of simple ratios is narrow, detached from the organism as a whole. Ratios in themselves, their value at a given

moment, have no value for decision making; only their movements have significance. The simple ratio value at any instant cannot say good or bad in a way that will permit managerial action or decision making. The value can only provide a clue. As the ratio moves in time, i.e., is plotted as a curve, we can get some idea of its characteristic, whether negative or positive. However, the value of the movement can be determined only by comparing the movement of that curve with the curves showing the movements of other important ratios. The greater the number of curves plotted, the greater the validity of assessing the relationship, of determining over-all patterns of good and bad.

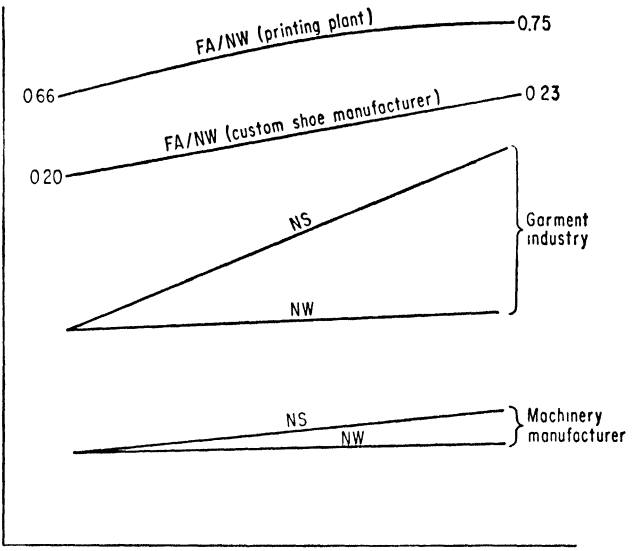
Obviously, a great number of curves of events can be plotted going in every direction. This would only serve to burden the evaluator who must decide on the state of affairs, the direction it appears to be taking, and the weight of the data. It is an almost impossible task, yet managements are periodically called upon to do this in the typical comparison of balance sheet data from one date to the next. The typical "last year with this year," "last three months of this year with the last three months of last year," "last month with this month" comparisons require superman efforts in extracting valid trends, if valid interrelationships are to be made. Obviously, this monumental effort is too impractical to put forth, and so the comparative tabulations are subjected to glances, grins, or grimaces, and the buttons on the president's desk get pressed and people complimented or blamed. These responsible persons cannot do anything but tell what happened after it happened; not one of them had generated a pattern of operating and the financial personality that could have changed the previous courses of action.

Ratios of Composite Characteristics

Instead of trying to integrate the meanings of the curve movements with all the others, it is possible to relate several of the more important ratios to a larger ratio representing a composite of all the characteristics. This larger ratio is the tertiary ratio. It is easy to construct and calculate in the form it is presented in this book, *but* it must be designed to support the *needs* and major *characteristics* of the company. Thus the ratio of FA/NW would not be included in a tertiary ratio for a company doing hand assembly of a wide number of items. Obviously, the relationship of inventory, working capital, net worth, and current liabilities would have to be given preference, because these factors would truly affect the over-all economy and stability of the company to a greater degree than would the change in fixed assets, which might only consist of factory benches and small hand tools. Keep in mind that the tertiary ratio is assessing the positive or negative *changes* in the structure, not the absolute economic value of assets.

The same change does not necessarily have the same importance in two different plants; in plants that employ a high degree of fixed assets, the change has less importance. For example, Exhibit 14-4 shows curves which, at the top, show the same change in the fixed assets to net worth for both a printing plant and a custom-shoe manufacturer. The change in the FA/NW of the latter has a much more serious effect on the capital structure because of the higher inventory and the required higher CA/TCE. The printing plant does not pile up inventory to anywhere near the same extent, and it normally has a low CA/TCE because of the higher value of its capital equipment. Therefore, while the

EXHIBIT 14-4. DIFFERING RATIO MOVEMENTS IN VARIOUS INDUSTRIES



percentage change in the FA/NW is felt slightly by the printing plant, the same percentage change can seriously unbalance the shoe plant's structure because of the changes it causes in the CL, the CR, and the economy, possibly because of high interest charges.

The bottom of Exhibit 14-4 shows the relationship between sales and net worth. The large and rapidly expanding relationship between the sales and net worth is a characteristic of some businesses, such as the garment or apparel industry. And unless it threatens the structure of the company by "overovertrading," it is considered normal. On the other hand, a much smaller rise of sales within the relatively same limits of the net worth could be disastrous to, say, a manufacturer of multipart machinery, because of a possibly high residual inventory that must be kept on hand to meet the needs of the production effort.

Construction of Tertiary Ratios

Exhibit 14-5 shows a tabulation of various types of tertiary ratio (TR) constructed from the elementary ratios listed in Chapter 12, together with some simple ratios which are obvious and need no special description. Some of these are developed for specific situations, to keep a watchful check on certain conditions; some can be used universally. In general, the ratios deal with the evaluation and control of the state of the capital structure or of financial management; in more specific cases, they report on the structure of the capital together with the results of operating—more like an upper-management tool.

The specific situations for which some of these ratios are developed deal with just when and for what reason the tertiary control is established. If the tertiary controls are installed in a normally healthy and functioning company, then the TR should be of the generalized type, but one which reflects some of the major facets of the company's financial and operating personality. In this sense, then, companies select ratios by equating their critical capital characteristics with an important term in the equation.

In other situations, the TR controls could be installed at the development of a very serious condition in the company's life, which could have been prevented had the TR been installed earlier. In this case the TR's are selected which specifically report on the most serious capital-affecting factors. Often, several TR's are used simultaneously to report on major areas, together with a more general type which assesses growth and operating performance.

The following is a brief description of some of the ratios shown in Exhibit 14-5, after which the data of five manufacturing firms are shown with TR's superimposed on elementary ratios.

TERTIARY RATIO FA. This ratio reports on profitability consistent with liquidity and the use of the company's total resources. It is used to show how the effect of the productivity of the total resources on the profits is modified by the magnitude of the circulating capital in the total capital employed. In some situations it shows what effect an increase in inventory will have on the structure without an acceptable increase in sales. In other situations, it is used to show the direction that the vigor of the fixed assets is taking.

TERTIARY RATIO FB. This tertiary control shows the effect of inventory turnover on the working capital position by considering the effect of rising liabilities.

TERTIARY RATIO FC. This ratio is similar to Tertiary Ratio FA but has greater emphasis on the use of the company's total resources. This control is suitable for companies in industries which normally have a high

EXHIBIT 14-5. TERTIARY FINANCIAL AND CAPITAL RATIOS

Ratio no.	Formula
FA*	$\left(\frac{NP}{NS} + \frac{NP}{NW} + \frac{CA}{TCE}\right) \times \frac{NS}{TCE}$
FB*	$\frac{NS}{INV} \times \frac{WC}{TCE}$
FC*	$\left(\frac{NP}{NS} + \frac{NP}{NW}\right) \frac{CA}{TCE} \times \frac{NS}{TCE}$
FD	$\frac{NP}{TCE} \times CR$
FE*	$\frac{NP}{TCE} \times CR \times \frac{NW}{TL}$
FF*	$\frac{CA}{TCE} \times \frac{NS}{TL}$
FG*	$\frac{NP}{TCE} \times \frac{NS}{CL}$
FH	$\frac{CA}{TCE} \times \frac{NS}{CL}$
FI*	$\frac{NP}{TCE} \times \frac{NS}{TL}$
FJ*	$\frac{NP}{NW} \times \frac{NS}{CL}$
FK	$\frac{NP}{TCE} \times \frac{NS}{CA}$
FL*	$\frac{NS}{TCE} \times \frac{CA}{INV} \times \frac{WC}{NW} \times \left(\frac{NP}{NS} + \frac{NP}{NS}\right)$
FM*	$\frac{NP}{NW}\left(\frac{NW}{NW + NS}\right)_a$ or $\frac{NP}{NS}\left(\frac{NS}{NW + NS}\right)_b$
FN*	Ratio FMa × CR
FO	$\frac{NP}{NW} \times \frac{TL}{NS}$ or $\frac{NP}{NS} \times \frac{TL}{NW}$
FP*	$\frac{NW}{TL} + \frac{CA}{TCE} + \frac{TCE}{FA} + \frac{TL}{CL} + \frac{NW}{TCE} + \frac{CA}{INV} + \frac{WC}{TCE}$
FQ	$\frac{INV}{CA} \times \frac{CL}{NW}$
FR*	$\frac{NW}{FA + WC}$

EXHIBIT 14-5. (*Continued*)

Ratio no.	Formula
FS*	$\dfrac{CA/CL + CL/NW + NS/INV}{FA/NW + FL/WC + TL/NW + INV/WC}$
FT	$\dfrac{CA/CL + CL/NW}{FA/NW + FL/WC + TL/NW + INV/WC}$
FU	$\dfrac{CA/CL \times NP/TL \times NS/INV}{CA/NW(FA/NW + FL/WC)}$
FV*	$\dfrac{CA/CL \times NP/TL}{CL/NW(FA/NW + FL/WC)}$
FW*	Ratio FV $\times \dfrac{NS}{INV}$
FX	$\dfrac{\left[\left(\dfrac{CA}{TCE} + \dfrac{NW}{TL}\right)\dfrac{NP}{NW}\right]\dfrac{NW}{TCE} + \left[\left(\dfrac{NS}{NW} + \dfrac{NS}{AR + INV}\right)\dfrac{NP}{NS}\right]\dfrac{TL}{TCE}}{CL/CA + TL/TCE + CL/NS}$
FY*	$\dfrac{CA/TCE + CA/CL}{FA/TCE + TCE/NW}$
FZ*	Ratio FY $\times \dfrac{CA}{TL} \times \dfrac{NW}{FA + WC}$
FA'*	Ratio FY $\times \dfrac{CA}{TL} \times \dfrac{NP}{NS}$
FB'*	Ratio FY $\times \dfrac{CA}{TL} \times \dfrac{NP}{NW}$
FC'*	Ratio FZ $\times \dfrac{NP}{TCE}$
FD'*	Ratio FY $\times \dfrac{NW}{FA + WC}$

* Described in text.

level of fixed assets in their total asset picture. These are industries which sell machine time, such as machine shops, and those in the graphic arts.

TERTIARY RATIO FE. This reports on what Tertiary Ratio FD does but with the added factor of ownership. In other words, it shows whether or not the above ratio grew at the sacrifice of loss of ownership and a consequent increase in the creditors' stake in the business.

TERTIARY RATIO FF. This ratio is a simple tertiary control, but a valuable one. It shows the impact on the liabilities of sales increases.

TERTIARY RATIO FG. This is a widely used tertiary ratio. It shows how

the changes in sales levels affect both the current liabilities and the results from using the total resources.

TERTIARY RATIO FI. This control shows the effect on the TL caused by sales increases which are justified by the profit increases on the total resources. This ratio is quick to show misleading practices of technical accounting rules about the classifications of the current liabilities (see Chapter 13).

TERTIARY RATIO FJ. This tertiary ratio shows the effect of the degree of liquidity of the CA. As inventory and accounts receivable rise for the same sales level, the ratio will decrease. The poor mixture of the CA may be justified by a sufficient rise in profits.

TERTIARY RATIO FL. This ratio shows the effect of the inventory turnover on the working capital, consistent with the use of resources and their productivity. It is actually a balancing of inventory, working capital, and the productivity of resources. Another way that this tertiary control can be regarded is as showing the trend of effect that the productivity of the total resources, the mixture of the current assets, and the relationship between the working capital and the net worth have on the operating performance; that is, how the profits are modified by the aforementioned factors as a result of financial management.

TERTIARY RATIO FM. This is not a tertiary ratio in a strict sense. It presents a weighted profit performance between that made on sales and on invested capital. It acts to take the joy out of a surge in the profit percentage of either. Very often, this ratio is used as a term in other tertiary ratios and is valuable in making full integration of data (see Chapter 15).

TERTIARY RATIO FN. This ratio makes use of the above ratio and shows the effect of sales-investment profits on the current position. If the NW rises with the same profit, Tertiary Ratio FMa decreases; but when NW rises, TL decreases, and if CL maintains the same proportion in the TL, the CR will rise enough to show a rise in the entire expression. A drop could be an indication of a weakening current position, even at the same level of profits; of maybe increases in sales are not being justified by an improvement in capital structure.

TERTIARY RATIO FP. Used in a very elementary way, and in certain types of manufacturing, this ratio can show the trend of the quality of financial management.

TERTIARY RATIO FR. This is not as much a tertiary ratio as it is a special form of elementary ratio. It is used as a term in other tertiary ratios and is helpful in evaluating the trend of the NW as to its sufficiency to cover the fixed assets and the working capital.

TERTIARY RATIO FS. This ratio evaluates the effectiveness of financial management in industries which do not have high inventory turnovers,

i.e., foundries, lumber mills, machinery builders, etc. The ratio would give distorted values if used in, say, meat-packing plants, where NS/INV might climb above 20. Obviously, it would make that ratio dominate the entire expression and cause an incorrect evaluation of the financial management. Tertiary Ratio FT is the same tertiary ratio as above, but without the inventory turnover in its numerator. It is useful in most businesses as an evaluator of the consistency of financial management.

TERTIARY RATIO FV. This is another financial type of tertiary ratio, but with the emphasis on the current liabilities. This one was used at a large manufacturer of steam-generating equipment after a reorganization was brought about because of the large stake of short-term creditors, who forced the bankruptcy. After a year or so, the company switched to the FS and FT type of tertiary ratio, in addition to the other ones they had been using. In this type of ratio it is possible to find it decreasing, indicating negative movement, while others of the tertiary type are rising. This is an almost certain out-of-proportion excess-liability condition of the type dangerous to the safety of the company.

TERTIARY RATIO FW. This tertiary ratio is like FV, but modified by the inventory turnover ratio. It is of importance in checking on the liabilities position in those industries tending to overtrade. It is considered an integration of the financial structure with the company's capacity and the utilization of its capacity.

TERTIARY RATIO FY. This is a tertiary ratio that reports on the *state* of the capital structure without any influence of the operating function. It integrates the state of liquidity with the balancing of the assets and the degree of ownership. It is especially sensitive to deterioration of the structure caused by an unjustified increase in the fixed assets.

TERTIARY RATIO FZ. Sales and operating are likewise not involved in this tertiary control. This ratio reacts somewhat like the preceding one but is especially attuned to the gyrations (particularly as relates to non-current liabilities increases) of the financing of the fixed assets and the working capital. It reports on the *management* of the capital structure.

TERTIARY RATIO FA′. This ratio has the basic quality of the FY series and shows the effect of profit drives on the liability position. It is helpful in determining whether the drives for profit increase the liabilities to the danger point. Conversely, where liabilities have previously been committed to a high degree, the drop in profits with the same liability level will cause a negative reaction in this control. In a sense, this control shows the *productivity* of the capital structure; that is, the extent that operating and financial management worked together or at cross-purposes. Mostly it reports on the effect of operating on the state of the capital health.

TERTIARY RATIO FB′. This ratio is like the preceding, but shows a trend toward satisfying the stockholders of the business. Where the manager has a greater desire to placate the stockholders than he does for earning profits on sales, he might unduly expand the borrowed capital, so that a given profit will show a greater return on the invested capital. In so doing, higher interest charges may be incurred which will reduce profits, but possibly not enough to impair the appearance of that profit against invested capital. If the return on the total resources (NP/TCE), however, is equal to or lower than the interest rate paid for borrowed capital, then the impact on the capital structure and on the return on invested capital will be very pronounced.

In other words, this ratio would show the tendency to emphasize the practice of boosting the return on investment at the sacrifice of the economy and capital stability of the company.

TERTIARY RATIO FC′. This ratio is like FZ, except that it introduces to the management of the capital structure the integration of the need to make a profit. In other words, if FZ decreased, indicating a weakening of the management of the capital structure, there might be a rationale for it if the earnings on the total resources rise sufficiently.

This control, like all the other tertiary ratios, is not a linear one. A given percentage increase in one will not cancel out the effect of the other. Any change in one is bound to be greatly magnified in the other, and so a large improvement in the NP/TCE justifies a rather small deterioration in the rest of the ratio FZ.

TERTIARY RATIO FD′. This tertiary ratio reports on the state of the structure as in FY, but slanted toward the ability of the net worth to cover the fixed assets and the working capital. It dramatically calls attention to an unbalancing of the above factors in companies that overtrade and that plan to expand their fixed capital.

Empirical Nature of Ratios

There are almost an infinite number of tertiary ratios that can be constructed, each designed to serve a specific function. Many will suggest themselves to readers. However, this must be firmly borne in mind: these ratios have no absolute value, but if defined properly, they can pinpoint certain positive or negative qualities; their movements are not necessarily linear, so that the degree of negativeness or of positiveness cannot be measured finely. Should a company gradually change its basic personality, product, and way of doing business, a tertiary ratio once selected as being functional for it may gradually become less useful. Ratios, like the creeping change, must be tested periodically. Generally, however, a well-defined and designed tertiary ratio will remain valid for many years.

Industry Effects on Ratios

Different industries are generally identified with very definite characteristics, and these must be reflected in the tertiary ratio selected, otherwise the movements could be misleading. In paper mills, breweries, industrial chemical plants, etc., the fixed assets to net worth is one of the elementary ratios to which the capital structure is sensitive. Therefore one would choose tertiary ratios which had a firm effect on the value of this ratio. This is manifest in Tertiary Ratio FP, which shows this factor, especially as it affects the division between the borrowed and owned capital and working capital. The FA effect is also shown in Tertiary Ratio FR, mostly as to how it affects the adequacy of the net worth without regard to the total capital structure. It is also shown in Tertiary Ratio FS, but in a much less dramatic way. This ratio would not be one to use to report on the tendency of the fixed assets to rise. The reason lies in the usual magnitudes of the various terms. The FA/NW ranges between 0.1 and 1.0 throughout general industry. (Of course, in some special cases it can go as high as 2.5.) On the other hand, NS/INV can go to 20 in meat-packing plants, much higher in breweries, and around 40 in candy plants. This relegates the FA/NW to a very minor position in the ratio. In Tertiary Ratio FT, with the removal of the NS/INV term, the ratio is still more sensitive to the CR than it is to the FA/NW.

Application of the Tertiary Ratios in Five Companies

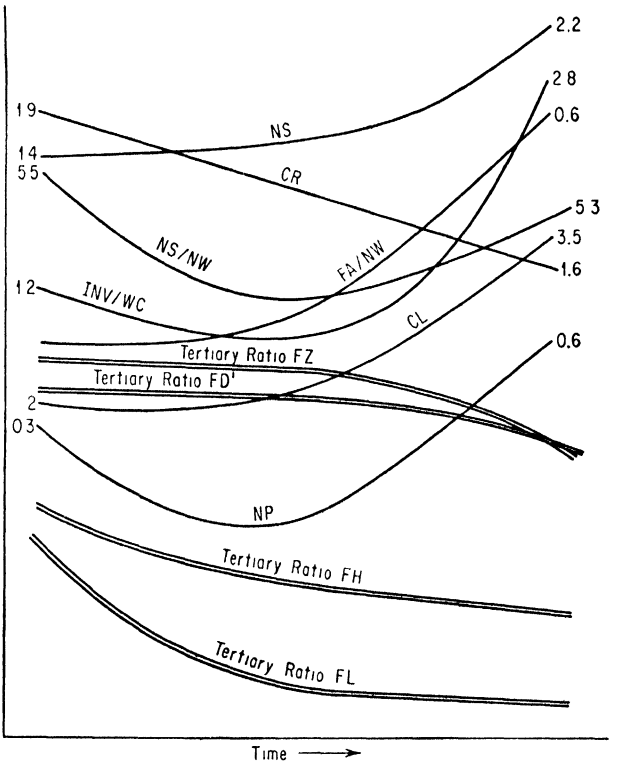
As an example of the actual relationships between the elementary ratios and the tertiary controls, the data of five companies are presented in graphic form. These are actual data taken from the records of clients for whom the controls were established. The data are taken over a period of time varying from six months to two years.

Company A's data were taken from monthly trial balances and represent a "testing back" of the data. In other words, the tertiary controls were not installed until the end of the period shown, but were calculated for the entire period to observe what their movement would have been had they been in effect for the entire period. In four of the five cases the management was wary of this kind of "ratioing." In the third company, company C, there was no experimenting; the tertiary ratios as shown were installed at the start of the period and used as a basis for financial management. This company, by the way, is the one referred to earlier in this chapter in the discussion of Exhibit 14-3.

Company A: (*Exhibit 14-6*). This is a plant making men's work and sports clothing—dungarees, overalls, etc. Its principals were very sales-minded and paid little attention to the need for balancing their capital

structure. Their net sales rose steadily as all efforts were devoted in that area of activity. They began to overtrade (not that they knew what the term meant), and the NS/NW went up to about 8. In the meantime, their CL rose sharply and their current ratio, which was unsatisfactory at the start of the measured period, fell to dangerously low limits, from 1.9 to 1.6. In anticipation of additional sales, more fixed assets were

EXHIBIT 14-6. MAJOR MOVEMENTS IN DATA AND RATIOS OF COMPANY A



acquired, at a poisonously high rate, the FA/NW going from 0.1 to 0.6. It was the depreciation charges on this equipment and the interest for the use of money which caused such a drop in the net profits shortly after the time the fixed assets were acquired.

Managements like these don't know when their capital structure is deteriorating, and they also don't know how to calculate the amount of deterioration to tolerate in exchange for added profits or gains elsewhere in the company. If they had had almost any one of the tertiary ratios mentioned earlier (and believed the trends they showed), they might have reexamined their course of business action.

Four tertiary ratios were "applied back" to the data to see what they would have shown had they been in effect. In Exhibit 14-6 the elementary ratios of company A are shown, together with the four tertiary ratios.

Tertiary Ratio FZ was applied to test the strength of the capital structure, and as shown, it reveals gradual deterioration. (Again it must be pointed out that just because all the ratios listed start out at their highest point at the beginning of the period does not necessarily mean that matters were satisfactory at the start of the period; it just means that affairs were better at the beginning of the period than they were later. *The ratios show relative movement.*) Notice how this ratio speeds its decline after the acquisition of the fixed assets and the bank loans. The same is true of Tertiary Ratio FD′, but at a somewhat slower rate.

The tertiary controls which integrate the effect of profits and sales are FH and FL. Notice that the largest drop occurs early in the period in both these controls. This is due to the added impact of the reduced profits on the capital structure. As the fixed assets are added, two things affect the ratios. First, the firm is overtrading and should reduce its sales or otherwise increase the invested capital; a usual alternative is to sell off some of its facilities.

This firm did the opposite and added equipment.

The entire state was affected by the paradox that even though it *must not add sales* because of the lack of net worth, *it should add sales* in order to utilize the additional equipment. For these types of companies, or rather for these types of managements, Tertiary Ratio FL is vital. After that one is accepted, the subtleties of others can be used, which are reactive more to the firmness of the structure on which the financial health is based.

Company B (*Exhibit 14-7*). Company B is a company manufacturing synthetic plastics and resin materials. It has been in business for many years, previously making more of the industrial chemical group. For the last eight years, it has been devoted principally to serving the plastics industries.

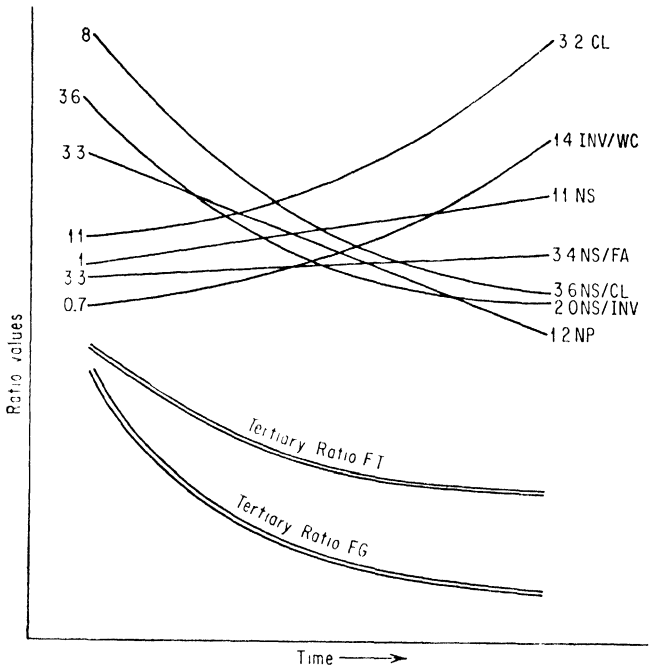
As shown in Exhibit 14-7, there were no spectacular sales drives, the sales rising ever so slowly. However, since plastics was a relatively new industry, the customers' needs and tastes were not too clearly defined. This gave rise to feelings of insecurity on the part of management, and it began to stockpile inventory in anticipation. As a result, the inventory climbed steeply with only a slight increase in sales.

The reader will remember the case of the man who held on tenaciously to his fixed inventory turnover ratio, with the result that the inventory became too heavy for his working capital and net worth. At least, in that case, the manager had a rationale for his action because

of a rise in sales equal to the rise in his inventory. At company B, not even this positive factor exists. Management is steadily increasing its inventory without any positive cause, and as fast as it is doing so, the capital structure is going downhill.

For about a 10 per cent rise in sales, the inventory more than doubled; the inventory climbed to a level about 50 per cent more than its working capital. Naturally, as was to be expected, the current liabilities jumped and net worth did not improve. And the major clue was NS/CL, which

EXHIBIT 14-7. MAJOR MOVEMENTS IN DATA AND RATIOS OF COMPANY B



nose-dived steeply. The results of this improperly planned management of the capital affairs are shown in the Tertiary Ratios FT and FG. The first integrates the sales activities of the company; FG is more heavily weighted to show the effects of the dropping profits. In these cases, a more dramatic ratio is preferred, like Tertiary Ratio FW, which includes the real impact of the increase in inventory for the same approximate sales level. At the end of the period, the CR was acceptable, and as shown by Tertiary Ratio FT, the deterioration was continuing, but at a slower rate.

Management used the CR as a guide, and some consideration was given to the working capital and the net worth. Management resignedly

explained that it knew it was expanding its inventory, so it had to expect a drop in the CR. But, it was rationalized, since working capital and net worth were substantially unchanged, there was nothing to worry about. This fallacious thinking led the company out of the protectiveness of a sound capital structure (before stockpiling) into one which, while still solvent, would creepingly place it in serious trouble. It also brought about a rapidly dropping profit with a slowly increasing sales level.

Had control not been exercised, the creeping change would have brought ruin. If nothing had been done about the condition of the company starting at the end of the period shown, the curve of Tertiary Ratio FT would have dropped at a slow decremental rate, hardly visible, and before the company knew what was happening, it would have been in difficulties. Of course, the major damage was done at the start of the curve, and considerable effort was necessary to get up near the top of the curve where the original period started. Fortunately, being in the process industry, the company's equipment was fixed and had been for years. The fixed equipment did not change from year to year, and the value of the fixed assets was decreasing because of depreciation. To become healthy and solvent the company did not have to sell off equipment (as some that overtrade must eventually do, in the absence of additional investment capital). All company B had to do was to dispose of inventory and liquidate some of its obligations. Recommended also, to bring in the aspect of the trend toward profits, was the use of Tertiary Ratio FG.

The company had a financial structure to support its old production effort (nonplastics), which was not redesigned to fit the new aims. One could not fit one into the other without causing ruptures in the capital inner tube. To meet the needs of their new-product interest, the financial structure was recast into one which would remain strong, even with a characteristically higher inventory required.

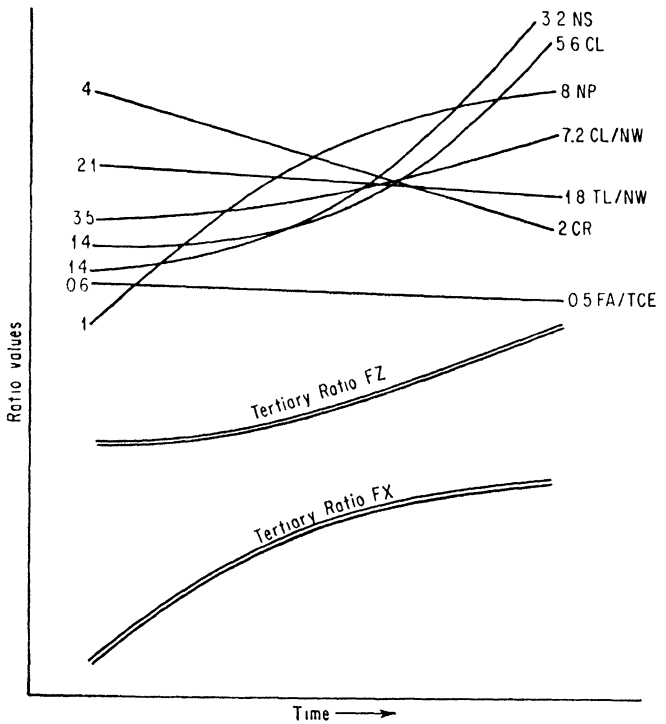
Since the creeping change occurs within people as well as things, the tertiary controls remained the watchdogs of the capital structure. And when some new "styrene" was setting the plastic world agog—not difficult to do—the management tested the effect of stockpiling some of that new inventory first. If the test of boosting its inventory placed the company in jeopardy, it resisted the move and first studied the market, the cost of selling the market, and the likelihood of obtaining a fair share. Only when the factors of capital strain versus cost of acquiring additional sales versus the profits were interrelated, was action taken.

The company now operates with an inventory about 40 per cent higher than when it was making the industrial chemicals, its CR is what it was at the start of the original period, its sales are increasing steadily, and profits are providing a reasonable return on the sales effort

and on the invested capital. This was brought about by a redesign of the capital structure, and the tertiary controls pointed the way to the needed improvements in sales, marketing, and inventory requirements.

Company C (*Exhibit 14-8*). This firm was an old established company making machined parts from castings and forgings. The firm had been owned by one family and had remained in the ownership and management of the family for many generations. The data and the

EXHIBIT 14-8. MAJOR MOVEMENTS IN DATA AND RATIOS OF COMPANY C



curves shown in Exhibit 14-8 are for a period *following* the installation of the tertiary controls. These were established to assist the professional general manager, who was retained to continue the business after the death of the major stockholder and top management official. This is the company briefly characterized on page 339 and shown in Exhibit 14-3.

In essence, the company operated conservatively, using the CR as a complete guide to the state of the financial health, thereby depriving itself of profitable markets easily obtained. The professional manager saw this potential and went after it; the CR dropped; he expected that. But he watched it and saw that it was within healthy limits. In the

course of the CR drop, sales and profits rose spectacularly. Tertiary Ratio FZ confirmed that the company's health was steadily improving, the slope showing that the leveling off would come eventually, but was still far away. The increase in sales and profits handsomely increased the net worth, especially since there was a very small increase in the fixed assets; the ratio showed the increasing vigor and productivity of the relatively fixed assets. Tertiary Ratio FX showed the results of over-all operating and financial management, integrating the effects of profits on the capital structure.

At the end of the period, the stockholders were receiving more dividends than ever before; the sales were more than doubled; the profits eight times what they were at the start of the period. There was no doubt that the tertiary ratios were fairly and logically depicting the general trend of the company. At the end of the period further analyses were made of the product mix and its effect on increasing sales and profits. Their purpose was to determine a ceiling on these efforts which was compatible with the lowest minimum and practical damage to the capital position.

Several tertiary ratios tested the effects of these changes, and a long-range program was established. The ratios showed that with the present product mix the sales could increase to almost double that attained at the end of the period shown. That meant a four-times increase in sales over the level that obtained when the consultant first came in to take over the management of the company.

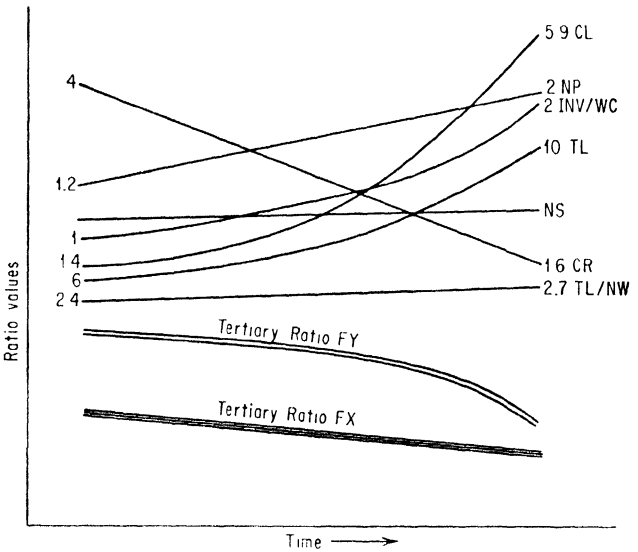
That four-times increase over the original sales level was with the same approximate product mix. And with that mix, the inventory would *begin* to place the company in a questionable liabilities position, so that it could be considered to be at the threshold of an overtrading position. However, that border line was advanced to a higher sales level, almost five times the *original* sales level, by the revision of the product mix, which reduced the inventory requirements quite sharply.

Of course, following the complete MC concept which was practiced in the company, the new product mix was selected consistent with the needs of expense recovery in the shop. Products which had a high material content, absorbed a small portion of the fixed, or stand-by, expenses, did not provide a satisfactory level of profits, and cost a lot to promote were dropped. Naturally, all products do not fit so conveniently into such a completely negative slot. Products represent a total integration of the effect of the negative and positive qualities.

Company D (*Exhibit 14-9*). This company makes electromechanical apparatus operating the the $20 million sales level. It was looking for more profits from its operation and also for more sales. Previous to this period the company had attempted a large sales drive in order to

get more usage out of its fixed assets (which had a value of $2 for every dollar the owners had invested in the company) and found itself at the point of bankruptcy because of the rising inventory. The company thought it would not revise its product mix, in order to have the volume favor more profits. While it did get increases in profits, the new mix involved products of higher material content and the inventory had to expand, like it or not. This boosted the CL by about five times and showed an unfavorably high INV/WC, which was continuing to rise, even though profits were also rising.

EXHIBIT 14-9. MAJOR MOVEMENTS IN DATA AND RATIOS OF COMPANY D



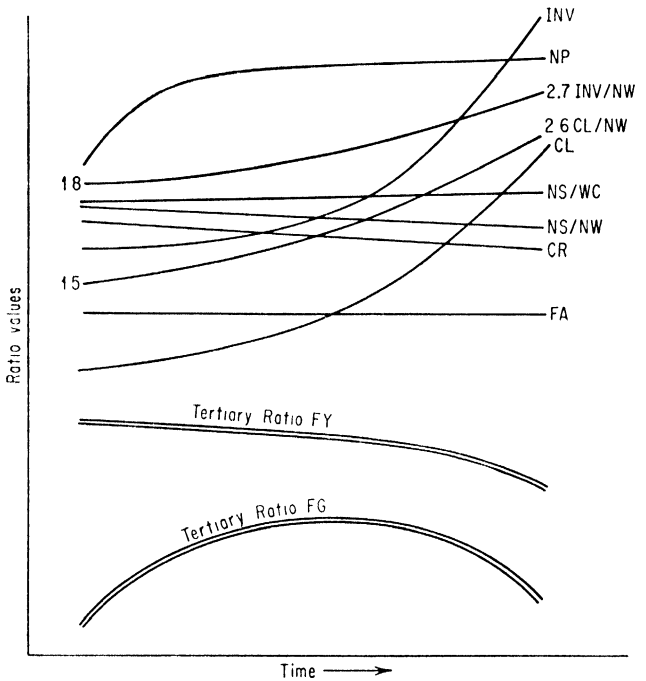
Tertiary Ratio FY shows the deterioration in the capital structure. As the CR rose toward the end of the period, the ratio dropped faster. Tertiary Ratio FX, which integrates the effect of profits, made a slower descent. This shows that the deterioration in structure is more important than profits, and had the profits not been made, this control would have plunged even more rapidly than Tertiary Ratio FY.

Since the company has a high fixed asset level in comparison with its net worth, an increase in sales is important to turn over a reasonable level of inventory to provide working capital. From the way the financial state was designed, the company got into immediate trouble as it approached 60 per cent of its capacity. It needed more sales in comparison with the level of the fixed assets it had, but more sales per se put the company in trouble once before because the added sales

boosted inventory. It was decided not to push sales but instead to revise the product mix. This thinking is commendable, but unfortunately it didn't go far enough. Even without the sales boosts, the revised mix boosted the inventory, and at the low turnover because of the low sales level, the working capital position was threatened.

The answer for this company was a combination of additional investment capital and a sell-off of some of its facilities. This was based on a study of the market, facilities costs, product profits, and the type of

EXHIBIT 14-10. MAJOR MOVEMENTS IN DATA AND RATIOS OF COMPANY E



redesigned capital structure. The added investment plus the receipts from the idle equipment was used to provide additional working capital for the inventory needed for the revised product mix and higher sales. The result was an operating capacity near 80 per cent, a sales increase of 50 per cent, profits commensurate with the sales increases, *and* all at about the same level of inventory of the end of the last period.

Company E (*Exhibit 14-10*). This company is a small manufacturer (assembler) of novelty electronic devices. It was growing too fast for its net worth and working capital because it was overtrading. It invested heavily in the items of inventory which it was thought would move fast. Sales just crawled along, but the company figured that if it

guessed correctly what the buyers would get excited about, then its stock of inventory would flow quickly into profitable sales.

A short time after this move, the profits did increase—and so handsomely that they were enough to compensate for the weakening of the capital structure. This was shown in Tertiary Ratio FG, which rose slower than the rise change in profits. But as profits tapered off, the continued weakening of the capital affairs slowly drove FG downward. This is manifest in the rapid rise of the inventory later in the period, after the full effect of the new sales policy was being felt.

So, whereas Tertiary Ratio FG shows the balance between the large profit increases and the not too serious (at that time) deterioration to the capital structure, the value had to rise. At the end of the period, it was dropping rapidly, which showed that it would take an astronomical profit to possibly justify the toppling capital foundation. On the other hand, Tertiary Ratio FY, which reports on the deterioration of the capital structure, irrespective of profits, showed quite a steady and rapid decline. Looking at this ratio, the intelligent businessman would not allow himself to be deceived or blinded by the high profits.

PROBLEMS

1. Distinguish between capital structure and financial management.
2. Explain why tertiary ratios are needed to guide management. Show by examples, using specific elementary financial ratios.
3. Pick one of the traditional ratios (except the current ratio or inventory turnover) and show how negative effects can be produced by holding it to a fixed value.
4. Develop a tertiary ratio for the example given in Problem 3.
5. Develop data for two similar companies in the same industry, both having the same inventory turnover, and show how one makes profits and is healthy, the other is in poor shape.
6. Develop appropriate tertiary ratios for conditions in Problem 5.
7. Develop data for two similar companies in the same industry, both having the same CR, and show how one makes profits and is healthy, the other is in poor shape.
8. Develop appropriate tertiary ratios for conditions in Problem 7.
9. Develop data for two similar companies in same industry, both having the same FA/NW, and show how one makes profits and is healthy, the other is in poor shape.
10. Develop appropriate tertiary ratios for conditions in Problem 9.
11. Explain the uses of the following advanced sales ratios and the activities affecting their value and discuss under what circumstances (negative or positive) they may rise or fall:
    a. Tertiary Ratio FD
    b. Tertiary Ratio FH
    c. Tertiary Ratio FK
    d. Tertiary Ratio FO
    e. Tertiary Ratio FQ
    f. Tertiary Ratio FT
    g. Tertiary Ratio FU
    h. Tertiary Ratio FX

12. Of the tertiary ratios shown in Exhibit 14-5, select those most appropriate for the following industries and explain your answer:
    a. Meat packer
    b. Commercial bakery
    c. Frozen-food manufacturer
    d. Chocolate-candy manufacturer
    e. Leather tannery
    f. Paint-brush factory
    g. Heavy-machine shop
    h. Lumber millwork company

CHAPTER 15 *Integration of the Activities of Production, Sales, and Capital*

Because of the complexities and competitiveness of modern industry, it is vital that decisions made by management support and enhance the profit-making abilities of the company, consistent with its state of health. No one really knows the impact of decision making; some people try to equate it with the "size" of the decision, assessing it by how many dollars are immediately at stake. This is fallacious. The remarkable thing about decisions is that they are powerful levers for influencing the future: the trend, the growth, and ultimately the survival of the company, regardless of its immediate size.

Summary of MC Concept

We attempted to show also that decision making is not an autonomous procedure, that it must be part of a whole. Yet MC can be established for the production effort with good results, especially if there are no regular means of presenting management with a weighted and balanced evaluation of the economy of production. Similarly, MC can be set up effectively for the sales activity so that maximum economy is obtained from the men and the department. But as we saw, each of those two can go off its separate way and accidentally work at cross-purposes. To have both of these functions pull the economy in the same direction, we had to interrelate their efforts so that one implemented the other. In the financial and capital areas, it was also possible to set up a separate MC with rewarding results. For regardless of anything else, if the production and sales functions, even though working together, cannot be supported by the capital structure, the entire effort is academic. Therefore it is essential that we relate the financial and capital functions to the production and sales efforts. When this is done, we have total company integration, a procedure whereby the effect in any one area can be measured in the other two.

Decisions Totally Integrated

Generally, regardless of the particular term used to describe a department's activities, a decision made in sales promotion, purchasing, personnel, research and development, etc., can be assigned to one of the three functions for purposes of MC, namely, production, sales, and capital.

To visualize the effect of decisions in one area as affecting the other two, consider that a decision in production to buy a machine affects the financial position because of the *cost* and *method* of financing it, and this affects the company's capital structure. It also affects the sales area because of the burden on it to obtain sufficient activity to recover the new machine's fixed expenses.

Consider that a decision in the sales area to promote certain products affects the production economy unless the products to be pushed are aligned with production's needs for expense recovery. If they are not, the NS/FA might be reduced and/or the inventory under- or overburdened, depending on the product mix sold. The state of the company's vulnerability is changed.

Consider that a decision in the financial area to increase the borrowed portion of the total capital at favorable interest charges so that the return on the investors' capital can be boosted will reduce the current ratio and will cause pressure on the sales to move products of highest dollar value, which might be those of the highest material content. This in turn can negatively or positively affect the cost recovery needs of the production effort, depending on what facilities are involved for these selected products.

No matter where the decisions are made, or their ostensible immediate magnitude, their effect is felt in every molecule of the company's structure. The MC concept presented in this book will:

1. Give management an objective and weighted evaluation of any facet of its operation
2. Enable control over any facet of its operation
3. Give management an objective basis for measuring and pretesting its decisions

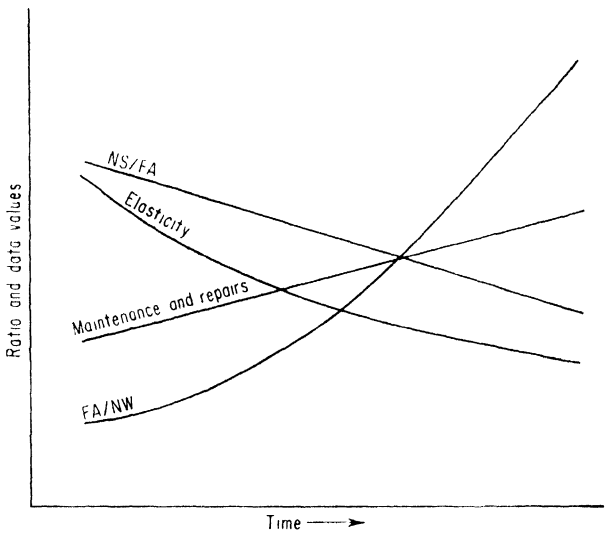
TYPICAL TOTAL INTEGRATION PATTERNS

The following are some of the interrelated, comparative movements of factors drawn from the three major segments of the company's life. These are presented to give the reader concept orientation as preparation for the total integration ratios later in this chapter.

Sales, Fixed Assets, Net Worth, Elasticity

Exhibit 15-1 shows a relationship between the sales, fixed assets, net worth, maintenance and repair, and elasticity. The curves show that as the magnitude of the fixed assets rises in comparison with net worth, the elasticity drops (break-even point rises). The elasticity figure, of course, is developed from operating data and shows the expenses incurred by the larger proportion of the fixed assets. Where such rises occur gradually, their cause lies in added depreciation of equipment,

EXHIBIT 15-1. THE "CREEPING CHANGE" IN ELASTICITY



insurance, taxes, and maintenance and repair. When the maintenance and repair curve is added and it rises as shown in the curve and the company has added no equipment, then the existence of these expenses is actually raising the company's break-even point; that is, for each dollar added of maintenance and repair, the company must overcome that with x dollars of additional sales in order to maintain the same dollar profit. However, if the sales on the fixed assets is sluggish and is dropping, as shown in the chart, the company has double troubles: the need for increasing sales to overcome the rising maintenance and repair costs, on the one hand, and the trend toward decreasing sales, on the other.

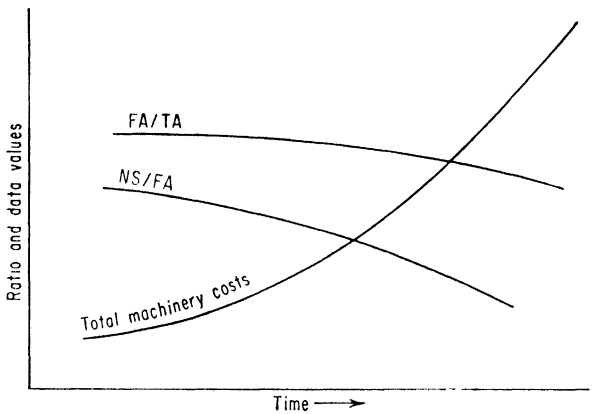
This type of trend is easily seen before it gets out of hand if it is plotted along these lines. Then the company can decide to dispose of

equipment on which so much maintenance cost is incurred and can sell off equipment which is underactive and which not only raises fixed assets beyond the level that sales can support, but also places the company in a rigid position with respect to expansion and credit, or a combination of both. To confirm the economy of the maintenance and repair costs, management need only consult Ratio G in Chapter 4, which evaluates this condition.

Total Assets, Sales, Machinery Costs

Exhibit 15-2 is a typical relationship between the total and fixed assets, the sales, and the total machinery costs. From the trend of the

EXHIBIT 15-2. DIAGNOSIS: EQUIPMENT LIMITING PRODUCTIVITY OF FIXED ASSETS



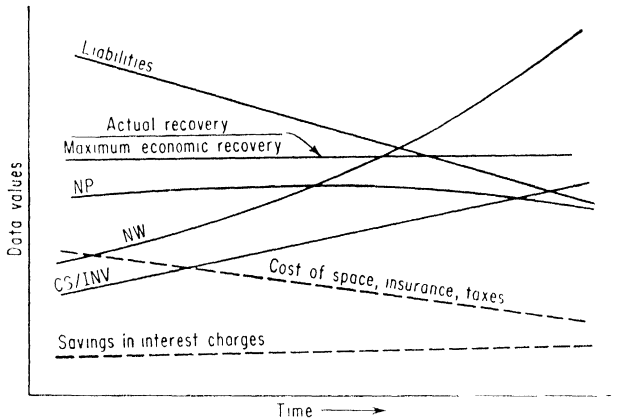
curves it is obvious that the productivity of the fixed assets is apparently limited by the condition of the equipment. And in addition, the selling prices are not recovering enough of the fixed charges. Notice the small reduction in the FA/TA curve. This is due purely to the normal depreciation of the fixed assets. If sales were higher, the receivables, and possibly the inventory, would be at higher levels, thereby causing the FA/TA curve to drop faster. And if profits were made on those sales, and if any part of these profits were left in the business, they would find their way into the circulating capital, which would further speed up the decrease of the FA/TA curve. The fact that this curve remains fairly flat can be an indication of equipment in poor condition and/or selling prices which do not fully recover the fixed expenses incurred in production and therefore do not attain the estimated profit margin.

Inventory, Net Worth, Space Costs, Interest Charges

The data of Exhibit 15-3 are typical in companies where raw materials, work-in-process, and finished goods are bulky and require lots of space. This applies to furniture, set-up paper boxes, clay sewer pipe, and the like.

Here we see the positive effect of an accelerated inventory turnover. As the inventory turns over more frequently (cost of sales/inventory, or the traditional NS/INV), less investment is required in the company to sustain its level. As the average on-hand inventory is reduced for the same level of sales, less space is required. This space, which costs

EXHIBIT 15-3. ACCELERATED INVENTORY TURNOVER VERSUS EXPENSE RECOVERY



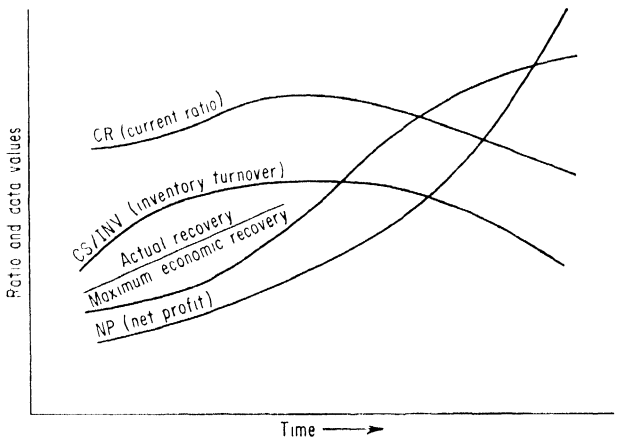
the company as much as any other square foot in the plant, includes the rental or depreciation, insurance, and the taxes, which apply to space occupancy. There is a small savings in interest-cost expense if the company had used borrowed capital previously to maintain an unnecessarily high inventory level and therefore a decrease in the liabilities. Under this circumstance, the net worth would rise.

While up to this point there are benefits to be derived from a faster inventory turnover, in terms of savings in the cost of space, interest costs, and in an improved current position, does the faster turnover aid materially in the operating economy of the plant? In this chart, the usage of the fixed assets hovers around 45 per cent, a rather low level. Is the very conservative financial position worth this amount of under-recovery? Exhibit 15-4 gives the answer.

First, the inventory level was maintained, but the sales accelerated. This, of course, increased the amount of expense recovery. Next the

product mix was analyzed to determine the best expense-recovering combination consistent with a balanced capital structure. Then the inventory was increased somewhat to support this and the sales level was reduced. This produced a sharp increase in the recovery, and even though the CR dropped, it was well within the safe limits for this firm. Note that the profits rose under this condition, whereas in the previous

EXHIBIT 15-4. OPTIMIZING INVENTORY TO SALES AND SAFETY



condition depicted in Exhibit 15-3, the profits were steady but mediocre.

Recovery, Product Mix, Capital Balance

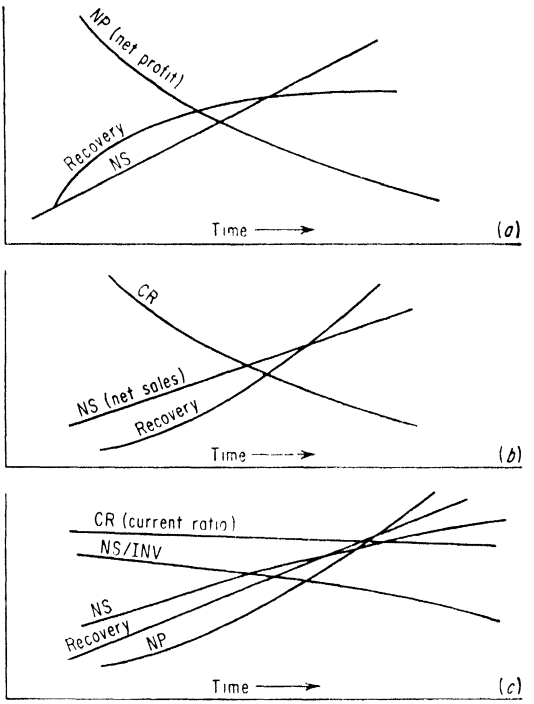
Exhibit 15-5 shows some of the basic relationships between the sales-production cause and the capital effect.

Section *a* shows an obviously unsatisfactory product mix. Sales increases steadily; recovery increases sharply at the beginning of the sales rise and then levels off, meaning that increases beyond the crossing of those two curves results principally in a sale of materials and the existence of large chunks of unrecovered fixed expenses.

Section *b* shows a steady sales increase with the best possible product mix for expense recovery, but the mix clearly unbalances the capital structure because of the large level of inventory (in this case) necessary to support this type of product mix.

Section *c* shows a typical optimum between the recovery and the inventory loading. Here recovery proceeds at a somewhat slower pace than it did in section *b* because of the inclusion of products which do not require as much inventory loading as those products which provided the maximum recovery.

EXHIBIT 15-5. BALANCING PRODUCT MIX TO RECOVERY AND FINANCIAL HEALTH

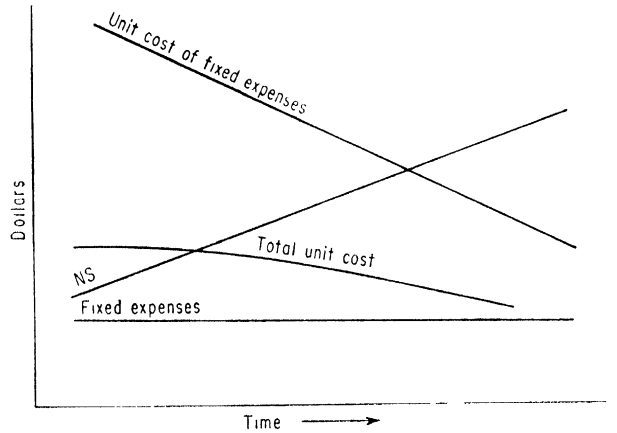


As a result, the CR does not fall as fast as it did in section *b*. Notice the NS/INV curve. In this case it is falling slowly, which shows a mix of generally lower selling prices. This is due to a more critical selection of the product mix, which involved less materials. This fact, however, has no negative effect on profits.

Unit Fixed Cost, Sales

Exhibit 15-6 shows the relationship between the sales and the fixed expenses. This is typical in all manufacturing. As sales increases within a fixed expense level, there is a large reduction in *unit fixed* costs and a small decrease in *total unit* costs. The angular separation between these two curves is a function of the variable-cost segment in the product. Obviously, as the total unit cost contains a higher percentage of a variable cost, the total-unit-cost curve will rise to the right. This relationship is important in setting goals for fixed expense recovery. In a new foundry, for example, the unit fixed cost line will be high, indicating a major target for expense recovery. Putting it another way, this high line indicates the absolute necessity for costing the products of

EXHIBIT 15-6. SALES GOALS FOR FIXED EXPENSE RECOVERY

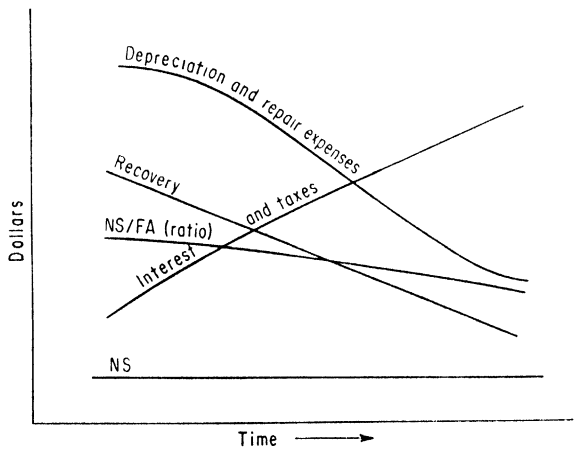


the foundry based on the cost of the use of facilities, allocating overhead in a way which will enable the consistent recovery of these fixed expenses. In a watch-making plant, there is no such urgency since the greater part of the total unit cost is skilled, high-priced labor.

Solvency, Interest and Taxes, Recovery, Depreciation and Repairs

Exhibit 15-7 shows the effect of modernizing in the plant by installing new equipment, without any increase in the sales level. A point to mention at this time is that these evaluations and examples of relationships are given as being typical of managerial decisions where the tax factor

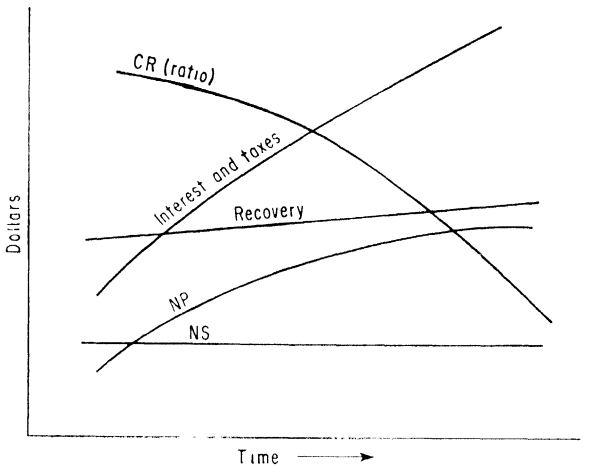
EXHIBIT 15-7. DIAGNOSIS: UNSUPPORTED MODERNIZATION



is not involved. While the motive for creating or finding tax loss areas is a common practice in industry, it is not considered in this book for fear of distorting the basic MC concept.

In Exhibit 15-7 we expect the obvious: a decrease in recovery, an increase in interest expenses, a decrease in the NS/FA, etc. However, it must be borne in mind that sometimes this type of move is a very successful one. For example, the same sales level could be maintained with a revision in the type of product mix. This could have been evaluated in advance to provide the motive for obtaining the new piece of equipment if the new mix added enough recovery to absorb the depreciation,

EXHIBIT 15-8. JUSTIFYING EXPANSION BY REVISING PRODUCT MIX



plus the other expenses of the new piece of equipment. In that eventuality, the expense charge of any major acquisition was the interest on the capital used to obtain the new machines plus the impact on the capital structure. This is shown in Exhibit 15-8.

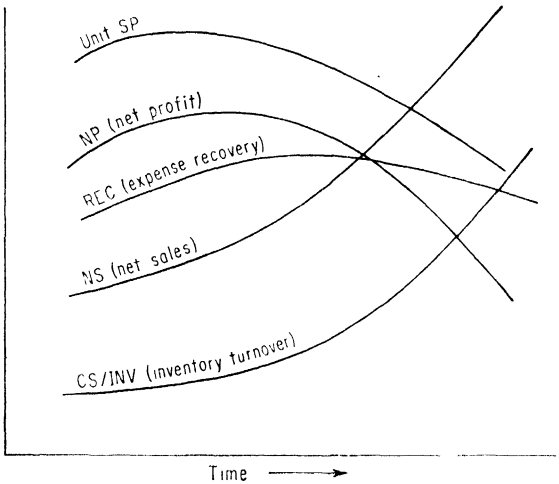
In Exhibit 15-8 the revision of the product mix levels off the recovery and produces an increase in profits. However, the CR drops, and perhaps it drops to an unsafe level. Actually, there is usually some sales increase when a new piece of equipment is added since the traditional managerial thinking revolves around sales increases rather than fixed expense recovery when new equipment is anticipated. Nevertheless, a projection of this type should be made to test the impact on the capital structure and on the production economy before any such major move is executed. Once the move is made, the sales effort curves should be added to ensure that the predesigned objectives are being implemented. Of course, for the pinpointing of sales effort tied directly to the economy

of the production centers, the specific sales control ratios mentioned in the sales section should be used.

Inventory Turnover, Profits, Recovery, Solvency

Exhibit 15-9 shows the effect of accelerating the inventory turnover for the sake of keeping that ratio as high as possible, via the medium of reducing unit prices. In spite of a rising sales level, both profits and recovery drop. Notice that at the beginning of the period in which the sales are rising and the prices held at the same level, the profits increase and so does the recovery. However, as the unit prices drop, more sales

EXHIBIT 15-9. NEGATIVE EFFECTS OF HIGHER INVENTORY TURNOVER

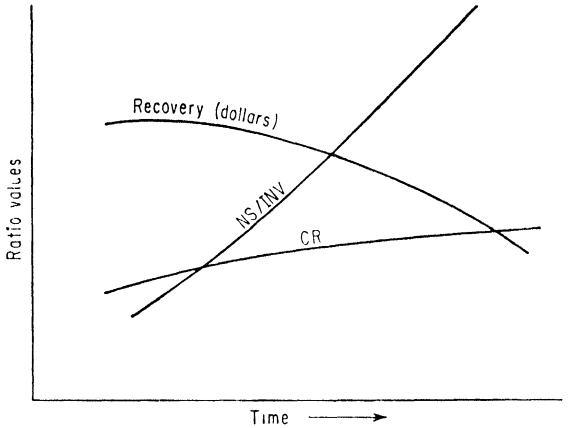


are attracted and profit falls off. However, the recovery keeps increasing and then levels off as the unit-price reductions bring the company into the break-even and loss areas.

This shows the dangers of arbitrarily trying to increase inventory turnover even if it means a reduction in selling prices. However, there are many situations where the reduction in selling prices (irrespective of the boosting of the inventory turnover) will accelerate sales and profits. This chart does not depict that condition, but it was mentioned earlier in this chapter under elasticity.

Exhibit 15-10 shows a situation in which increased sales are not recovering expenses. Since the current ratio is improving and sales are increasing, the improvement is the result mostly of the speed of collecting the accounts receivable. In other words, don't let the increase in the CR with the increase in the sales mislead you. Actually, what was

EXHIBIT 15-10. DIAGNOSIS: TRUE COSTS IGNORED; CR MANAGING

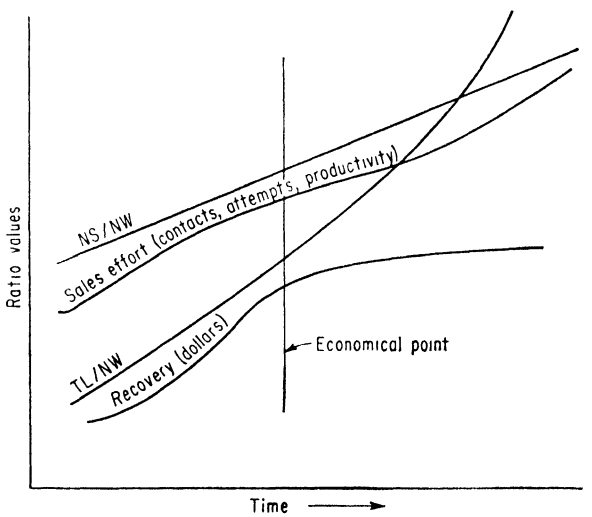


happening here was that the company was ignoring its true costs and managing on the basis of its CR. The recovery curve is the positive clue.

Sales Effort, Recovery, Liabilities, Net Worth

Exhibit 15-11 shows a relationship between sales, net worth, recovery, and the sales effort. The applied sales effort is producing sales increases in almost direct proportion. This immediately shows an efficiency and productivity above average. This company used MC in production and

EXHIBIT 15-11. SALES-MINDED OWNERSHIP



sales. It did not go into any integration, and it did not go into MC for the capital structure.

Here's what was happening, at a slow, insidious rate of speed. The sales effort was applied successfully; it produced more and more sales. The owners (purely sales-minded) were delighted. At the same time, the sales to net worth was also rising to the point where the liabilities were becoming excessive for the net worth. The company was overtrading, as shown by the rapid rise in the liabilities/net worth curve with increases in sales. The applied sales effort resulted in *any* type of sales.

At a point, it became easier to sell products which did not recover as much expenses, and this is shown by the recovery curve, which rises fast and then levels off very quickly. This relationship shows that undoubtedly there is an optimum point of applied sales effort where almost the maximum recovery is effected and the other requirements are also satisfied. This is shown by the vertical line marked economical point. Actually, the company had earned 95 per cent of its profits at this optimum point and was risking the foundation of the company by striving for the other 5 per cent.

After the casting of this chart, the company integrated production and sales and, with a revised product mix, was able to increase sales with a direct increase in recovery. Also there was no increase in the liabilities/net worth because of the consideration given to inventory loading in the selection of the new mix.

Expanding Fixed Assets, Sales Efforts, Market Potential

Exhibit 15-12 shows a typical situation where the time appeared ripe for examining the need to expand the fixed assets in order to capitalize on both the market potential and sales efficiency.

As can easily be seen, the sales effort produces an increase in sales up to a point. Beyond this point, potential exists in the company's markets, but it cannot be converted into sales because of the limitation of the equipment. Of course, before adding to the fixed assets, an analysis of the product mix, recovering ability of the mix, and the effect on the flexibility and solvency of the capital structure must be examined, from which a balanced decision must emerge. Exhibits 15-13 and 15-14 show the effect of the negative and positive decision.

In both these charts the before-and-after test conditions are shown as periods I and II, respectively. In Exhibit 15-13, recovery lags somewhat behind sales with increases in sales, but the recovery is consistent and improves the company's elasticity. Thereafter, the elasticity drops, but this is not serious; the recovery dips, and then matches or exceeds sales speed, indicating a positive product mix. The FA/TA does not

EXHIBIT 15-12. RIPE TIME FOR EXPANSION

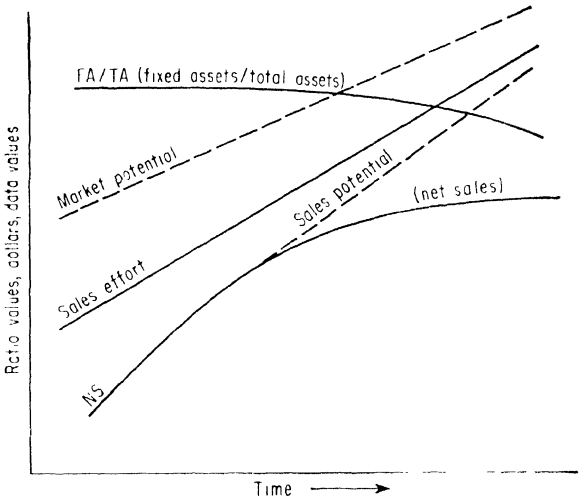
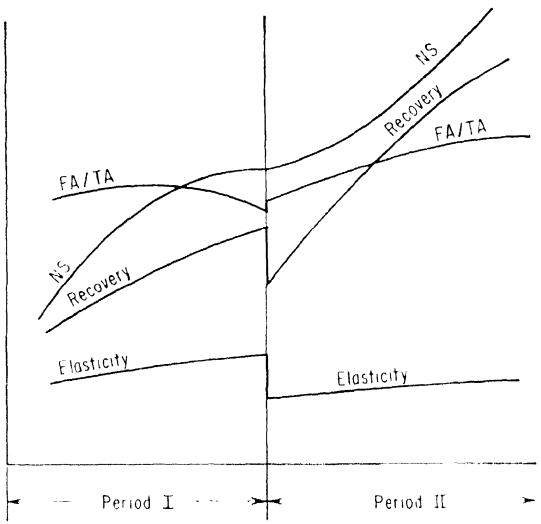


EXHIBIT 15-13. RESULTS OF A POSITIVE EXPANSION



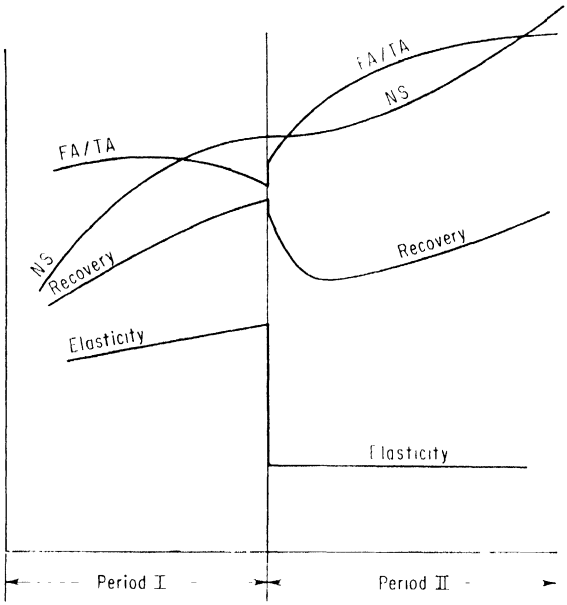
rise too much, confirming the extent and velocity of recovery. The FA/TA is also beneficially affected by the sell-off of unproductive facilities.

However, if the mix is selected poorly, the result can look like the condition shown in Exhibit 15-14. Here, as sales increased, the products sold did not recover much of the fixed expenses, with the result that

the recovery took a big dip after the addition of the new piece of equipment (added lump sum of fixed expenses). Then it rose ever so slowly because of the nature of the mix. The old equipment was not sold off, and the FA/TA rose and, in combination with the slow recovery, dropped the elasticity seriously.

In essence, if this type of decision did not affect the stability of the capital structure, it could have then made it too rigid to change, thereby committing the company in this one direction for quite some

EXHIBIT 15-14. RESULTS OF A NEGATIVE EXPANSION

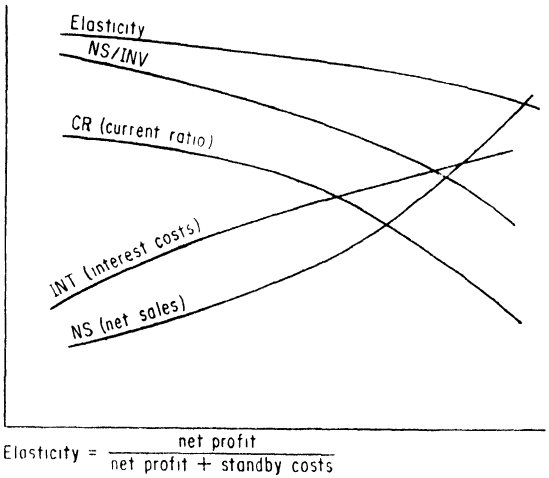


time. This chart neglects the aspect of profits, but needless to state, a slowness or lack of recovery impacts on profits seriously.

Excessive Sales, Elasticity, Capital Balance

Exhibit 15-15 is another typical representation of a condition in which sales increases for the sake of increases can cause rises in inventory levels out of proportion to its capitalization. This in turn causes a severe drop in the CR because of excessive borrowings necessary to support the inventory. The interesting thing here is the direction of the elasticity, which is falling slightly because of the presence of interest charges. This creeping change can gradually cause profit making to be difficult.

EXHIBIT 15-15. DIAGNOSIS: POOR HEALTH AND INELASTICITY RESULT OF SALES



Interest charges are part of the total overhead of the company, and as pointed out previously, *for each increase in overhead there is a correspondingly greater increase in sales required to overcome it and still leave the profit untouched.* The reader is aware of many things which contribute to a change in elasticity. The smallness of elasticity decreases is a proper criterion, but these small segments can add up fast and pose an unnecessarily high task for the sales and management.

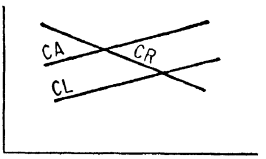
Overhead, Sales, Current Ratio

Exhibit 15-16 first shows on top the typical relationship between rises in the CA and CL and the effect on the CR. This is now an elementary relationship. The bottom shows an acceptable condition under which this occurs, as the effect of a positive expansion of sales. So even though the CA and the CL are both increasing in the same proportion, and therefore the CR is dropping, the elasticity is increasing, and the overhead cost in the total cost (cost of sales) is decreasing, thereby leaving a greater margin of profit. A company like this can operate at a profit over a considerable portion of its capacity.

Curve Movements of Specific Situations; Diagnoses: Cancellations, Production Flow, Receivables

Exhibit 15-17 shows a situation which occurs in many companies. The curve of order cancellations shows that delivery promises were not kept. Was this due to a frugality of financial policy, resulting in a low inventory level? Or was it due to production difficulties? Or a combina-

EXHIBIT 15-16. POSITIVE EFFECTS OF REDUCED CR WITH SALES EXPANSION



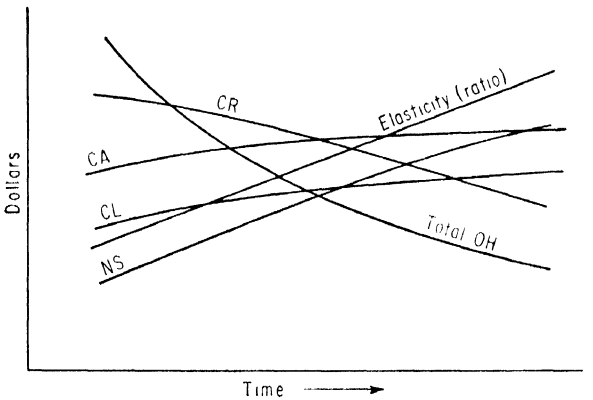
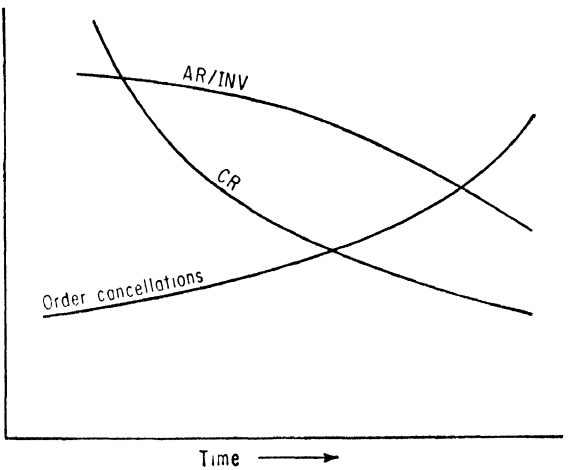


EXHIBIT 15-17. DIAGNOSIS: INSUFFICIENT INVENTORY (IMPEDING PRODUCTION FLOW)



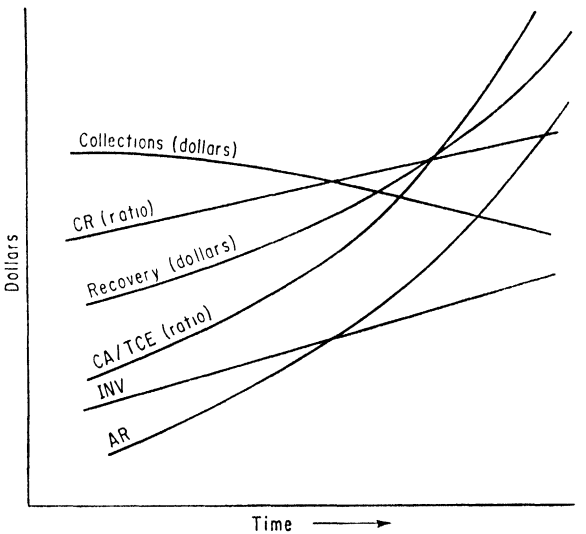
tion of both? When the CR curve decreases as shown, together with a drop in the inventory to receivables curve, it is usually the result of a drop in receivables and a decreased CA picture. This occurs when, with sufficient sales, there is a retardation in production flow and an expanding work-in-process inventory.

If the CR curve rose under the same conditions of order cancellations, it might show that production is not the reason but rather that there is an unrealistically high cash position (a poor distribution of the current assets) and an inventory not geared high enough to meet the needs of the company. This condition usually deals with the raw-material portion of the inventory.

Fast Recovery, Negative

Exhibit 15-18 shows that accelerated recovery for the sake of the acceleration, when other matters are not considered (like the effect on

EXHIBIT 15-18. DIAGNOSIS: ACCELERATED RECOVERY NEGATIVE



the capital structure), can be injurious to the company. Here we have the combination of slow collections and the type of product mix which emphasizes the usage of material. This boosts the accounts receivable and the inventory and gives a deceptive rise to the CR. Not deceptive as far as the current position is concerned, for that certainly did improve, but deceptive as far as the over-all balance between operating and the capital structure is concerned. Of course, this makes the CA/TCE rise sharply because of the rising receivables and inventory.

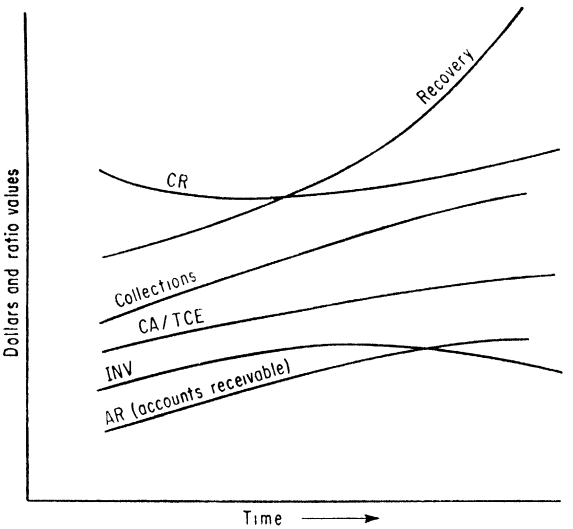
It could also be a sign of a heavy work-in-process inventory or delays in production. However, under that circumstance, the inventory would show more of a rise.

This condition shows that effort now had better be applied to the policing of the receivables and the investigation into the reasons for any possible delay in production. Under about the same set of circumstances, Exhibit 15-19 shows a more positive condition.

Fast Recovery, Positive

In Exhibit 15-19 the rate of collections is improving and the receivables not rising as fast. With a more modest increase in the CA/TCE,

EXHIBIT 15-19. DIAGNOSIS: ACCELERATED RECOVERY POSITIVE



the inventory falls and the CR drops a small amount. Notice that there is a point at which the accelerated collections with the slowly but readily rising receivables made the CR rise again. Even if the CR did not rise but remained at its lowest level in the period shown, provided it did not threaten the current position of the company, the situation would be improved. For what is the good of accelerated expense recovery if collections do not keep pace with the working capital requirements of the company?

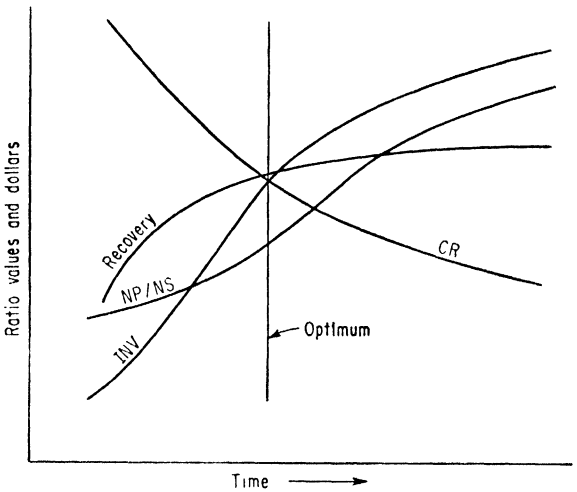
Selection of Optimum Product Mix

Exhibit 15-20 diagnoses the troubles in the product mix and finds the optimum point for the company. The product mix causes a sharp recovery at the beginning of the period on low-material-content prod-

ucts, as shown by the lower portion of the inventory curve. Then as sales continue, the recovery tapers off, with an increasingly greater use of inventory. This drops the current ratio because of the increased use of capital to finance the higher average level of inventory. The cost of this capital levels off the NP/NS a bit, but the NP/NS continues to rise in spite of the leveled-off recovery.

This shows that the company is actually making a profit, beyond the optimum point shown, on merchandising its raw materials. It could be

EXHIBIT 15-20. DIAGNOSIS: POOR PRODUCT MIX; OPTIMUM SELECTED



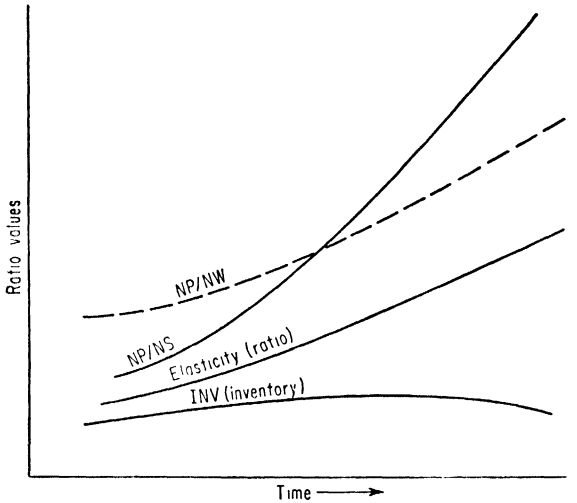
quite a risky venture in industries where there is a high degree of raw-materials price volatility.

Positive Mix, Elasticity, Inventory, Return on Investment

Exhibit 15-21 shows a better product mix. The sales increased high enough so that the profit compared with fixed costs climbed, and so did the elasticity. The fact that the NP/NS rose faster than the NP/NW indicated that the FA lacked vigor but was just beginning to become more active. INV/WC remained satisfactory and was not excessive. The product mix did not boost inventory; it decreased it. Control must now be exercised to see to it that as the fixed assets are made more vigorous, the increased sales do not cause a reversal in the direction of the inventory.

Very often this condition exists in companies where the amount of sales or the amount of fixed expense recovery is limited by the ability of the capital structure to assume the possible burdens imposed. It is a

EXHIBIT 15-21. A PROPER PRODUCT MIX

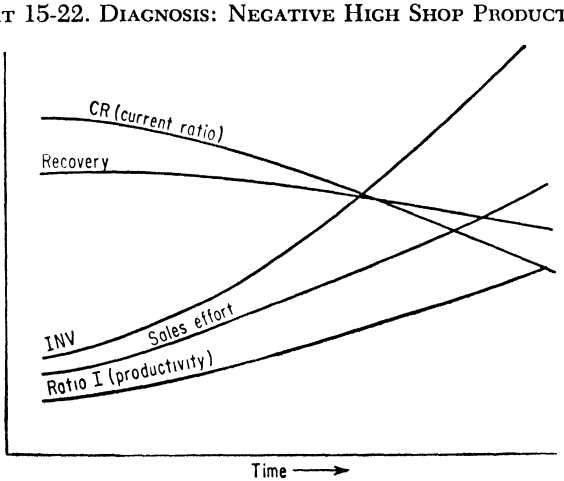


tragic situation, stemming from an improperly designed organization or the results of creeping change.

Negative High Productivity

Exhibit 15-22 presents an interesting situation for diagnosis. Here we have a high factory productivity and a high and sustained sales effort but a dropping recovery and a slowly dropping CR. What is the trouble? The difficulty arises with using unweighted data like the productivity ratio without modifying them with other economic factors in the plant.

EXHIBIT 15-22. DIAGNOSIS: NEGATIVE HIGH SHOP PRODUCTIVITY



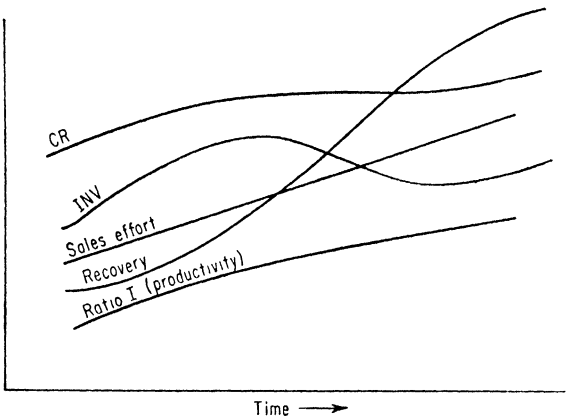
What happened here was a high productivity on inexpensive facilities, whereas the productivity was needed on the more expensive machines. But apparently there were either no production standards available or the foremen were not applying them. As a result, recovery was not being accomplished.

However, the products for which there was high productivity on inexpensive equipment contained a considerable amount of materials, and so we had the dilemma of a rising inventory without benefit of expense recovery. The inventory-in-process increased without a fast enough outgo into accounts receivable, and the CR dropped. The addition of the sales effort curve shows that the sales drive is for the wrong products and that the mix has to be revised. Basically, however, management should police its standards coverage so that the most expensive facilities get covered first. A proper relationship for this type of situation is shown in Exhibit 15-23.

Positive Productivity

Exhibit 15-23 shows the proper relationship between productivity and recovery with the support of the sales effort (that is, if the sales effort

EXHIBIT 15-23. PROPER INTEGRATION OF PRODUCTION, SALES, AND FINANCE



curve went in the other direction, the recovery curve could not possibly rise even though the productivity could be high). The movement of the inventory shows the optimization of the mix as far as material content is concerned, and this has some slight effect on the CR.

Equipment, Financing, Ownership, Solvency

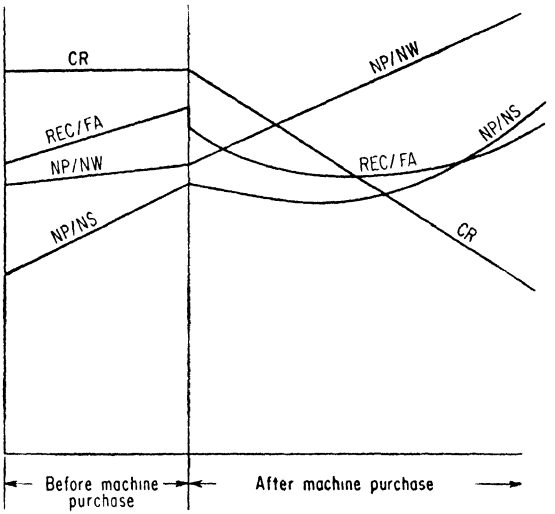
Exhibits 15-24 and 15-25 show the effect of new equipment being added but financed by either borrowed capital or by owners' capital.

Both of these sets of curves shows the before-and-after conditions. Before the purchase, in both cases, we see a steady CR, a rising rate of recovery on the fixed assets employed, a reasonable return on the invested capital, and a fast-rising profit on sales with sales increases.

Here was the effect of using borrowed capital (Exhibit 15-24). Immediately after the purchase, because of the introduction of another segment of fixed expenses which the sales did not have a chance to recover, the recovery dropped and then slowly began to show a rise, with an increase in sales.

Since the purchase increased the liabilities as well as the assets, the CR dropped and the NP/NS dropped because of the delay in recovery

EXHIBIT 15-24. EFFECTS OF FINANCING EQUIPMENT WITH BORROWED CAPITAL



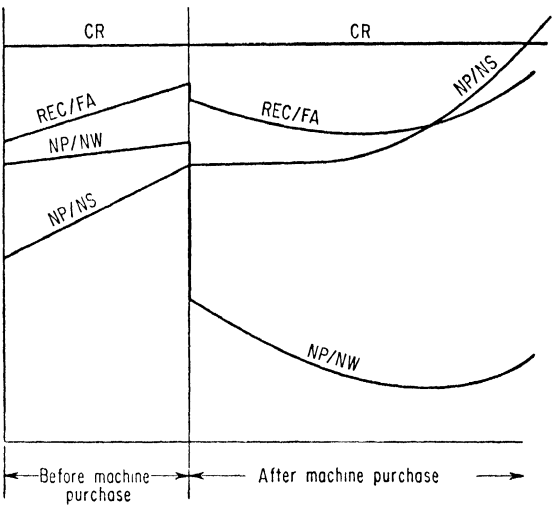
plus the expenses of borrowing the capital (interest, etc.). However, the NP/NW rose because the profit, even though it had reduced, constituted a greater portion of the owners' capital. Now, however, the creditors had a greater stake in the company than they had before. This risk might not be worth the added recovery and added capacity.

Other considerations, then, are the cost of obtaining the additional business for the higher capacity made available by the new purchase. And a very important point is the time lag of such recovery below the former level and the costs over the time it takes to restore itself to a profitable level. This is a recovery-subsidy cost, which is a very real one and which the company must consider along with its probable gain after this period. All these considerations must be equated to the degree

of ownership it has to part with. Needless to state, the degree of the CR drop must also be considered, especially as it affects the credit-obtaining ability of the company.

Exhibit 15-25 shows the same purchase made by the owners' capital, that is, by having the owners put more funds into the business for the exclusive purpose of buying this machine. In this situation, the CR remains at about the same level since the liabilities do not change and the machine becomes a fixed asset. The recovery is a little bit faster since it is not burdened with the interest charges required in loans. This allows the NP/NS to rise faster than in the former case but

EXHIBIT 15-25. EFFECTS OF FINANCING EQUIPMENT WITH INVESTED CAPITAL



severely drops the return on the invested capital. Actually, such a drop should be calculated before the decision to buy is made, so that the owners know exactly how the new investment will affect their return.

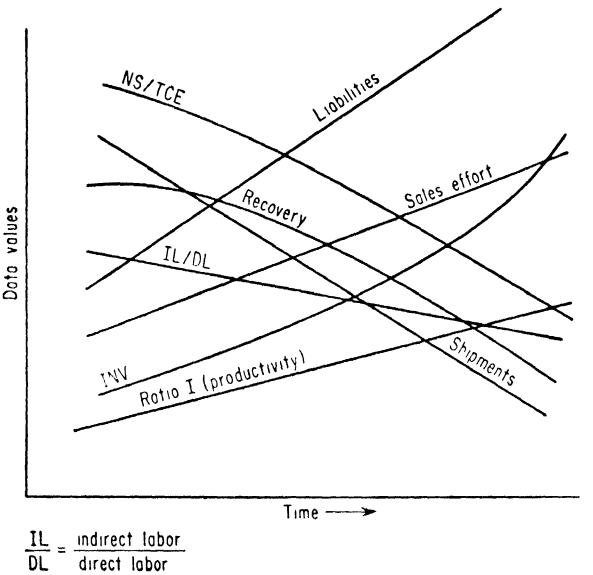
Since the expenses against the machine are reduced, the NP/NW starts to rise after it recovers from its initial shock (in the form of a large piece of investment increase). Where there are good prospects for the company and the reason for the drop is well understood by the stockholders, this is the preferable method of financing the purchase. The reader should remember, however, that where the NP/TCE is higher than the borrowing interest rate by a considerable number of percentage points, there might be merit in financing the purchase by a combination of both borrowed and invested capital, thus preserving some of the profit-making resources of the company for the investors.

Sales Effort, Productivity, Liabilities, Shipment

Exhibit 15-26 shows a condition mentioned at the beginning of this book, with reference to the arbitrary reduction of expenses. The reader should refer back to Chapter 5, which discussed some of the troubles that a company could get into by the use of arbitrary expense or labor reductions. This was the situation at a company covering a span of only three months.

At the start of the period, the plant manager, in an economy move, decided to show a reduction in the indirect labor to direct labor ratio,

EXHIBIT 15-26. EFFECT OF ISOLATED PRODUCTION DECISION ON TOTAL ECONOMY



$$\frac{IL}{DL} = \frac{\text{indirect labor}}{\text{direct labor}}$$

without taking the trouble to use or develop tertiary ratios which would show the impact of the real effect. He laid off a few materials handlers and shipping clerks. The results were felt throughout the company and rocked the very foundation of the capital structure.

The manager saw an improvement in the IL/DL ratio and checked that against productivity, which did not fall off but instead kept rising. The coverage of the production standards was about 35 per cent of the direct labor operations, and the operations which showed the largest productivity spurts required little indirect labor support. The manager did not investigate that far, however.

The controller noticed large increases in the inventory (the company had monthly balance sheets) and a severe fall-off in shipments. The factory was being choked with work-in-process, and there was also a large accumulation of finished goods which were not being shipped. This situation kept building since the sales effort was continuously applied and there was not enough coordination to get sales to change the emphasis of their efforts, even if only temporarily to relieve the burdensome inventories.

During this time, since shipment had lagged, the receivables had been cut back and cash flow became a problem. This gave rise to borrowings (increased liabilities), and because of an already thin CA level, the CR dove wildly, cutting off most of the credit normally available to the company. About three weeks after the manager made this unweighted and arbitrary decision, he was taken ill and the "managing" was taken over by his assistant, who was no more aware of the organic effect than his boss was.

If any confirmation of the condition was needed, it existed in the NS/TCE ratio. Everybody raced around analyzing and trying to suggest ways of solving the problem. The manager, sick in the hospital, was consulted. He suggested a night shift to wear away at the backlog, and to finance it, the company temporarily discounted its accounts receivable with its local bank on a nonnotification basis. What a sad commentary for a well-established company, caused solely by this irrational managerial move!

The sadder thing about this was that it never crossed the manager's mind that it was the layoff of a few people three weeks back that started it. This situation will occur very easily in the same situation in companies that must stock high levels of expensive inventory and depend on a fast production cycle in their manufacture. Naturally, not all companies are as vulnerable to this type of managerial action. Some may be just as crippled by reducing the maintenance crew, or by revising their method of production scheduling, or by changing suppliers, etc.

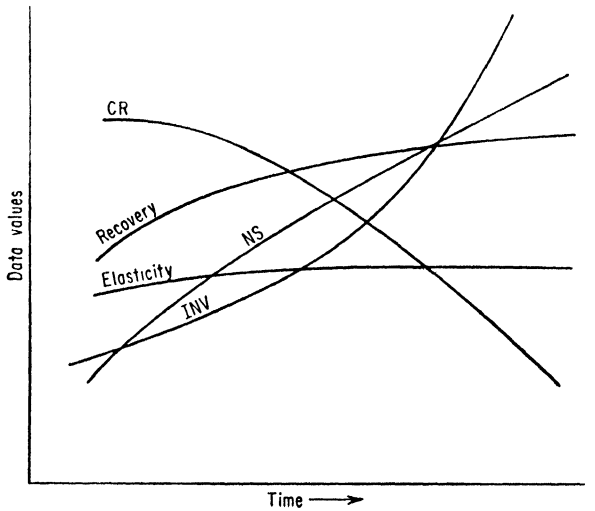
Wrong Product Mix, Recovery, Solvency

Chart 15-27 diagnoses a condition which, to all intents and purposes, does not look logical. Here is a steady sales increase and a rapidly falling CR, but with a slight rise in the elasticity and an increase in recovery. Actually, this is the picture of a company promoting the wrong product mix and causing high inventory commitments. This set of curves also is typical of a company that costs its products inconsistently, where the company is in the business of selling machine and plant time and allocates overhead costs on the basis of direct labor instead of on

the cost and usage of facilities. (See discussion on Machine-Hour Rates in Chapter 11.)

With the improper product mix the drop in CR is probably not justified by the slight increase in recovery. And the slow movement in elasticity shows an economic vulnerability because of the low level of profit compared with the fixed expenses. Omitting the consideration of the CR for the moment and the added costs of borrowed capital, if any, the expense-recovering ability of the present cost estimates was tested and the proper selling prices and the increase in profit that should be produced were ascertained.

EXHIBIT 15-27. DIAGNOSIS: INCONSISTENT ALLOCATION OF OVERHEAD EXPENSE TO PRODUCT COST



This test showed that whereas the customers, *in toto,* were charged 42 per cent of the sales dollar for overhead, the real cost (as determined by the MHR) was closer to 65 per cent. Were it not for the fact that the company had overstated its materials and direct labor costs, the company would have operated at a loss. As it was, it netted 1.7 per cent as profit instead of the hoped-for 15 per cent on sales.

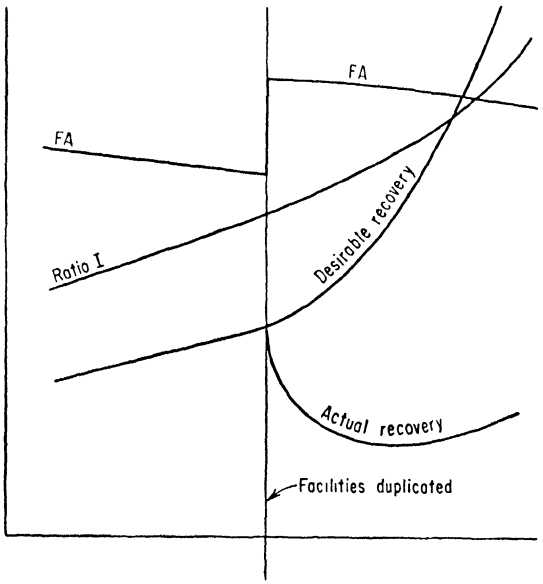
Excessive Productivity, Fixed Assets

Exhibit 15-28 shows the basic effect of higher over-all shop productivity. As productivity is increased (on salable items, not just for the sake of high productivity), the expense recovery rises. This continues until the economic maximum has been reached, that is, just before the duplication of facilities is required. During this time, the fixed assets

decrease somewhat because of the depreciation. At the point of duplication, of course, the actual recovery drops, since now more activity is required to keep the facility busy.

Productivity still rises, but is useless, since output cannot rise now that there is the fullest use of the available capacity. Often this leads to make-work production, especially where the wage incentive plan was improperly designed and matters are at a state where, unless this type

EXHIBIT 15-28. EFFECT OF DUPLICATING FACILITIES TO SUPPORT HIGHER PRODUCTIVITY



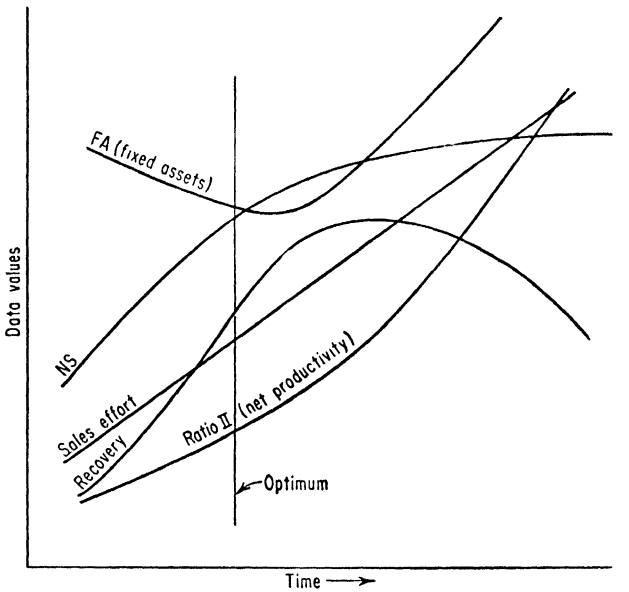
of work is permitted, the workers lose interest in the plan. Exhibit 15-29 presents an actual case history of this situation.

Optimum Productivity, Recovery

Exhibit 15-29 shows the effect of higher productivity for the sake of productivity alone, other factors not considered. Actually, as shown by the optimum vertical line, when productivity has reached about 104 per cent (4 per cent above the fair day's work level), the company was at its optimum in economy and capital structure. At the optimum level (104 per cent) the company obtained about 90 per cent of its fixed expense recovery and was not required to duplicate any of its facilities to support the high available productivity or the increase in sales.

As the chart shows, there was a diminishing relationship between sales efforts and the sales made, showing that there was no valid objective in even considering duplication of facilities. The recovery curve also showed that it would take some time before anywhere near the former recovery was attempted. Instead of keeping the industrial engineers busy with ways of boosting productivity (which was really not important above 104 per cent), it would have been better to use them in scheduling and planning an improved product mix which lowered inventory requirements and in working out maintenance incentives

EXHIBIT 15-29. DIAGNOSIS: PRODUCTIVITY FOR THE SAKE OF PRODUCTIVITY



which kept indirect costs low. The company had only its direct production workers on incentive. The industrial engineers were diverted to indirect incentives and supervisory incentives, which maintained the indirect expenses at a low level without interfering with production requirements and which squeezed the profit cents out of the proper areas.

TOTAL INTEGRATION TERTIARY RATIOS

Tertiary ratios for each of the major areas were constructed in Chapters 4, 9, and 14 for production, sales, and capital, respectively. These serve to give upper management condensed evaluations within

the individual sections. Their movements were then plotted to reveal individual response characteristics of these areas so that management could exercise balanced control.

However, as we saw from the previous charts, an event in one area affects events, movements, and economy states throughout the company. Frequently it is beneficial to management to use control indices from

EXHIBIT 15-30. TOTAL INTEGRATION TERTIARY RATIOS

TITR no.	Formula
TIA*	Tertiary Ratio OO × Tertiary Ratio SAA × Tertiary Ratio FG
TIB*	Tertiary Ratio QQ × Tertiary Ratio SCC × Tertiary Ratio FS
TIC*	Tertiary Ratio AA × Ratio SL × Tertiary Ratio FQ
TID*	Ratio V × Tertiary Ratio SNN × Tertiary Ratio FE
TIE*	$\frac{\text{AREC}}{\text{BREC}} \times \frac{\text{FA}}{\text{maintenance and repair + depreciation + insurance expenses}}$
TIF	$\frac{\text{AREC}}{\text{BREC}}$ × Ratio FV
TIG	$\frac{\text{AREC}}{\text{MER}}$ × Ratio FXI
TIH	$\frac{\text{BREC}}{\text{AREC}}$ × TL
TII	$\frac{\text{INV} \times \text{MER}}{\text{AREC}}$ × Ratio FI
TIJ	$\frac{\text{AREC}}{\text{BREC}}$ × Ratio FIV × Ratio FXII
TIK*	$\frac{\text{BREC}}{\text{AREC}}$ × Ratio FI × Ratio FXXV
TIL*	$\frac{\text{AREC} \times \text{TL}}{\text{MER}}$
TIM	$\frac{\text{AREC}}{\text{BREC}}$ × Ratio FIII
TIN*	$\frac{\text{AREC}}{\text{MER}}$ × Ratio FII

* Described in text.

which to get a total measure of the impact from one or more events, regardless of where they occur in the company. These are called total integration tertiary ratios and are constructed from data taken from the financial and operating areas. The terms of the ratios are primary data, elementary, advanced, and/or area tertiary ratios in any combination that will produce the desired effect. And again, this is often an industry criterion.

Exhibit 15-30 lists some typical total integration tertiary ratios (TITR) and their formulas.

The following are descriptions and uses of some of these ratios together with appropriate charts:

TOTAL INTEGRATION TERTIARY RATIO TIA

Tertiary Ratio OO × Tertiary Ratio SAA × Tertiary Ratio FG

This ratio is used as a period evaluator of the total company economy. In this expression the profits earned in a previous period are placed in proper perspective. The profits reported in the present but earned by a previous performance are deserving of a positive evaluation only if the present events are tending toward the production of a profit at some future report date. In other words, simultaneous with the report of a profit, there coexists previous events as yet unconsidered in any profit statement which may influence a future profit positively or negatively. This circumstance is considered in this ratio.

In effect, the pattern of yesterday's actions in sales and production, which have not been profit-costed, tempers any profit calculation reported today. This shows the economic trend of the company; it is a clue to what the next period's profits might be.

Exhibits 15-31 and 15-32 show how TITR-TIA is used to spot a profit rise or decrease, respectively, in advance.

TOTAL INTEGRATION TERTIARY RATIO TIB

Tertiary Ratio QQ × Tertiary Ratio SCC × Tertiary Ratio FS

This ratio relates the movements of the sales and production efforts to the shifts in the capital structure. Basically, an upward movement is positive and may originate from any of the three major company areas. A tertiary ratio of this type is designed on the assumption that top management is interested in total effect and leaves to the subordinate levels the task of intrafunctional improvement. A positive shift in this ratio is caused by many events, individually, or more commonly by a *combination* of events. These actions can be of various magnitudes and can be either positive or negative. This tertiary ratio gives the total effect on the company.

Ratio TIB will show how the interrelationship of the positive movement of the production economy and the sales effort success trends will affect the overtrading position of the company. A drive for expense recovery which results in overstocking of inventory levels will show up immediately in Tertiary Ratio FS. High productivity in the shop, which is not being supported in sales, will be indicated in both Tertiary Ratios SCC and FS. Lower productivity in the shop, with an economical effort in selling the available capacity, will show up positively in Tertiary

EXHIBIT 15-31. USE OF TITR IN SPOTTING A TREND TOWARD HIGHER FUTURE PROFITS

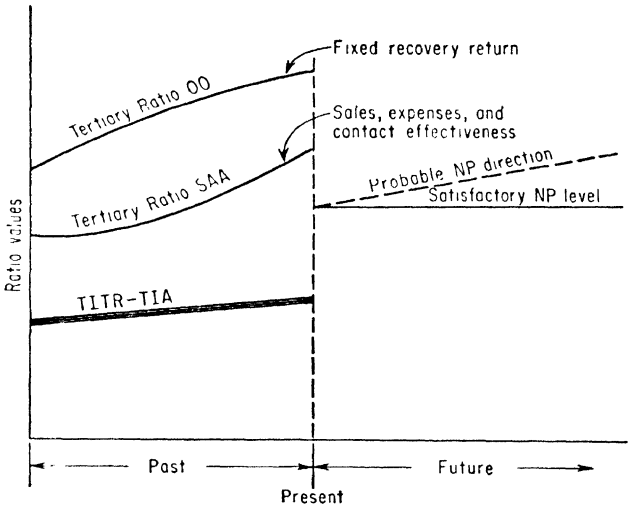
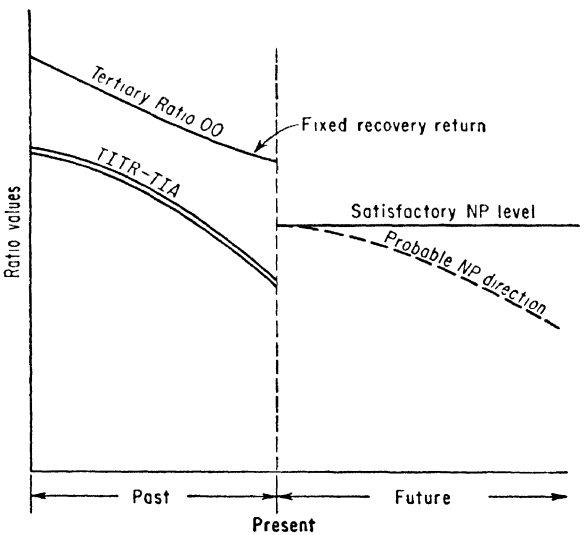
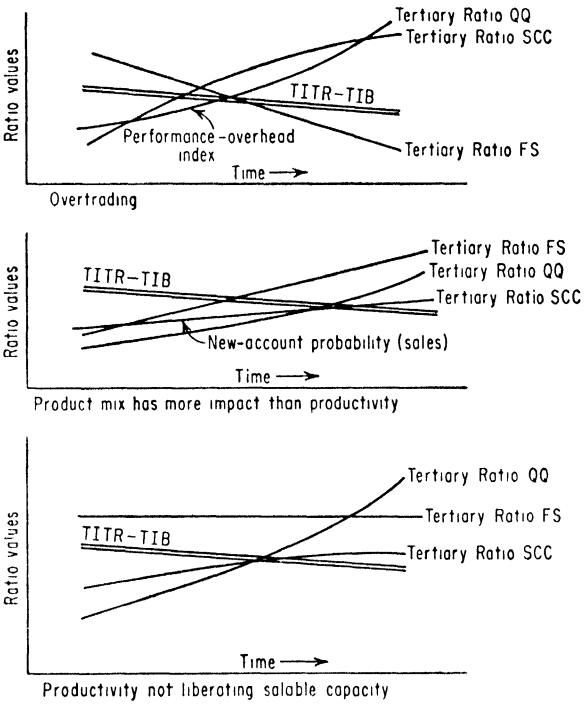


EXHIBIT 15-32. USE OF TITR IN SPOTTING A TREND TOWARD A DROP IN FUTURE PROFITS



Ratio FS. High sales effort in excess of the ability of the shop to supply the needs will show itself in Tertiary Ratio SCC, because of the lower level of sales, and in Tertiary Ratio FS, if the selling involves high-material-content items. If an improper product mix is being sold, the

EXHIBIT 15-33. UPPER MANAGEMENT'S INTEREST IN TOTAL EFFECT: SAME DEGREE OF TITR NEGATIVITY FROM EITHER OVERTRADING; PRODUCT MIX'S ECONOMIC DOMINANCE OVER PRODUCTIVITY; OR PRODUCTIVITY'S INABILITY TO LIBERATE PRODUCTIVE CAPACITY



drop in Tertiary Ratio FS will pull down the value of the ratio enough to attract early managerial attention.

Exhibit 15-33 shows the use of TITR-TIB.

TOTAL INTEGRATION TERTIARY RATIO TIC

$$\text{Tertiary Ratio AA} \times \text{Ratio SL} \times \text{Tertiary Ratio FQ}$$

This ratio shows the justification for the excessive level of sales expenses in terms of the gains it brings to the company. Even though expense economy decreases, the sales brought it provides an opportunity both for higher fixed expense recovery and improved financial health.

This ratio is especially valuable in justifying the type of product mix sold. Often management will use this ratio to test in advance the merits of promoting a particular type of product mix.

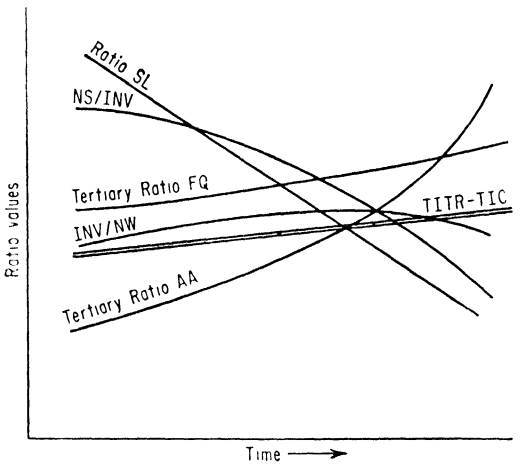
Exhibit 15-34 shows the movement of TITR-TIC in comparison with other data and ratios.

TOTAL INTEGRATION TERTIARY RATIO TID

Ratio V × Tertiary Ratio SNN × Tertiary Ratio FE

This formula shows the effect of productivity on the profitability of the company's total resources, consistent with its state of health and

EXHIBIT 15-34. EXCESS SALES EXPENSES JUSTIFIED BY BETTER ECONOMY AND FINANCIAL HEALTH

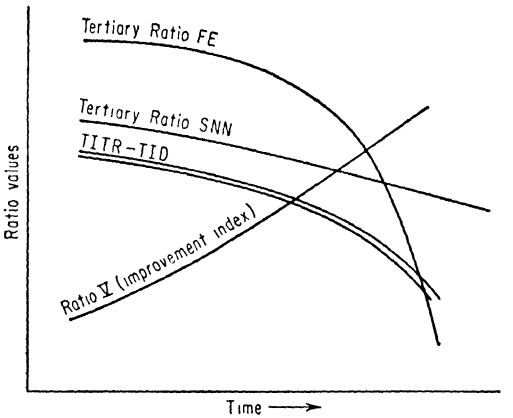


Ratio SL = expense productivity (sales)
Tertiary Ratio AA = performance-excess index

the support of sales. Thus if the plant's productivity rises and it is not supported by a suitable effort in sales, the capital position of the company is affected and TID drops. This is shown in Exhibit 15-35. A similar effect is shown when sales effort is being wasted because production cannot support it. This circumstance is felt in the financial areas, and the ratio drops.

Not all negations start in the operating area; we have said this many times. For example, if the productive and sales efforts are satisfactory, the condition could be negated if such efforts are unbalancing the capital structure. And in spite of high sales and shop productivity, then, this ratio TID can drop.

EXHIBIT 15-35. EFFECT OF PRODUCTIVITY ON PROFITABILITY OF TOTAL RESOURCES



Tertiary Ratio SNN = overall performance index (sales)

Total Integration Tertiary Ratios Involving Recovery

The knowledge of the state of recovery at any one time, or of its velocity, when compared with previous periods and when sales trends are known, represents a fairly complete integration of operating performances; that is, the production-sales efforts and the effect on operating can be measured in terms of expense recovery. The missing link, of course, is the impact that the recovery state attained has on the capital structure: its effect on the inventory levels, the inventory balances, and the trends toward better or poorer states of health, etc.

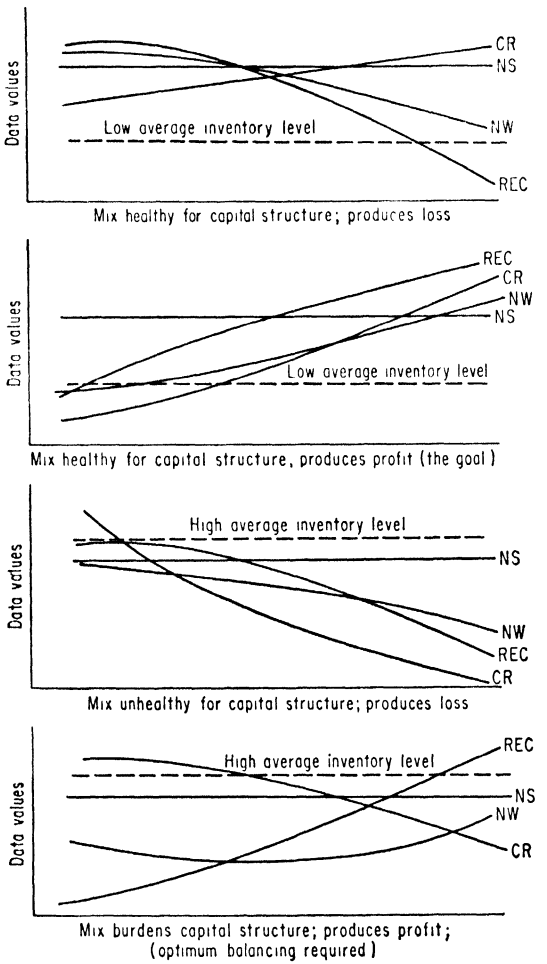
Acts in any area of the company will affect the state of recovery, its amount, its speed, its change of direction, etc. Conversely, decisions commencing with the needs for improved recovery will likewise impact on other areas. For example, a decision to revise product mix to improve recovery may boost inventory levels; a decision to finance a purchase or add equipment will increase the amount to be recovered. In the first case, the current asset and borrowed capital balance changes; in the second, the velocity of the recovery changes by shifts in equipment usages and an additional burden is placed on the sales effort.

Exhibit 15-36 shows four variations of the interaction of recovery with the other aspects of the company.

The following are brief descriptions of some of the TITR listed in Exhibit 15-30 which include recovery data. The abbreviations are:

AREC = actual recovery
BREC = budgeted recovery
MER = maximum economic recovery (before duplication of facilities)

EXHIBIT 15-36. BALANCING RECOVERY TO INVENTORY LEVELS PRODUCES PROFITS AND HEALTH



TOTAL INTEGRATION TERTIARY RATIO TIE

$$\frac{\text{AREC}}{\text{BREC}} \times \frac{\text{FA}}{\text{Maint. and rep.} + \text{deprec.} + \text{insurance exp.}}$$

This TITR shows the trend of the fixed asset economy and is useful in predicting future economy for budgeting as well as for testing the probable effects when additional equipment is added.

TOTAL INTEGRATION TERTIARY RATIO TIF

$$\frac{\text{AREC}}{\text{BREC}} \times \text{Ratio FV}$$

This ratio tests revisions of product mix. Obviously, the same sales level can produce varying levels of recovery, depending on the product mix.

TOTAL INTEGRATION TERTIARY RATIO TIK

$$\frac{\text{BREC}}{\text{AREC}} \times \text{Ratio FI} \times \text{Ratio FXXV}$$

This TITR appraises the effect of product mix and increased recovery on the capital safety.

TOTAL INTEGRATION TERTIARY RATIO TIL

$$\frac{\text{AREC}}{\text{MER}} \times \text{TL}$$

Can the total liabilities stand the effect of using maximum usable capacity?

TOTAL INTEGRATION TERTIARY RATIO TIN

$$\frac{\text{AREC}}{\text{BREC}} \times \text{Ratio FII}$$

This ratio shows the effect on inventory of drive for faster expense recovery.

Charts of Movements Using Total Integration Tertiary Ratios

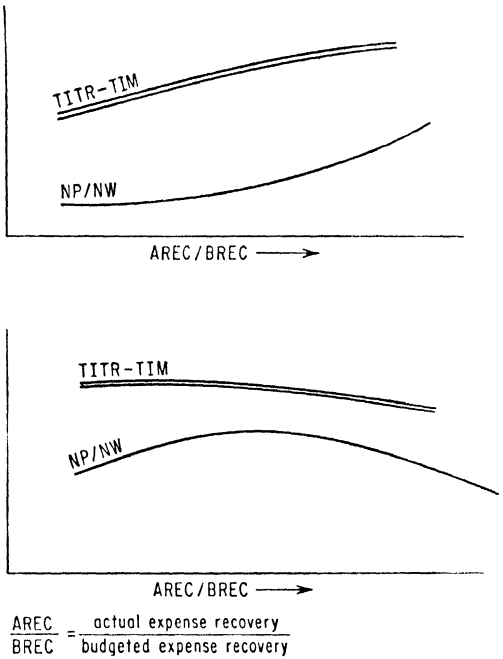
Exhibit 15-37 shows the movement of TITR-TIM, which reveals an inconsistency in estimating. The top portion shows how TIM will behave for proper costing. The lower portion shows the higher sales are being obtained at the sacrifice of the equitable selling prices. This causes a lack of recovery, a drop in profits, and a consequent slowly falling TIM.

Exhibit 15-38 shows the effect of increased recovery on profits and the capital structure. It is a positive condition, as represented by the slowly increasing TIJ. This is from the data of company C, given in Exhibit 14-8 and discussed in Chapter 14. This TITR-TIJ was used from the very beginning of the period, and the exhibit shows its movement for the entire period.

Exhibit 15-39 is also for company C and shows how the safety limits were set for the company. TITR-TIK shows that recovery in excess of 70 per cent would begin to threaten the capital structure.

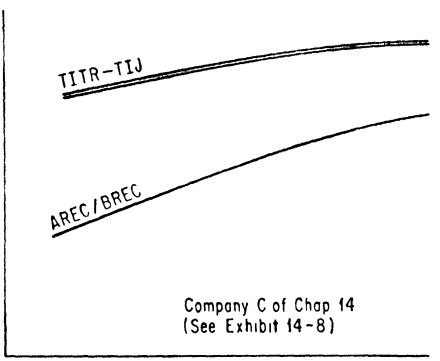
Exhibit 15-40 is a total integration which finds the critical or optimum point in the plant's productivity. The movements of the curves show

EXHIBIT 15-37. THE PRESENCE AND EFFECT OF INCONSISTENT COST ESTIMATING WITH A TITR



$$\frac{\text{AREC}}{\text{BREC}} = \frac{\text{actual expense recovery}}{\text{budgeted expense recovery}}$$

EXHIBIT 15-38. THE EFFECT OF INCREASED RECOVERY ON PROFITS AND HEALTH WITH A TITR



that there is no point in increasing productivity (performance) above this point, not so much because of the accelerated Ratio M′ as because plant productivity is not being supported by increased sales. All the higher production pressure does is boost inventory levels and render the circulating capital less fluid.

EXHIBIT 15-39. FINDING SAFETY LIMITS FOR SALES AND RECOVERY WITH A TITR

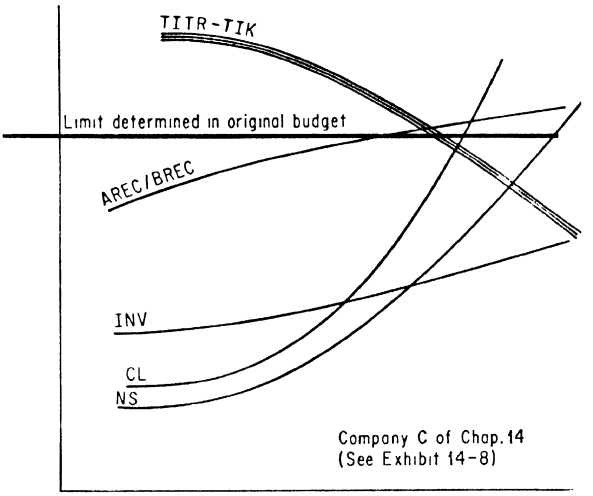
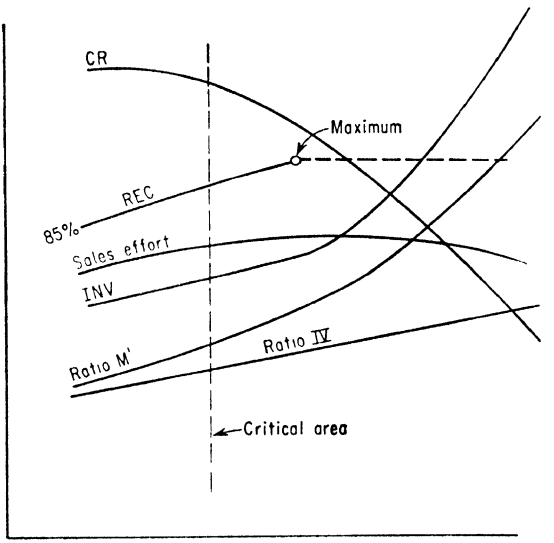


EXHIBIT 15-40. FINDING CRITICAL PRODUCTIVITY FOR FINANCIAL HEALTH WITH A TITR



Besides, the company is at a high level of recovery, and increasing plant efforts above this point, especially since the production cannot be sold, results in a tremendous surge in starting work-in-process and a fast movement toward insolvency.

PROBLEMS

1. *a.* In the curves of Exhibit 15-1, what changes in the company's operation would negate the creeping change in elasticity?
   b. Develop a TIR which shows this.
2. Develop a TIR to spot the condition shown in Exhibit 15-2.
3. Re Exhibit 15-3, show what could happen to the set of curves if the AREC/MER increased by 25 per cent during the period:
   a. In a plastic-injection-molding plant
   b. In a home-type radio-assembly plant
4. Develop a TIR for conditions in Exhibit 15-4.
5. Develop a TIR which will show up a trend toward a difficult-to-remedy insolvency in spite of high profits and expense recovery. Use a specific company (in a specific line of manufacture) to support your project.
6. Develop a TIR to stimulate management toward modernizing its equipment when the conditions are proper.
7. Show the effect that a slow collection policy, continuous productive output, increased sales effort on high-material–low-recovery products, and increased market penetration has on a company of your choosing. Develop data and ratios and show the movements which enable management to get proper perspective for trouble-shooting.
8. Which condition of Problem 7 is most serious for the immediate? The longer term? What steps should management take first for the immediate? The longer term?
9. Develop two TIR's for spotting the trend affecting immediate and longer term in the company chosen in Problems 7 and 8.
10. Develop a TIR to diagnose whether selling prices are recovering expenses and providing the planned profit.
11. Following the data considered in Exhibit 15-11, develop a TIR to find the economical point between sales, net worth, sales effort, total liabilities, and speed of recovery for a heavy-machining company.
12. Develop a TIR to show condition in Exhibit 15-15. Mention a specific company and explain.
13. Develop a TIR to show the slow-up in production flow caused by insufficient inventory. Specify a company and explain.
14. Develop a TIR to diagnose when increased recovery is positive to the company. Specify a company and explain.
15. Develop a TIR to reveal the economic quality of product mix. Specify a company and explain.
16. Develop a TIR to show the economic quality of a plant's productivity. Specify a company and explain.
17. Develop a TIR to show the economic quality of production management. Specify a company and explain.

18. Following the conditions of Exhibit 15-23, plot the curves showing a proper integration of production, sales, and finance for a toy manufacturer at the height of:
    a. The selling season
    b. The production season
19. Following the conditions of Exhibit 15-26, plot the effect on the total economy of these isolated decisions:
    a. Reduce selling expenses.
    b. Increase work force.
    c. Increase building occupancy.
    d. Install production wage incentives (no quality control attached).
    e. Use up old inventory first.
    f. Buy "bargain" inventory on credit.
    g. Promote a newly developed product.
    h. Penetrate a new territory (requires 30 per cent increase in sales effort).
    i. Sell old machinery.
    j. Buy new machines.
    k. Subcontract parts.

    Show whether the isolated decision caused an over-all positive or negative effect on the company's economy and present data to support your conclusions. Include curves representing ratios from production, sales, and finance.
20. Explain how you would use the following total integration tertiary ratios for five widely varying industries and give your reasons:
    a. TIG
    b. TIH
    c. TII
    d. TIJ
    e. TIM

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