

Break-even Analysis: A Model Planning Tool?

An Honors Thesis (ID 499)

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In today's dynamic world economy, the United States maintains a perilous position--perched on the brink and faced with the prospect of falling off its pedestal as the world leader in technology, innovation, and in a sense industry itself. Its slightly tarnished image as the world economic power is most readily apparent in its recent setbacks in the world trade arena, as the trade deficit continues to mount, and the U.S. competitive position is being challenged by external powers as never before.

The United States's ability to respond to such a challenge has been equally hampered by its internal economic woes. The Reagan and Carter administrations, as with their predecessors, have been faced with the seemingly insurmountable task of controlling inflation and unemployment in the light of this most delicate position of U.S. business and industry. With controversy over the economic policy to be employed for the 80's--demand versus supply-side--progress has been limited even more as power struggles between both camps have hampered productive strategy developments.

These events have in many ways changed the very course of the U.S. economy. It has within the last century undergone three distinct and varied changes in response to these external and domestic conditions. Our economy has changed from a labor-intensive, agricultural based economy in the early twentieth century to a capital-intensive, manufacturing based economy in the mid twentieth century to an information-intensive, technology based economy in the late twentieth century. These changes in emphasis have had a profound effect on those basic factors of production postulated by David Ricardo or land, labor, capital and the talent of Joseph Schumpeter's innovative entrepreneur, without which productive enterprise would not take place. Employment statistics alone illustrate this trend within our economy and its effect on labor, as employment in

agriculture has given way to a surge of employment in manufacturing which has in turn lowered in favor of an emphasis in the service sector. Estimates of the capital investment per worker in each of these sectors has also given us insight into the movement within our economy.

There has been much speculation on the part of economists and business researchers alike as to what the primary motivational force behind this trend might actually be. Much current thought on this issue deals with the increasing advent of high technology and know-how which, in and of itself, has broad implications for U.S. business managers and the decisions they make.

John Kenneth Galbraith, in his book The Industrial State (1969), witnessed this shift in our economy and viewed it as a necessity arising from the complex components of modern society. Galbraith realized the advantage of "dividing and subdividing the component parts of industry and of the systematic application of knowledge to those various areas," yet he also recognized the impact on business decision-making and processes of such an advancement, which he outlined and referred to as the six consequences of the imperatives of technology.¹ The first consequence, as he saw it was a marked increase in the span of time between the beginning and end of a project or task. The more advanced the technology involved in such a venture, the more rigorous and time consuming becomes the processes to be completed before its conclusion. As any manager will readily recognize, time is money, and extra time spent on project completion not only has direct costs, but opportunity costs as well. Indeed today's manager has witnessed this phenomenon in his own operations.

The second consequence of technology according to Galbraith is an increase in the amount of capital used in the production process. In competitive industries, the need to innovate indeed becomes a survival need for most firms, and innovation has its price. In attempt to improve production processes for

quicker manufacturing turnover and less costly methods of manufacturing commodities, the necessary investment in capital equipment becomes apparent. It is simple enough to see the increase in expenses as a result of this additional investment, yet less apparent is the cost of the technology or know-how which goes into the construction of such equipment or the development of new techniques to improve outdated ones. The advances we are witnessing in American Industry today are indeed costly in many respects. Many hours are spent in research, sometimes fruitless, before just the right combination of factors is put together in such a way as to answer industry problems.

The third consequence of this new technology is the ensuing inflexibility of business decisions as investment in time and capital increases. It soon becomes much too costly a proposition to terminate a project after much time and money has been expended on its behalf, regardless of what external factors have prompted such a proposal. This increases the risk factor inherent in all such ventures, and changes management's outlook or perspective on project proposals.

Another resultant consequence of technology is the need for more specialized and trained personnel to deal with these changes within the firm. This is not only that manpower involved in the actual technical process, but also those individuals responsible for the planning and control of the firm. As the elements brought to bear on the decision making process become increasingly more complex, these individuals must be highly trained, skilled, and experienced at what they do. Mistakes become costly and precision is vital.

The "inevitable counterpart" of such specialization is organization, which is the fifth consequence of the imperatives of technology as postulated by John Kenneth Galbraith. Most scholars and managers alike would recognize this as a typical if not invariable response of business to deal with the

complicated procedures implied by new technology. Staff and paperwork increase as a function of the complexity and risk introduced by change. Whether an increase in "organization" is a benefit or detriment to American industry is beyond the scope of this paper. (Let it be said, however, that in the view of this author, much can be said for simplicity.)

Out of all of these consequences exposted thus far: increased commitments of time and capital, the inflexibility of such commitments, necessity of specialized manpower, and the need for the development of large organization, comes the final and perhaps most significant of all--the necessity for planning. Changing technology does indeed dramatically alter what can be obtained from any given supply of factors (land, labor, capital, and entrepreneurial ability), yet "...at any time, there will be a maximum obtainable amount of product for any given amount of factor inputs...",² which indicates that the idea of comparative advantage, as put forth by Ricardo, is intimately intertwined with successful planning. In as much as capital budgeting is the allocative process by which the resources of the firm (or factors of production) are applied to various ventures, the method by which this is accomplished should be the very heart of planning within the firm.

Managers, as a result of the dynamic nature of business enterprise today, must learn to project the planning process well into the future in order to effectively evaluate appropriate technology now to be utilized within a five to ten year time span. It is on this aspect of business management that the future of American industry hinges. It has been shown that those countries with superior planning skills in this area have succeeded in maintaining high levels of growth due to their emphasis on the long range planning process as opposed to the realization of short term goals. If America is to be competitive with such countries, and to regain its former comparative advantage in industry

more attention must be devoted to productive investment through effective capital budgeting measures in light of long term goals and, improved techniques to aid in such a process. It is this very topic to which I shall address the remainder of this paper.

Long range planning within the last fifteen years has received widespread acceptance from most major U.S. firms and is utilized, in fact, rather extensively in large corporations, as was discovered by Toyohiro Kono in his comparative study of long range planning in the U.S.A. and Japan. Kono found that more than 80 percent of large U.S. corporations have some type of long range plan for their enterprise, and that they felt it necessary "for better allocation of resources."³ Japanese firms also value planning within their operations, as 77 percent of their large corporations have a long range plan. Their reasoning for planning, however, is slightly different. Long range planning Japanese style is "used to improve the decision at the top,"⁴ due to the fact that top management and the planning department play the most important role in strategic decision making. Both the U.S. and Japan stress project evaluation as the key factor in the planning process (as opposed to quantitative techniques), yet American firms report a more closely controlled follow-up procedure. These U.S. firms updated their plans at regular intervals and adopted contingency plans to accommodate changes in the external environment, while Japanese managers were found to be less likely to stick closely to the plan itself but rather attempted to implement it through budgeting and project planning.

Although there are slight deviations in the way planning is viewed in each of these countries, the processes are also very similar between them. If this is in fact the case, why are the Japanese continuously praised for their planning efforts, and seemingly more successful at it?

Looking more closely at the components of the long range plans (LRP's) used by U.S. and Japanese firms (refer to endnotes), a striking dissimilarity can be seen in the emphasis given to various elements of the LRP itself. Japanese firms have consistently responded in Kono's survey more to those elements of the LRP germane to the essential structuring of a synergistic firm--that is: manpower planning (as well as education and management development), capital investment in light of cost reduction, and environmental forecasting. In contrast, most American firms placed their primary emphasis on the estimated profit and loss statement and estimated flow of funds. This would tend to support conjecture on the part of financial experts and economists alike as to the true motivational force behind decision making in the United States. Are our managers really only interested in short run profit?

Any principles textbook in the area of finance will tell you from the onset, by way of assumption, that the goal of management should be to maximize the wealth of the stockholder rather than attempting to maximize profit. In fact, it is typically maintained that the two goals are, indeed, mutually exclusive, and that only the goal of shareholder wealth maximization will ensure the survival of the firm. If we assume this to be true, why then are managers so preoccupied with profit? Indeed, profit is essential to all firms for survival so in a sense interest in securing a profit is warranted, yet especially in our current inflationary cycle, much harm can be done to those firms overly preoccupied with profit and loss reported on financial statements.

According to the National Machine Tool Builders' Association President James A. Gray, "For too long in American industry we have focused on public reports of phantom profits and avoided reading between the lines."⁵ If management were to read between the lines of public reports they would find a grossly misconstrued profit figure as a result of the ravages of inflation on the two

most important elements in profit calculation--sales and costs. The cost figures are most drastically changed by the impact of inflation in that inventories and depreciation expenses are mistated-- due to replacement costs and the method of depreciating equipment respectively. When traditional accounting techniques and figures are used, many financial analysis techniques utilizing these figures can be deceiving, causing even some inadequate projects to look great. "But that company also would be on its way out of business," Mr. Gray also pointed out, "The point is, conventional accounting methods discourage capital investment."⁶ And management's reliance on profit considerations and just such figures decreases their effectiveness as decision makers and can cause a great deal of harm to their operations.

Even the financial analysis techniques mentioned above for the allocation of resources within the firm, are not indicative of those you would expect to be used in prompting decisions by management for the maximization of shareholder wealth. Instead they all tend to result in decisions aimed at maximizing the profit accruing to the firm without regard to other factors. It is only natural that managers are constantly conscious of profit as management in the U.S. rewards its managers to a great extent on the basis of project profit. Decision makers attempting to improve their record with the company are reinforced in the use of techniques such as ROI, Payback, IRR, NPV, and DCF as conclusive basis for capital budgeting. These tools are not inherently misleading in terms of undermining the competitiveness of the firm, yet they are often employed in such a way, in that those projects yielding the highest IRR or NPV, or perhaps with the quickest payback will be selected for funding regardless of their implications for the long range position of the firm. In short, productive investments often fall by the wayside as a result of a mere manipulation of numbers.

The United States government itself is a major contributor to the short

term thinking pervading business thinking as it often discourages the productive capital investment necessary for U.S. industry to prosper amidst its competitors. The flat-rate investment credit available for most equipment purchases, for example, favors short-lived over long-lived investment, as it lowers the effective tax rate more for those types of investments.⁷ As a result, those industries which use predominantly short-lived equipment (construction, and motorized vehicles) are subsidized to the detriment of those requiring relatively long-term investments (primary metals, communications, and utilities). It is by such a mechanism that U.S. investment dollars are being funneled into decaying industries and least productive uses.

Toru Nakamura, in his article "Productivity Losses through Capital Misallocation in the U.S., Japan, and West Germany,"⁸ found substantial government-induced bias in the allocation of capital in the U.S. This bias was exemplified through favorable taxation of owner-occupied housing and the double taxation of corporate income, and has caused pronounced "inefficiency, measured by the extent of U.S. productivity losses." These inefficiencies, though existent, are small in Germany and negligible in Japan.

One explanation for the efficiency in Japanese capital allocation rests in the role the Japanese government plays in the capital market. In his study of "Equity Financing and Gearing in the U.K., U.S., Japan, and Israel," Meir Tamari noted that "Public policy in Japan...increases the availability of funds, lowers the cost of borrowing, and limits the loss to the lender," all of which provide an atmosphere conducive to investment for business, and in turn encourages innovation.⁸ The net cost of owner-occupied housing in Japan is also maintained at a level higher than the net cost of business capital, which indicates the importance Japanese society places on business investment relative to family housing.

These results tend to imply that capital formation in the U.S. could also be made more productive if the net cost of owner-occupied housing is raised, while that of business capital is lowered. The Economic Recovery Tax Act of 1981 has made great strides toward this end (at least toward relieving the bias we spoke of earlier), with its provisions for a revamping of the capital gains tax system, and a rapid capital recovery program to replace the previously slow depreciation process. Indeed under the old depreciation schedules, it would have been quite conceivable that a company investing in new plant and equipment today could see anywhere from two to four rollovers in technology before those investments would reach obsolescence by government standards. As a tax deductible expense, depreciation is, in a sense, a form of government subsidy. There are no "natural laws" as to how depreciation occurs or should be scheduled for--it should, however, reflect the intent of the government granting the subsidy and the changing needs of business and industry. Such a realization on the part of U.S. leaders has been long overdue, and has laid the groundwork for more cooperation between business managers and their governmental counterparts.

Regardless of these positive changes from the advent of Reaganomics, much conflict is yet to be resolved between the long term direction of governmental policies and the short run methods of achieving them. The tight money policies espoused by Paul Volker have been wreaking havoc on the incentive of U.S. business and industry to assume the risk of innovation amidst high interest rates and instability. Those firms willing to take such a risk often find themselves in a position which necessitates an increase in price in order to cover increased fixed cost. This serves to effectively lower cost competitiveness, in an economy already suffering from decreases in demand. Such a risk then might well cause a firm to price themselves out of their market, especially in light of the

foreign competitive threat. Japanese manufacturers are able to slash their prices on particular exports to levels not even imaginable by many U.S. firms due to extensive government protection and subsidies. This "dumping" of Japanese goods on American markets does little to convince American managers of the necessity of productive investment as survival itself appears tentative in the short-run. U.S. managers must, however, learn to do more than profess the desire for long run viability in world markets. They must take active measures toward such a goal by developing policies and tools aimed at the maximization of shareholder wealth. For if they do not, they will truly be denying their *raison d'etre*.

Techniques now in existence not only have profit-maximizing implications, but are basically shareholder oriented in perspective. Managers must have a management tool with which to tune the machine of capital budgeting and expenditures in view of the complexity of factors coming to bear on each and every decision.

Those budgeting tools most frequently used by business managers are ROI, Payback, and net present value techniques.⁹ These methods of project analysis have led managers to make positive investment decisions most frequently when: 1) the payback period is short, 2) the ROI is high, 3) the investment would require the use of a proportionately small amount of the funds available to management, and 4) when the risk that would be undertaken by the project is not large.¹⁰ The danger in this type of outlook on investment is not readily apparent, as each of the above stated criterion would tend to emphasize the characteristics that an ideal investment should possess. All managers would without doubt prefer an investment that would require limited funds, yet yield a high return, in a relatively short period, with little risk. After all, time is money, and profit is in the bank. What such a limited analysis belies is

what we spoke of earlier as the process by which productive investment decisions are often overlooked. Investments for the future are often more costly, more risky, and (in the short run) yield little profit. Typical evaluation criterion are not equipped to take into consideration such vital factors as these. With the business environment what it is today, business managers must be constantly aware of the changing external factors influencing their business enterprise in order to prepare themselves for whatever contingencies should develop. Perhaps even more crucial to meeting those external challenges, however, is a superior understanding of the internal operations of their organizations in order to more successfully plan a course of action.

Sensitivity analysis has in recent years experienced a surge of popularity as managers are attempting to combat uncertainty through this form of risk analysis. Statistics haven't necessarily reflected this trend, however, in many cases due to the fact that firms do not even know that what they are in fact undertaking is called "sensitivity analysis."¹¹

Sensitivity analysis in its simplest form is a reference to the process by which variables and assumptions are changed to determine their impact on the profitability of the firm. It can take on many complex forms with the use of computers, such as in David Hertz' Monte Carlo simulation.

Monte Carlo simulation involves 1) developing a model of the project, 2) specifying probabilities for each of the determinants of cash flow, 3) and directing the computer to assign values to each of these determinants and to assess cash flows that would result from all possible scenarios. This algorithmic problem solving model sounds ideal, but most firms would probably find it much too costly to develop originally and to keep up-dated as the inputs would be dynamic and difficult to maintain. A great deal of skill is also necessary for the implementation of such a process as even a slight error in

inputs or the initial model would drastically impair its usefulness.

Although a useful "laboratory tool," it would be misleading to assume as many do that a model to accurately and precisely describe all uncertainties and interdependencies could actually be developed. Models such as Monte Carlo simulation do hold much promise for the future as more and more business firms will have the excess computer capacity and funds to afford such an undertaking, and the skills required to make the most of what is available in terms of information inputs and outputs, but from this author's point of view it is not a practical tool for general business enterprises.

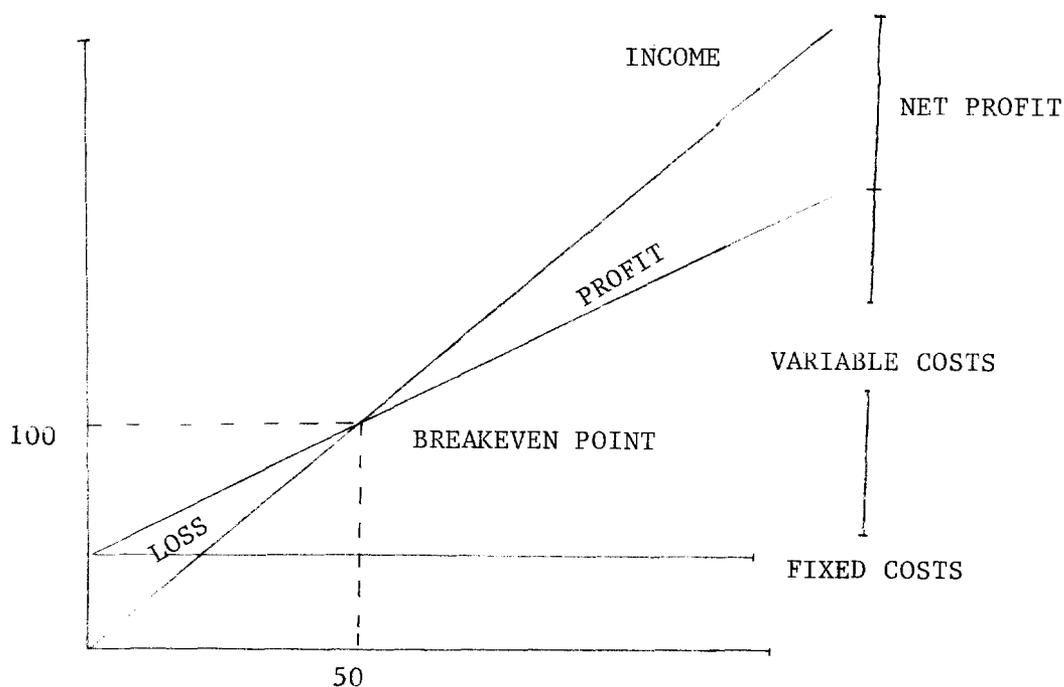
Although we must accept imperfection in regards to building a model financial planning methodology, there are still some points on which we must maintain a level of high expectation. That is we are still able to outline those qualities essential for a paradigm of planning. Most obviously, the model planning tool must be effective while not too complex to be practical for all business managers to use, regardless of the size of their organization. It must also be relatively inexpensive and flexible enough to use in evaluating environmental, governmental, and technological changes. In order for our model tool to have relevance today, productivity considerations must be able to be incorporated into its use. And finally, it must be consistent and adequately able to integrate with existing sophisticated numerical analysis in project evaluation.

While this synthesis of a planning paradigm may to most seem simultaneously simplistic and inattainable, it serves to set the framework within which all possible offerings must be evaluated. Indeed, it has served to tighten the perspective of this author in her search for a suitable tool for management's use in capital planning for productivity and growth.

After a diligent search of the literature a rather startling and unlikely

candidate for such a position remained as the best fit to the framework established above--BREAKEVEN ANALYSIS. This seemingly forgotten form of sensitivity analysis goes a long way toward yielding short-run answers that make long-run sense.

Breakeven Analysis is an analytical technique used in studying the relationships among fixed costs, variable costs, and profits. These relationships are most typically illustrated in the form of a graph or chart, much as the figure below:



The breakeven point occurs at that point at which sales will just cover total costs, when total cost is equal to variable plus fixed costs. This point is particularly important to management as up to the breakeven point the firm suffers a loss, while after that point a profit begins to accrue to the firm.

Fixed costs remain relatively constant through time and do not vary with

production. Some typical elements of fixed cost are depreciation on plant and equipment, interest charges on debt, rentals, salaries (executive), and general office expenses. Variable costs, on the other hand, do vary with production levels, and include such items as factory labor, materials and sales commissions.

One key assumption in this type of analysis is that those relationships being examined--namely between cost, volume, and profit--can be expressed as a linear approximation of what may more realistically be curvilinear cost and price functions. This approximation can be used without significant loss of accuracy, however, due to the fact that, within a relevant range, levels of production do maintain a level of constancy. With some modifications the model can also be constructed to be used in those situations demanding a higher degree of realism.

Breakeven analysis is most often used in budgeting, new product, and pricing decisions. It has most often been considered a short-run tool for financial analysis, yet this author would argue its viability as a long range methodology. Critics of this viewpoint might sight a number of rough spots in the process of breakeven analysis as reason for its dismissal, yet many of these seemingly insolvable problems have within the last several years been smoothed away by innovative reasearch in this area. An example of this is seen in the difficulty in measuring output and relating it to costs when a firm has a variable product mix, which was alleviated by the development of the technique by which each product or component within the product mix is weighted by the use of a physical production index. Breakeven analysis is not without its limitations, but much has been done toward its refinement within the last half of the century. It can now be used with both direct and absorbtion costing systems, modified to take inflation (both linear and compounded) into consideration, as well as random demand and the level of production used in the determination of actual

sales and profits--all thought to be insurmountable drawbacks to its use.

Another consideration in this conflict of views is the nature of the cost and profit relationships of the firm. Information about future relationships between these items would be impossible to speculate on with absolute accuracy and BE analysis naturally relies on that information available to us through current operating data, and in some instances, historical input. Although those who view BE analysis as only being useful in the short-run would emphasize that this point alone illustrates it would not be an effective planning tool, its purpose is forward-looking, as it is designed to aid in making now decisions for the future. No planning tool will be able to forecast future events with total accuracy and BE is no exception.

BE analysis is, however, a very useful tool for management's use in understanding business operations, their environment, and the implications of their business decisions, despite its weak points. It is based on very fundamental business relationships which managers find easy to work with, yet insightful. The input data, although often requiring a great deal of effort to compile, is composed of those things which firms have available to them, to a large extent due to the requirements of financial accounting. This makes the development and up-dating of breakeven less difficult than with other models, and it can be used as a common basis of discussion on all levels of management and between virtually all departments.

It is for all of these reasons that it is a comparatively inexpensive tool which makes it equally feasible for a small business as for a large corporation. For those organizations which have existing computer capacity sufficient to handle necessary computations, BE analysis is painless to construct. It does not rely on such equipment, however.

Breakeven analysis is also very flexible. It can be used in a variety of different capacities, as it can yield information useful to pricing decisions, help determine the feasibility of new products, including financing considerations, and forecast profit at various levels of sales for existing products. With special adaptations, it can also incorporate rate of return planning into the analysis and aid in setting volume-sensitive ROI targets based on return on new assets.¹² As you can see, it also works well in conjunction with, and in addition to, existing numerical measures of project performance.

Breakeven is not designed to be a conclusive measure upon which go or no-go decisions are made. It does, however, help to clarify relationships, assumptions, and the impact of our environment—all essential to any good decision. In fact, in current literature while much research has been done on sophisticated numerical analysis techniques aimed at improving project ranking and justification, little emphasis has been placed on this crucial aspect of the decision making process. In the words of K. Larry Hastie, "What is needed are approximate answers to the precise problem rather than precise answers to approximate problems," and that in a nutshell is what BE analysis provides.¹³

Productivity of investments can also be measured by utilizing breakeven analysis. Those investments which effectively increase fixed cost and lower variable costs to a significant degree, make the firm more competitive and more productive. These changes enhance the viability of the firm thereby increasing shareholder wealth. Thus, breakeven analysis helps to promote the necessary objective of the maximization of shareholder wealth which we spoke of extensively in our earlier remarks. Although it may not justify those projects whose benefits are not fully realized during the frame of time established for breakeven analysis, this simple rule can give managers a reference by which to make such a judgement in the long run.

With a little effort devoted to breakeven analysis on the part of financial experts, even more modifications could not only eliminate its weaknesses, but make it a virtually indispensable planning tool. Indeed, breakeven analysis has been overlooked far too long as an extremely useful tool for management in understanding their firms' business operations, their environment, and the implications of their business decisions. In making management aware of such things, it paves the way toward more effective and productive long range planning, which would serve to increase those firms' competitiveness and through a combined effort--U.S. competitiveness as well. That, after all is the bottom line.

"ENDNOTES"

COMPONENTS OF LONG RANGE PLANS ***

| | U.S. | Japan |
|--|------|-------|
| *Environment forecasting | 48 | 74 |
| Analysis of the company strengths and weakness | 48 | 58 |
| Forecasting the future of own company under present policy | 48 | 42 |
| Problems and opportunities of the company | 65 | 40 |
| Mission and objectives of the company as a whole | 52 | |
| Goals and policies of long range plan | 48 | 95 |
| Diversification | 39 | 30 |
| Internal new products development | 35 | 53 |
| Company acquisition | 39 | 2 |
| Research and development | 35 | 37 |
| New market development | 57 | 26 |
| Multi-national management | 13 | 23 |
| Strengthening the marketing competitive power | 30 | 37 |
| *Cost reduction plan | 35 | 53 |
| Computerization plan | 17 | 25 |
| Others | 4 | |
| Sales plan (marketing plan) | 74 | 67 |
| Production plan | 35 | 67 |
| *Capital investment | 78 | 90 |
| Investment subsidiaries | 35 | 39 |
| Material plan | 17 | 26 |

COMPONENTS OF LONG RANGE PLANS CONTINUED

| | U.S. | Japan |
|--|------|-------|
| *Manpower plan | 52 | 86 |
| Education and management development | 13 | 23 |
| Employee welfare | 9 | 12 |
| Planning of organization | 26 | 26 |
| *Estimated profit and loss statement | 87 | 70 |
| *Estimated flow of funds | 83 | 72 |
| *Estimated balance sheet | 78 | 49 |
| Assignment of responsibility | 22 | 25 |
| Schedule of programme | 35 | -- |
| Unsolved problems | 22 | 25 |
| Contingency plans for adverse situations | 57 | 4 |

**All figures expressed in percentages.

FOOTNOTES

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