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THE IMPORTANCE OF KEY SUCCESS FACTORS FOR THE MARKETING OF MATURE INDUSTRIAL PRODUCTS

RESUME

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ABSTRACT

This paper reports the implications of interest to industrial marketing managers of an empirical research project concerning the key success factors of mature industrial products.

Four main conclusions can be drawn from the survey data:

1 - There are critical success variables in the mature industrial context; 2 - The critical success variables change from industrial product to product; 3 - Homogeneity is greater in unit technology than in products using mass or process technology; and 4 - the importance of the several competition modes (quality, cost, delivery) change within the mature industrial context.

The paper concludes by extracting implications useful for industrial marketing managers.

I - INTRODUCTION

Empirical research was conducted within the mature industrial context to test. The propositions:

1 - Different types of products have different key success factors (1).

2 - For each type of mature industrial product, organizations whose strengths match the key success factors will outperform their competition.

The study was restricted to mature industrial products for several reasons. First, it was hoped that by limiting the study's scope to a specific type of product, it would be possible to test whether different requirements for success could be identified, even within apparently similar product contexts. Second, mature industrial products are of great importance, both in terms of their relative numbers and in terms of their contribution and value in the American economy. (Thorelly and Burnett [25]).

(1) By "key success factors" we mean those tasks or variable characteristics which must be performed particularly well for an organization to outperform its competition - Andrews, [3]; Christensen [8].

II - THE RESEARCH METHODOLOGY

The research methodology involved five steps.
The first step was to develop a typology of industrial products. With the typology constructed, industries were selected for their cells. A sample of firms for each industry was then selected. Next a list of variables (e.g. service, image, location) was chosen from the literature. Finally, data was collected (from 190 survey questionnaires).

II.1. The Typology of Mature Industrial Products

A parsimonious way of characterizing the mature industrial product context was needed. While many possible classifying schemes exist, literature suggested the two-dimensional typology presented in Exhibit 1 within each cell are examples of industries pertaining to that cell. The two dimensions are technology and transaction complexity.

Exhibit 1 about here

Technology was chosen because it can be argued that technology is especially important for industrial products. In contrast to selling in consumer markets, where emotional factors play a

large role, the industrial purchasing process is mostly rational, with emotional elements playing a very secondary part. There follows the implication that industrial buyers stress the intrinsic characteristics of products primarily, and their intangible and perceived aspects only secondarily. Such intrinsic characteristics are closely related to the concept of technology.

Technology was operationalized through unit (or small batch), mass (or large batch), or process, and is represented by the three columns of Exhibit 1. Several authors (Woodward, [29]; and Hellriegel and Slocum, [15]) have used this operationalization in order to study the requirements for success in different contexts. Others have opted for operationalizations which are distinct from but ultimately partially equivalent to those employed in this study (1).

(1) For instance, Perrow [23] distinguished between routine and non-routine technology based on the frequency with which exceptions occurred, and on the extent of the search required in the event of those exceptions. In unit technology, exceptions occur frequently, but they do not require extensive search (Woodward,[29]). In contrast, in process technology, exceptions (emergencies, production stoppages, etc.) are quite rare, but when they do occur, the necessary search is extensive. In consequence, unit technology can be designated as "non-routine" and process technology as "routine" technology.
As a final example, Harvey [14] used a scale of technical diffuseness to operationalize technology. His scale reflects the average number of product changes made by each firm during the ten years preceding the study. Therefore, "the more technically diffuse the firm, ... the greater the degree of made to order" in its products (op. cit., p. 249). As Harvey himself recognized, this means that the technically diffuse production mode corresponds to Woodward's unit technology.

The selected environmental dimension was transaction complexity. A review of the literature on industrial marketing and organizational buying behavior was conducted to determine the particularly significant dimensions of the task environment of industrial products. Transaction complexity was selected (1).

Transaction complexity is an index consisting of three highly-correlated variables: infrequency of purchase, buyer-seller interaction (time and number of people involved in a specific purchase), and risk of product malfunction. As has been indicated (Fisher [12], Webster [26], Lilien [18], Johnston and Bonoma [16]) the first two components of the index - infrequency of purchase and buyer-seller interaction - are closely correlated. Goods which are typically purchased frequently, such as office supplies, heating fuel, and abrasives, are usually bought with very little buyer-seller interaction. On the contrary, those goods for which buyer-seller interaction is greater also tend to be purchased infrequently. Examples of such products are production machinery and other capital equipment including cranes or computers (Bodge [9], Lilien [19], Levitt [17]).

The third component of the transaction complexity concept is the risk of product malfunction. A buyer perceives a product as "risky" if it is complex or if the buyer is not certain about

(1) Several other concepts within the task environment have received great attention. Among them: change and uncertainty (Duncan [10]); heterogeneity (Hasenfelt [13]); richness (Aiken, and Hage [1]); and complexity (Emery and Trist [11]. However, rather than using these dimensions, which are important for any type of product - consumer, industrial and services alike - it seems more appropriate to focus on those dimensions which are especially important for industrial products specifically.

how the product will actually perform, in which case great negative consequences may occur (Bauer [5], Sjoberg [24]). The importance of the concept of product risk has been stressed by several authors in marketing literature (e.g., Bettis [7], Baird [4], More [22]).

As has been noted, there is a strong correlation between purchase infrequency, buyer-seller interaction, and product risk. This supports their treatment as a singular construct - our transaction complexity (1).

Exhibit 1 presents the typology to be used in this study. The

(1) It can be argued that industrial marketing and organization buyer behavior literature indicate that other variables are important, besides those included in the transaction complexity index. However, it is not possible to include all of the theoretically relevant variables in any typology. If the study were to do so, the typology would become extremely complex. This study, then, had be selective.

This study utilizes those variables judged to be more important, in terms of both the number of references in the literature and the relevance attributed to them by experts in the field of industrial marketing and organization buyer behavior.

Most of the other variables indicated in the literature as being significant, such as vertical versus horizontal market, standardization, importance of quality, and the extent of interaction among an organization's departments, are related to those used in this design [21; 26]. In fact, as the transaction complexity increases, the market tends to become more vertical; standardization, lower; the importance of quality, higher; and the interdependence among the several departments of an organization, more extensive. This much has been observed by Fisher [12] and Dodge [9].

horizontal dimension represents technology (unit-mass-process). The vertical dimensions represents transaction complexity.

It should be noted that although all combinations between technology and transaction complexity (that is, the completion of all twelve cells) are theoretically possible, empirically, four of them (those cross-hatched in Exhibit 1) are so thinly populated as to be of minor theoretical concern.

II.2. - Selection of the Industries

Once the typology was constructed, industries had to be selected to fill its cells.

The decision was made to focus on three cells: cells number one, three and seven, due to space and resource limitations.

Indeed, as will be discussed below in section 2.4., data for this research had to be collected first hand, from several panels which were composed of industry experts (mostly managers). Performing the necessary tests for all cells would have been extremely time-consuming since it would have involved selecting first the industries (which, as shall be seen had to satisfy several criteria) then the firms for each industry (whose selection, also had to obey several criteria), and, finally, the panel of respondents for each industry.

Moreover, in order to test this research, it is not necessary to make tests in every cell of the typology. The main objectives of the research were to test whether key success factors change from one context to another, and whether firms whose strengths match the key success factors will outperform their competition. Given these aims, tests on three cells, or six industries, would

provide a good basis for induction.

For the reasons outlined above, the decision was made to test only three cells instead of all the typology cells, and to select cells one, three and seven, as opposed to possible combinations of other cells.

The selected industries had to satisfy several criteria. They needed to be purely representative of just one cell of the typology and possess no hybrid characteristics. They could be engaged in only limited exports, to avoid problems of cross-subsidization and the possibility that some products which are mature in the United States market might be in an early phase of their life cycle in some foreign countries.

Most important, the industries had to be homogeneous. With this requirement, the existence of more than one strategic group in each industry was minimized, and consequently, the possibility of organizations relying on different strengths to compete. When the homogeneity requirement was not met, the industry was thoroughly analyzed, and a strategic group within it which satisfied the other criteria was selected. This is why, in the list of industries below, we selected a subset of compressors (stationary compressors of one thousand horsepower or more, typically used in large manufacturing establishments and in chemical process services), and, a subset of valves (standard ball, butterfly, and gate valves, excluding custom-made valves such as those used in nuclear plants). In other words, the unit of analysis in this research was either homogeneous industries (with only one strategic group within them), or specific strategic groups within the industries. Thus, hereinafter, the term "industry" indicates either a homogeneous industry or a strategic group.

Based on these criteria, the following six industries - two for

each cell - were selected:

Cell 1: LARGE STATIONARY COMPRESSORS (1000 HORSEPOWER OR MORE)
Used in large manufacturing establishments and in chemical process services. One example is centrifugal air compressors. (SIC codes 3563101-18 and 3563142-56)

METAL CUTTING MACHINE TOOLS (SIC code 3541)
The emphasis was on numerically, computer, or manually - controlled drilling, grinding and boring machine tools, transfer lines, machine centers, and turning and milling machines.

CELL 3: STANDARD ANTIFRICTION BEARINGS (SIC codes 36621/2/3)
(only standard bearings manufactured in large batches - specialily bearings, such as those of very large size or with extremely high precision requirements, were excluded.)

STANDARD VALVES (SIC codes 3494362-5, 3494367-0, and 3494372-5) only commodity-type valves which are mass produced - Excluded from consideration were custom-made specialily valves, such as most of those used in the nuclear and petroleum industries.)

CELL 7: IRON ORE (SIC code 10)
COAL (SIC code 1211)

II.3. Selection of the Sample of Firms in Each Industry

With the industries selected, the next step was to choose specific business units and firms within those industries. The selection of organizations had to obey several criteria:

- Availability of published financial data (annual reports or SEC line-of-business data on the specialized organization or on the busines unit of interest.

- Low Exports. For the reasons outlined above, the selected organizations had to have a low percentage of exports (less than ten percent).

- Concentration of sales (over 70%) in the industry of interest (either by the entire firm itself or by the strategic business unit for which return-on-assets data was available.

- Low degree of vertical integration of the firm to which the SBU the belongs. The reason was twofold: to control for vertical integration as a source of benefits, and, more importantly, to counter the fact that vertically integrated firms often sacrifice the performance of an SBU in order to benefit other units up - or downstream in the flow of production.

Once these criteria were decided upon, there still remained the choice of the ideal number of such firms in each industry. The choice should reflect two factors working in opposite directions. 1) On the one hand, the larger the number of firms,

per industry, the larger the total sample and, therefore, the lower the probability of sampling errors. 2) On the other hand, working with a large number of firms in each industry would involve two risks: a) Some of the selected firms might not satisfy all of the above-stated criteria. b) Employing a large number of firms would also make the questionnaire longer, thus reducing the response rate and possibly the response quality of the expert panels.

In the end, the use of five firms for each industry was decided upon as the best trade-off between these competing factors. This meant that thirty organizations (five firms x six industries) were included in the total research sample.

II.4. The List of Variables

Industrial marketing, organizational buyer behavior and technology were reviewed in search of those variables which were generally designated as important in specific types of technology and transaction contexts. The output was the list presented as Exhibit 2.

As an example of the kind of comments in literature which underlie the list of attributes presented in figure 6, Bessi and Pahle [6] state that image is a specially important tool to manage a capital equipments business market share (pp. 160).

II.5. The Survey

The survey was carried out in the United States and was based upon information supplied by 190 questionnaires. For a detailed explanation of the survey see the appendix "Where the Data Comes From". Exhibits 3 and 4 present the results of the research. The results are based on information supplied by expert panels in a total of twelve panels (two panels for each industry). The panels were made up mostly of managers in companies manufacturing the products.

Exhibit 3 shows the importance (as judged by the first set of expert panels) of the seventeen variables for the profitability of companies in each mature industrial product.

The variables are listed according to the average rating they received. A scale of one (not important) to seven (extremely important) was used.

Exhibit 4 shows data on the selected thirty organizations. The exhibit presents the firms performance rating and how the members of a second set of panels (distinct from the former) rated the organizations (compared to competition) on the five variables which had been selected. Again, a scale of one (very poor) to seven (excellent) was used.

The first column of Exhibit 4 lists all thirty organizations included in the research. The first four belong to the iron ore industry, the next six to coal, the next five to machine tools, etc. No firm is identified by name for reasons of confidentiality and anonymity which were promised to the experts.

Next to each organization is its performance rating (for a more detailed explanation see the appendix "Where the Data Comes From" and the average ratings it received in the variables listed at the top of Exhibit 4. These variables are the five variables rated as most important for performance in a given industry/strategic group by the first panel of that product (see Exhibit 3). The first five variables pertain to the iron ore as well as to the coal industry; the next five, to machine tools and compressors; and the last five, to bearings and valves.

III. RESULTS

Some basic conclusions are suggested by the survey, namely:

1 - There are critical variables within the mature industrial context.
2 - Those critical variables change from product to product.
3 - Homogeneity is greater among organizations using unit technology than among organizations using mass or process technology.
4 - The importance of the several competition modes (quality, cost, delivery) change within the mature industrial context.

We shall briefly analyze each of these conclusions below.

III.1. There Are Critical Variables Within The Mature Industrial Context

This research points to four indicators supporting the notion that key variables do, indeed, exist. That is, that for any mature industrial product, there are some tasks an organization's performance is particularly dependent upon.

1. DO KEY SUCCESS FACTORS EXIST?

1. The first indication for the existence of key variables is provided by the data obtained from the first set of panels. The industry experts were asked to rate, on a seven

point scale, the importance of seventeen variables for the performance of an organization in six different industries. In all mature industrial products, they rated some variables as more important, others as less important. Some variables were rated near the top of the scale, others near the bottom, and still others in between. The first are, in the experts'opinion, the key success factors.

The existence of considerable variance among the ratings of the seventeen variables in each of this study' s products is, therefore, a first indication that in any context there are some variables which are more critical than others (key success factors). Please see Exhibit 5A

2. To test for the statistical significance of the difference among the variables' ratings in each product, several T tests were performed. Exhibit 5B shows the T tests for the six products analyzed in the research. As can be seen, for each product, there are statistically significant differences between the variables' ratings. In the machine tool industry, for instance, the difference between the ratings attributed to the working force's technical knowledge and to production management is significant at the 0.0052 level (0.26 x2 because it is a two-tailed test).
The difference between the ratings of working force technical knowledge and purchasing is significant at the 0.0002 level, and so on.
(Please see Exhibit 5B).

The fact that in each of the six industries, T tests among the variables' ratings are statistically significant, constitutes a second indication that in any context there are some factors which are more critical to success than others.

3. The third indication for the existence of key success factors is provided by the responses of the second set of panels. Please recall that these panels rated a selected sample of organizations in the five variables which the first panels considered to be most critical in the industries which the firms belonged to.

In order to regress the firms' performance on their ratings on the five variables, an index was computed, representing a firm's rating on all five attributes of its cell.

The index is a weighted sum of the ratings of each firm in the five variables. The weights are the ratings given by the first panel to each variable in each mature industrial product (1).

(1) Let us take a firm in the iron ore industry, for example, Firm Number One in Exhibit four. The ratings of the first firm on the variables location of reserves, quality of reserves, distribution, labor relations and technical sophistication of the equipment were respectively 6.25, 4.13, 4.6, 4.71 and 5.38.
The ratings of these same variables in the iron ore industry, as judged by the first panel, were 6.7, 5.8, 5.9, 5.0 and 5.4 (Exhibit three).
Therefore, the weighted sum of Firm One is (6.25 multiplied by 6.7) plus (4.13 multiplied by 5.8) plus (4.66 multiplied by 5.9) plus (4.71 multiplied by 5.0) plus (5.38 multiplied by 5.4) which equals 145.6.
Once the weighted sum of each firm was calculated, the deviation from the mean of the industry the firm belongs to was taken, and then that deviation was divided by the industry mean. Finally, the resultant quotient was multiplied by 100 to obtain percentage values. The formula is the following:

$$\frac{\text{(weighted sum of firm) minus (average of the weighted sum of all the firms of the industry the firm belongs to)}}{\text{(average of the weighted sums of all the firms of the industry the firm belongs to)}} \times 100$$

- It is important to take the deviation from the sample average because a weighted sum of 70 (for example) is good or bad depending upon the other sample firms having a weighted sum of 60 or 80 (for example).
In the former case the 70 is good - in the latter case, it is bad. That is, one must take into consideration what the weighted sums of other firms of the same industry are.
- One then divides by the industry average because how bad a deviation of minus 10 (for example) from the industry average is, depends upon whether that average is 40 or 80. In the former case, it is, of course, worse.
- Finally one multiplies by 100 to work in terms of percentage values.

The meaning of the index is simple. It indicates how a firm is rated (compared to its competitors) in what is important (as judged by the first panel) in its industry. The higher a firm is rated in those variables hypothesized to be most important for performance in the industry, the higher its index will be. The lower it is rated in the industry critical variables, the lower its index will be.

With ten observations (organizations) for each typology cell (cell number one - machine tools and compressors; cell number three - valves and bearings; cell number seven - iron ore and coal) and a single regressor (the index representing how the organizations are rated overall in the five most critical variables), the degrees of freedom are eight and the results were as follows:

Cell 1: $r^2 = 0,62$; $P < .01$
Cell 3: $r^2 = 0.62$; $P < .01$
Cell 7: $r^2 = 0.89$; $P < .001$

The major inconvenience of the regressions is the small sample size (ten firms) and, consequently, the low number of degrees of freedom (eight). In order to increase the sample size, an across-cells regression was performed, in which all thirty firms belonging to cells one, three, and seven were used. The regressors the same index used above and cell dummies. The r^2 was 0.87 ($P < .001$).

The results indicate that there is a strong relation between how a firm is rated (compared to competition) in a few variables (the key success factors), and how it performs.

The higher a firm is rated in some variables, the higher its performance will be. Consequently, it does pay off for an

organization to be rated higher than its competition (that is, to have strengths) in some variables which are crucial for performance. It pays off to have strengths which match the key success factors.

4 - A final test was performed on all thirty firms. The sample of thirty firms was divided into two subsamples of firms rating higher and lower in the index. Then, the statistical significance of the difference of performance between the two subsamples was tested for (T test).

The level of statistical significance was high (0.004), indicating that the firms which are rated higher than their competition (which have strengths) in a few critical variables (key success factores) do indeed perform better than the competition.

III.2. Different Industrial Mature Products Have Different Key Success Factors

The existence of key success factors, discussed above, does not by itself imply that they differ from product to product. One could hypothetically have a situation where the same set of variables would be critical for performance in all types of mature industrial products. In such a case, one would have a universal theory of key success factors, within the context of mature industrial products.

However, the results of this research provide support for a contingency theory of key success factors. They suggest that what is critical for performance in one product is different from what is critical for performance in another product.

Using data from the first set of panels, T tests were made to compare the variable's ratings in each pair of cells: cells one and three; cells three and seven; cells one and seven. Exhibit 6 gives the results. The direction of the arrow (up or down) indicates whether a variable's rating increases or decreases from one cell to the next. The numbers below the arrows and within brackets indicate the level of statistical significance of an increase or decrease in a variable's rating from one cell to the next.

For instance, in the column comparing cell one and cell three, the first row indicates that the product quality index (average of the ratings received by image, product R & D, service and technical knowledge of the sales force) is more important in cell one than in cell three. The difference in rating is significant at the 0.0001 level (one tail test).

As Exhibit 6 illustrates, the importance of almost every variable changes considerably from cell to cell. This fact lends further support to the notion of a contingency theory of key success factors.

Three exceptions exist: marketing knowledge of the sales force; advertising/sales promotion; and customer financing.

The marketing knowledge of the sales force could, perhaps, be called a UNIVERSAL SUCCESS FACTOR of mature industrial products (see Exhibits 3 and 6). The variable itself is ideal for working in contexts where the risk of product functioning is average or low, but not extremely low (it achieves its highest importance in cell three). However, in industrial products, risk never reaches very low levels. Moreover, in the contexts where competition in product quality dominates (e.g., cell one - see Exhibit 8), the technical knowledge of the sales force is critical. This, in turn, enhances the importance of the

marketing knowledge of the sales force (the reverse is not true) - Moncief [21].

For these reasons, the marketing knowledge of the sales force seems always to be quite important in industrial mature products.

Advertising, sales promotion, and customer financing are never of great importance in cells one and seven. They seem to be UNIVERSAL NON-CRITICAL SUCCESS FACTORS in the mature industrial context (see Exhibit 3 and 6). This is the result of two factors. First, the risk involved in buying industrial products is generally greater than in buying consumer products (Fisher [12]; Webster [27]). Second, the study of cells five and eight in the typology was not included in the current research. In both of these cells, the risks of product functioning and availability are very low, and as a consequence, price competition dominates. In these two cells, one could expect advertising and customer financing to achieve a greater importance (Lynch and Hooley [20]; Park, Roth and Jacques [28]).

In all probability there are also moderating variables at work. A moderating variable representing the influence of low risk (cost competition) on the importance of advertising may be the marketability of the market (Dodge, [9]). The greater the number of potential customers and the lower the risks of product functioning and availability, the greater is, perhaps, the importance of advertising. This is a topic for future research.

Similarly, there may be a variable moderating the relationship between cost competition and the importance of customer financing, namely the relative financial power between sellers and buyers. This would mean that customer financing should achieve a significant importance only when cost competition is important and the industry sellers typically have more financial

power than the buyers. In the coal industry, for example, where the buyeres are frequently utilities, the utilities usually enjoy higher financial power than the coal mining firms. This may explain the minor importance of customer financing in cell seven. This is a topic for future research as well.

III.3. Homogeneity Among Mass Technology Firms is Lower Than Among Unit or Process Technology Firms

Exhibit 1 presented the typology as it was used in this study, with examples of industries illustrated in each cell. The fact that some cells of the typology are very sparsely populated underscores the fact that homogeneity among mass technology firms is lower than among unit or process technology firms. This difference (which was first noted by Woodward [29] who, however, failed to explain it conveniently), is due to the fact that while there is only one cell in the unit technology column and three in the process technology column, there are four cells in the mass technology column (see Exhibit 1). That is, the number of cells in mass technology is larger than in the other types of technology. This means that the variety of products produced by mass technology is greater than the variety which can be found in unit or process technology. It ranges from conveyors and equipment for handling materials (trucks and tractors), in cell two, to abrasives and marking devices in cell five. As a result, mass technology firms are much less homogeneous among themselves than firms in other types of technology.

Moreover, the fact that some cells of the typology are very sparsely populated, stresses that THERE IS AN EMPIRICAL RELATION BETWEEN THE TYPE OF TECHNOLOGY (unit, mass or process) used by a firm AND THE FOLLOWING VARIABLES:

A) Type of products sold by the firm. Unit technology firms produce capital goods (installations and equipment). Process technology firms do not produce these types of goods. Mass technology firms produce all types of goods.

B) Marketing characteristics of the goods produced by a firm (price, technical complexity, etc.). Typically, unit technology firms produce high price, high complexity commodities which are associated with high critical contingencie, purchased very infrequently and with extensive buyer-seller interaction. The opposite situation exists in process technology firms, whose output is generally fairly standardized. Mass technology stands between these two, and in its output one can find goods with all marketing characteristics.

C) Characteristics of the task environment of the organization. Unit technology firms have a task environment characterized by a very high level of transaction complexity. The task environment of process technology firms is characterized by lower transaction complexity. Mass technology stands in between.

III.4. The Importance of the Various Competition Modes (Quality, Cost or Delivery) Change Within the Industrial Mature Context

Evidence supporting this proposition is seen in an analysis of variance (ANOVA) performed on cells one, three, and seven for the following variables:

- Product quality competition (composed of the attributes

of service, product R & D, sales force technical knowledge and image);

- Product cost competition (attributes of Process R & D and size);
- Product delivery competition (attribute distribution).

The results are presented in Exhibit 7. From the exhibit one can conclude, with a high degree of confidence, that the importance of each competition mode (as judged by the first panel ratings) is different from cell to cell in the typology. This means that the importance of each competition mode is different in equipment goods, components and raw materials.

From the information provided by the T tests presented in Exhibit 6, one can conclude that product quality competition is most important in cell one and then decreases in importance towards cell seven (see Exhibit 8); that product delivery competition, on the contrary, was rated highest in cell seven and decreases towards cell one; and that product cost competition is most important in cell three and then decreases in importance in the direction of both cells one and seven (please refer Exhibit 8).

IV. IMPLICATIONS FOR INDUSTRIAL MARKETING MANAGERS

The results presented in Section III have several implications for management.

From Section III.1. (empirical evidence supports the contention that key success factors exist within the mature industrial context) follows the importance of FOCUS.

Managers must dedicate the majority of their time, their best personnel and the bulk of their company's budget to the few critical tasks in which excellence is required. They should concentrate their efforts on performing a few tasks very well, instead of performing a great number of tasks only reasonably well. All non-essential tasks should be done in a merely satisfactory manner. In short, avoid global marketing mediocrity.

From Section III.2. (key success factors change from product to product) follows the need that (even within the restricted domain of mature industrial products), when considering an extension of their company's product line, marketing managers should ask themselves what the key success factors of that new product are, and if their firms are better at those success factors than the new competitors they will face. When considering offering a new product, an organization should first analyze whether or not its strengths (those tasks it does best) match the tasks which are critical for success in that product.

An affirmative answer to this INTROSPECTION PROCESS is an incentive to offer the product, whereas a negative one should

encourage management to re-evaluate its plans with care. It may well happen that a potential new product is so attractive (in terms of profits, potential growth, size, etc.) that in spite of lacking the required strengths, an organization decides to proceed with it. In such a case, however, it is likely that the company will perform below average in the new market. As this study shows, above average performance demands those strengths which match the key factors for success of each product.

From Section III.3. (homogeneity is lower among mass technology firms than among unit or process technology firms) it follows that organizations using mass technology should use special caution when considering the introduction of a new product. It is the mass technology firm which will face new success factors and competition practices when extending its product line (even when the technology employed in the production of the new product(s) will be the same - i.e. mass, versus unit or process).

Since no organization can be expected to possess strengths in all areas, new product introduction (even using the same type of technology) is a riskier business for mass than for unit or process technology firms.

From Section III.4. (the importance of competition in quality, cost and delivery changes from product to product) it follows that ORGANIZATIONS SHOULD ADAPT THEIR MARKETING OFFERINGS (service, price, etc.) to the position those organizations occupy in the typology (Exhibit 1).

A change from one typology cell to another may require alterations in the marketing offering and/or competition practices. If these changes are not made, the organization will be poorly adapted to its new situation, and performance will suffer, as a result.

CONCLUSION

This paper has reported on the implications of interest to marketing managers of a research project concerning the key success factors of mature industrial products.

The empirical evidence suggests that key success factors do, indeed, exist; that they change from product to product; that mass technology products are less homogeneous than unit or process technology products; and that within the industrial mature context, there are changes in the importance of the various competition modes (quality, cost and delivery).

These assertions lead to several implications: the need for industrial marketing managers to focus on each product's critical success variables; the need for careful evaluation of one's company's strengths before extending the product line (of special importance for mass technology firms); and the need to adapt the marketing offering to the special requirements seen in the typology cell (Exhibit 1) which the organization's product belongs to.

Follow-up research could study other typology cells and/or repeat this analysis for non-mature industrial products. Comparisons could then be drawn with the results contained in the current report.

Finally, the possibility that customer financing and advertising/sales promotion are universal non-critical success factors, and that the marketingknowledge of the sales force is a critical success factor for industrial products, deserves

further attention. The moderating role played by variables such as the horizontality of the market and the relative financial power between sellers and buyers (as discussed in Section III.2.) should also be analyzed.

APPENDIX

WHERE THE DATA COMES FROM

The data collection process consisted of three distinct stages:

A - In the first stage, panels of experts (mostly managers, but also some consultants and buyers from the industry in question), were asked to rate the order of importance of seventeen variables for profitability on each industry. The panels of experts, one for each industry previously indicated, considered variables such as service, distribution, and technical sophistication of the equipment (see Exhibit 2). In other words, the experts were asked: "On a scale of 1 to 7, how would you rate the importance of each of the following seventeen variables for the profitability of an organization in industry x?"

The questionnaires also contained an open question to allow those who responded to indicate other variables they felt critical for success in each industry. Care was taken that all industry panels consisted of a similar cross section of experts. Exhibit 3 presents the results.

B - In the second stage, information was obtained on how a selected sample of companies marketing each product rated on the several variables. Since it is very difficult to evaluate an organization's rating on a given variable (such as service, image or distribution) through published data, a second set of expert panels (one for each of the six

products referred to above), was assembled. These panel members, which were different from the members of the first panels, included some industry experts from financial institutions, but they were mostly managers from corporations in the industry. They were asked:

> "Compared to the industry average, how would you rate the following organizations according to the following variables?" Again a scale of one (very poor) to seven (excellent) was used.

In order to keep the questionnaire short, the questionnaire sent to the second panels of each industry included only the five variables which had been judged as being most critical (key success factors) by the first panel of that industry. No manager was allowed to rate his own organization.

C - <u>In the final phase of data collection, financial data on the selected organizations</u> was collected from annual reports and 10ks. The value of each firm's return on assets was computed on a five-year average.

It should be noted that in order to minimize the possibility that the panelists would be biased towards the best performing firms, several steps were taken. The objective of the research was not communicated to the members of the second set of panels; the order of the firms in the questionnaires was alphabetical, not according to increasing or decreasing levels of performance. Bankrupt companies and badly performing organizations of much smaller size (and, therefore, visibility), were excluded from the selected sample of firms. Five-year averages were used as measures of organizational performance, thus

decreasing the likelihood that the panels' members had perfect information regarding the ranking of the companies in terms of performance.

The vertical dimension of Exhibit 4 lists all thirty companies included in the research. The first four are involved in iron ore; the next six, coal; the next five, machine tools; five, compressors; five, bearings; and the last five, valves.

Next to each company is its performance rating, followed by the average rating it received in the variables listed at the top of Exhibit 4. These variables are the five variables rated as most important for performance in a given product by the first panel of that product.

The first five variables pertain to the iron ore as well as to the coal industry; the next five, to machine tools and compressors; and the last five, to bearings and valves.

Finally, it was important to take into account that the average profitability for one industry could be higher or lower than that for another. In order words, it was necessary to acknowledge that the industries could differ in attractiveness.

In order to control this industry effect, the difference between its own performance and the industry average was computed for each firm, then divided by the industry average and multiplied by 100 (in order to work with percentage values).

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Exhibit One

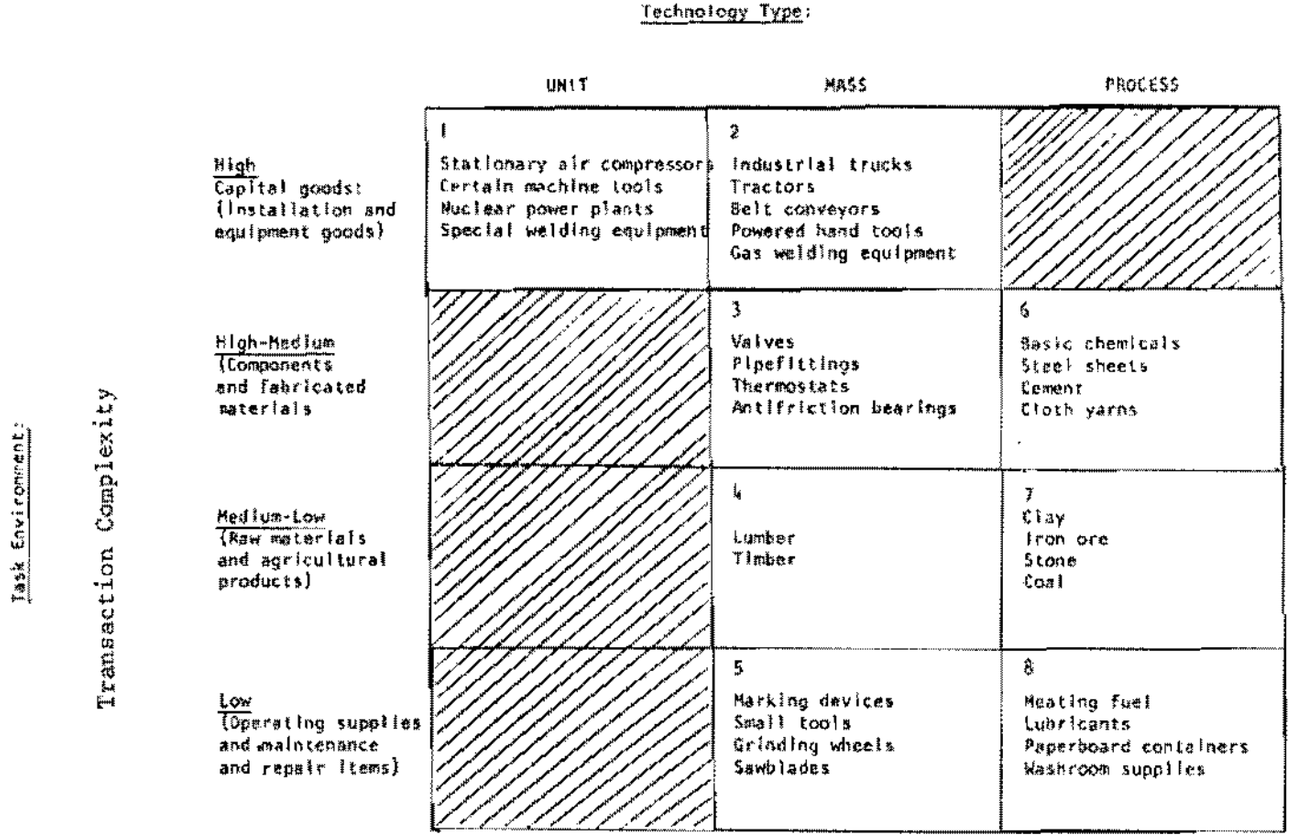

Technology Type:
UNIT
MASS
PROCESS
Task Environment:
Transaction Complexity
High
Capital goods:
(Installation and
equipment goods)
1
Stationary air compressors
Certain machine tools
Nuclear power plants
Special welding equipment
2
Industrial trucks
Tractors
Belt conveyors
Powered hand tools
Gas welding equipment
High-Medium
(Components
and fabricated
materials
3
Valves
Pipefittings
Thermostats
Antifriction bearings
6
Basic chemicals
Steel sheets
Cement
Cloth yarns
Medium-Low
(Raw materials
and agricultural
products)
4
Lumber
Timber
7
Clay
Iron ore
Stone
Coal
Low
(Operating supplies
and maintenance
and repair items)
5
Marking devices
Small tools
Grinding wheels
Sawblades
8
Heating fuel
Lubricants
Paperboard containers
Washroom supplies

EXHIBIT TWO

THE QUESTIONNAIRES CONTAINED A TOTAL OF SEVENTEEN ATTRIBUTES RELATED TO DIFFERENT ORGANIZATIONAL AREAS. THE SEVEENTEEN ATTRIBUTES WERE:

1 - IMAGE (goodwill , prestige, reputation). (the extent to which the name of the organization creates a generally positive attitude in the minds of the customers, not merely whether the organization is market visible or not).

2 - TECHNICAL KNOWLEDGE OF THE SALES FORCE (technical knowledge of the methods used in producing the products; ability to advise customers what is technically feasible; ability to evaluate the capacity of the organization to meet the technical requirements implied by the customer's needs).

3 - MARKETING KNOWLEDGE OF THE SALES FORCE (ability to persuade customers and to cover the territory well, knowledge of the marketing-credit, delivery, etc.-- in general, policies of the organization and knowledge of the customer's needs and values).

4 - ADVERTISING AND SALES PROMOTION (all types of advertising including TV, radio, outdoors, direct mail newspapers, and specialty magazines; all types of sales promotion, including sampling and trial, shows and exhibitions, price incentives and premiums).

5 - APPLIED PRODUCT RESEARCH AND DEVELOPMENT (activities directed towards modifying, improving, adding new features to, and developing new products)

6 - SERVICE (quality and availability; installation, coaching the customers in using the product, and repairs).

7 - PROCESS RESEARCH (engineering activities directed towards changing, not the products themselves, but the way the products are manufactured).

8 - FIRM SIZE (to exploit economies of scale due to greater mechanization, as well as economies in the materials handling, administrative, marketing and financial areas).

9 - CUSTOMER FINANCING (all types of financial arrangements offered by the organization to customers in order to increase their purchasing power or facilitate the terms of sales and, therefore, to increase the capacity utilization of the supplier, e.g., financing expansion of customer installations, guaranteeing of customer bank loans, offering better credit terms for sales).

10 - DISTRIBUTION (transportation, warehousing, and expedition) (ability to maintain low output and input distribution costs and to assure that the deliveries of the outputs are made on the right date and in the right quantity),

11 - LOCATION OF THE MANUFACTURING FACILITIES (proximity to the market; to transportation means, such as lakes, rivers, railroads, and highways; or to sources of raw materials and labor).

12 - TECHNICAL SKILLS OF THE WORKFORCE IN THE MANUFACTURING DEPARTMENT (technical skills and level of expertise required from the workforce in the manufacturing plant in order to perform their tasks).

13 - QUALITY CONTROL SYSTEM (a formalized system to inspect, sample, and test the quality of the products, distinct from the production technology and from workers activities directed toward manufacturing those products).

14 - PRODUCTION MANAGEMENT (planning and routinization of the work flow and the tasks to be performed in the manufacturing department, and of the formalized cost control system in that same department).

15 - PURCHASING DEPARTMENT (ability to obtain access to sources of inputs (raw materials, etc) and / or low price for inputs and / or a steady supply of inputs).

16 - LABOUR RELATIONS (1 - few accidents and mistakes by plant workers and few stoppages and interruptions in plant prodution; 2 - low number of strikes, and low level of turnover, lateness, and absenteeism).

17 - TECHNICAL SOPHISTICATION OF THE EQUIPMENT (extent to which the equipment and machinery used in the manufacturing plant of the firm is up to date).

EXHIBIT THREE - FIRST PANELS DATA

Compressors		
Attribute	Ranking	Rating
Service	1st	6.2
Personal sales technical knowledge	2nd	6.2
Image	3rd	6.2
Working force technical knowledge	4th	6
Product R&D	5th	5.6
Personal sales marketing knowledge	6th	5.3
Quality Control System	7th	5.2
Technical Sophistic Equipment	8th	4.6
Prodution management	9th	4.5
Labour Relations	10th	4.4
Process R&D	11th	4.1
Purchasing	12th	3.8
Size	13th	3.7
Distribution	14th	3.4
Advtg/SP	15th	3.2
Location	16th	3.1
Customer Financing	17th	2.7

Machine Tools		
Attribute	Ranking	Rating
Service	1st	6.8
Personal sales technical knowl	2nd	6.5
Image	3rd	5.9
Product r&d	4th	5.8
Working force technical knowledge	5th	5.6
Personal sales marketing knowl.	6th	5.5
Quality Control System	7th	5.3
Technical sophistic equipment	8th	4.9
Process R&D	9th	4.8
Product management	10th	4.3
Advertising	11th	3.8
Labour Relations	12th	3.8
Customer Financing	13th	3.7
Purchasing	14th	3.1
Size	15th	3.1
Distribution	16th	2.9
Location	17th	2.7

Bearings		
Attribute	Ranking	Rating
Quality control system	1st	6
Distribution	2nd	5.9
Process R&D	3rd	5.9
Product management	4th	5.6
Personal sales marketing knowl	5th	5.5
Technical Sophistic Equipment	6th	5.4
Image	7th	5.3
Personal sales technical knowledge	8th	5.3
Product R&D	9th	5.1
Labour Relations	10th	5
Size	11th	4.9
Work force technical knowledge	12th	4.7
Purchasing	13th	4.5
Service	14th	4.3
Advt/SP	15th	3.6
Location	16th	3.1
Customer Financing	17th	2.4

Note: The seventeen attributes were rated on a scale of importance from one (lowest), to seven(maximum)

Exhibit three — First Panels Data (continued)

Valves		
Attribute	Ranking	Rating
Distribution	1st	6.1
Process R&D	2nd	6.1
Personal sales; marketing knowledge	3rd	6
Prodution management	4th	5.8
Image	5th	5.8
Quality control system	6th	5.4
Technical Sophistic, equipment	7th	5.3
Product R&D	8th	5.3
Size	9th	5
Purchasing	I0th	4.9
Personal sales technical knowledge	11th	4.7
Labour Relations	12th	4.7
Service	13th	4.4
Working force; Technical knowledge	14th	4.4
Advtg/SP	15th	4.1
Location	16th	3.9
Customer financing	17th	2.6

Iron ore		
Attribute	Ranking	Rating
Location of reserves	Ist	6.7
Quality of reserves	2nd	5.8
Distribution	3rd	5.8
Tecnhical sophisti.	4th	5.4
Labour Relations	5th	5.
Prodution management	6th	5
Quality control system	7th	5
Process R&D	8th	4.8
Working force technical knowledge	9th	4.8
Personal sales; rechnical knowledge	10th	4.8
Size	11th	4.6
Product R&D	12th	4.5
Personal sales; marketing knowledge	13th	4.3
Image	14th	4.2
Customer financing	15th	3.2
Service	16th	3
Advtg/SP	17th	2

Coal		
Attribute	Ranking	Rating
Location of reserves	Ist	6.7
Quality of reserves	2nd	6.6
Labour Relations	3rd	6.5
Distribution	4th	5.7
Personal sales; marketing knowledge	5th	5.6
Tecnhical Sophistication equipment	6th	5.4
Prodution management	7th	5.4
Working force technical knowledge	8th	5.2
Size	9th	5.1
Quality Control system	10th	5.1
Image	11th	4.9
Personal sales Technical knowledge	12th	4.5
Process R&D	13th	4.4
Customer financing	14th	3
Service	15th	2.7
Product R&D	16th	2.6
Advtg/SP	17th	2.4

Exhibit Four Results of the Second Panels Data

	Firms	Performance	Locat Reserv	Qlty Reserv	Distr	Labor Rela	ISE	Service	PS Tech	Image	PR R&D	WF Tech	Proc R&D	Distr	Qlty CS	PM	PS Mkt
IRON ORE	(1)	- 5.98	6.25	4.13	4.66	4.71	5.38										
	(2)	- 59.28	4.86	4	4.11	5	4.5										
	(3)	+ 72.93	5	4.43	4.75	5.33	4.71										
	(4)	+ 86.18	5.5	4.43	5.63	5.33	5.21										
COAL	(5)	- 877.18	2.75	3	4	3	2.5										
	(6)	+ 367.16	5.58	4.36	5	3.8	5.27										
	(7)	+ 183.35	5.5	5.58	5.1	4.45	5.35										
	(8)	- 267.08	3.25	3.38	4	5.17	3.28										
	(9)	+ 573.32	5.08	5.18	4.22	6	5.23										
	(10)	+ 1.09	4.92	5.08	3.8	3.75	4.17										
MACHINE TOOLS	(11)	- 45.35						4.13	4.25	3.8	3.22	4.25					
	(12)	- 12.57						5.6	5.44	6.18	6.09	5.5					
	(13)	- 46.38						5.6	4.44	4.55	4.36	4.5					
	(14)	+ 74.89						5.3	4.89	5.36	5.18	5.25					
	(15)	+ 27.32						4.73	4.71	5.25	4.65	4.83					
COMPRESSORS	(16)	- 112.29						3.38	3.38	3.36	3.5	4					
	(17)	+ 137.13						5.5	6	5.86	5.43	5.42					
	(18)	+ 32.68						4.5	5.08	5.29	5.43	4.42					
	(19)	- 10.55						5.23	4.75	5.45	4.42	4.91					
	(20)	- 46.97						3.77	3.69	3.71	2.93	3.75					
BEARINGS	(21)	+ 62.88											5.1	5.7	4.4	4.56	5.09
	(22)	- 152											2.2	2.7	2.6	3.13	2.45
	(23)	+ 42.15											4.3	4.4	4.6	4.67	4.09
	(24)	- 6.88											3.22	4.88	4.73	4.17	4.1
	(25)	+ 42.14											5.27	5.27	4.91	5.33	5.25
VALVES	(26)	- 86.99											3	4.11	4	3.43	3.56
	(27)	+ 91											3.58	4.33	4.36	4.33	4.25
	(28)	+ 73.92											5.25	5.33	5.91	5.78	6.33
	(29)	- 106.93											3	3.42	5	5	4
	(30)	+ 68.49											3.83	3.42	4.67	4.1	4.69

NOTES:

Locat. Reserv - Location of reserves; Qlty Reserv - Quality of Reserves; Distr - Distribution; Labor Rela - Labor Relations; ISE - Technical Sophistication of the Equipment; Service - Service; PS Tech - Personal Sales Technical knowledge; IMG - Image; PR&D - Product R&D; W.F. Tech - Working force technical knowledge; Process R&D - Process R&D; Distr - Distribution; QCS - Quality Control System; PM - Production Management; PS Mkt - Personal Sales marketing knowledge.

Exhibit 5A

Variance of the ratings
given to the attributes
by the Industries 1st panels

	Machine Tools	Compressors	Bearings	Valves	Coal	Iron Ore
Variance	1,583635	1,3179	0.96989	0.78082	1.81608	1.1837

Exhibit 5B

Some examples of T tests performed on the 1st
panel data which are statistically significant at the 0,01 level
(list not exhaustive)

M Tools

Variable	T	Pr > |T|
PQTPC	12.26	0.0001
PQTDIST	8.96	0.0001
PQTLOC	10.72	0.0001
PCTDIST	3.01	0.0067
WFTPM	3.42	0.0026
WFTPUR	5.99	0.0001
WFTLAB	6.33	0.0001
QCSTLAB	3.77	0.0011
WFTLOC	7.23	0.0001

Compressors

Variable	T	Pr > |T|
PQTPC	9.54	0.0001
PQTDIST	7.88	0.0001
PQTLOC	6.54	0.0001
WFTPM	4.94	0.0001
WFTPUR	6.24	0.0001
WFTSE	4.65	0.0002
WFTLAB	5.62	0.0001
QCSTPUR	3.86	0.0011
WFTLOC	7.26	0.0001

Bearings

Variable	T	Pr > |T|
PQTDIST	-3.08	0.0052
PQTLOC	5.39	0.0001
PCTLOC	7.33	0.0001
DISTLOC	8.31	0.0001
WFTQCS	-6.31	0.0001
WFTPM	-3.25	0.0035
QCSTSE	3.47	0.0021
QCSTLAB	3.15	0.0045
PMTPUR	3.68	.0013

Valves

Variable	T	Pr > |T|
PQTDIST	-3.53	0.0021
PQTLOC	3.65	0.0016
PMTPUR	2.94	0.0081
WFTSE	-3.02	0.0068
WFTPM	-4.51	0.0002

Coal

Variable	T	Pr > |T|
PQTPC	-3.40	0.0034
PQTDIST	-5.14	0.0001
PQTLOC	-12.60	0.0001
QCSTLAB	-4.74	0.0002
WFPUR	-4.03	0.0009

Iron Ore

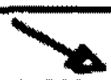
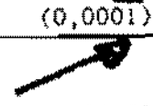
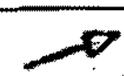
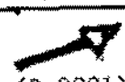
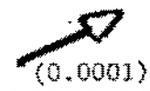
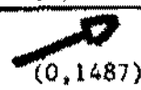
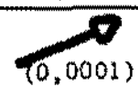
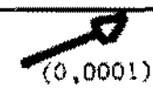
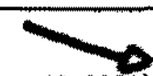
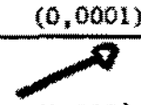
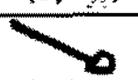
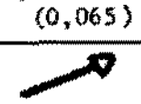
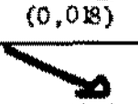
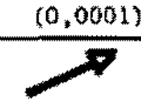
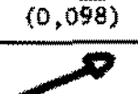
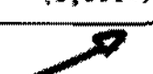
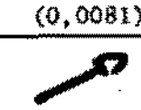
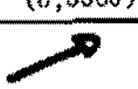
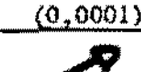
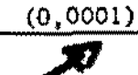
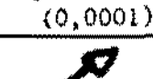
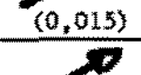
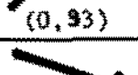
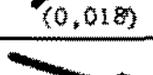
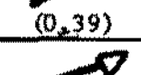
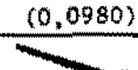
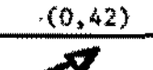
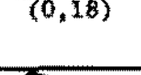
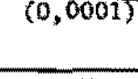
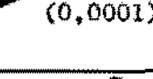
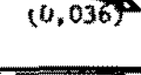
Variable	T	Pr > |T|
PQTDIST	-3.88	0.0026
PQTLOC	-8.31	0.0001
PCTDIST	-3.29	0.0072
PCTLOC	-5	0.0004
WFTLOC	-7.61	0.0001

Note:

PQ - Product quality competition index (average of the ratings of product R&D, service, image and sales force technical knowledge).
PC - Product cost competition index (average of the ratings of process R&D and size)
DIST - Distribution
LOC - Location
WF - Working force technical knowledge
PM - Production management
LAB - Labor Relation
QCS - Quality control system
PUR - Purchasing/Quality of reserves
TSE - Technical sophistication of the equipment

Exhibit Six

I tests on the differences of each attributes ratings among cells

Variables	From cell 1 to cell 3	From cell 3 to cell 7	From cell one to cell seven
Product Quality Competition (1)	 (0,0001)	 (0,0001)	 (0,0001)
Product Cost Competition (2)	 (0,0001)	 (0,011)	 (0,0040)
Product Delivery Competitio (3)	 (0,0001)	 (0,0001)	 (0.0001)
Location	 (0,1487)	 (0,0001)	 (0,0001)
Working Force Technical Knowledge	 (0,0001)	 (0,047)	 (0,0074)
Quality Control System	 (0,065)	 (0,018)	 (0,52)
Production Management	 (0,0001)	 (0,098)	 (0,0084)
Labor Relations	 (0,0081)	 (0,0006)	 (0,0001)
Purchasing/ Quality of Reserves	 (0,0001)	 (0,0001)	 (0,0001)
Technical Soph. Eqpt.	 (0,015)	 (0,93)	 (0,018)
Marketing Knowledge of the Sales Force	 (0,39)	 (0,0980)	 (0,42)
Advertising/ Sales Promotion	 (0,18)	 (0,0001)	 (0,0001)
Customer Financing	 (0,036)	 (0,14)	 (0,64)
Distribution	 (0,0001)	(0,21)	(0,0001)

(1) Product quality competition index = composed of attributes service, product R&D sales force technical knowledge and image.

(2) Product cost competition = index composed of attributes process R&D and plant size.

(3) Product delivery competition = index composed of attributes distribution and location.

(4) Within brackets is the level of statistical significance of the test, that T (one tail test).

Exhibit Seven

Analysis of variance of the three competition modes across cells

Product Quality Competition

k (number of cells) = 3

m (no. of attributes within each cell) = 8 (4 product quality variables multiplied by 2 industries)

n = k x m = 24

Source	Degrees of Freedom	Sum of Squares	Mean Squares	F Ratio
Among cells (k-1)	2	20.29	10.1045	24.18733
Within cells (n-k)	21	8.773	0.41776	

The F ratio is statistically significant at 0.00000710 level (two tail test).

Product Cost Competition

k (number of cells) = 3

m (no. of attributes within each cell) = 4 (2 product cost variables (size and process R&D) multiplied by 2 industries)

n = k x m = 12

Source	Degrees of Freedom	Sum of Squares	Mean Squares	F Ratio
Among cells (k-1)	2	4.926	2.463	7.67289
Within cells (n-k)	9	2.889	0.321	

The F ratio is statistically significant at the 0.02270 level (two tail test).

Product Delivery Competition

k (number of cells) = 3

m (no. of attributes within each cell) = 4 (2 product delivery variables (distribution and location) multiplied by 2 industries)

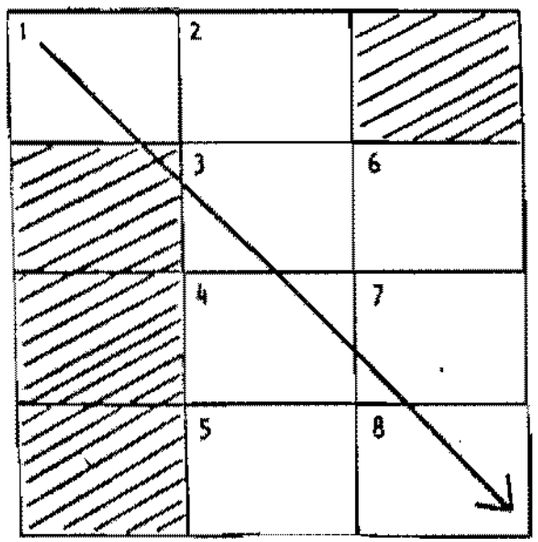
n = k x m = 12

Source	Degrees of Freedom	Sum of Squares	Mean Squares	F Ratio
Among cells (k-1)	2	19.7508	9.8754	11.0248
Within cells (n-k)	9	8.0617	0.89574	

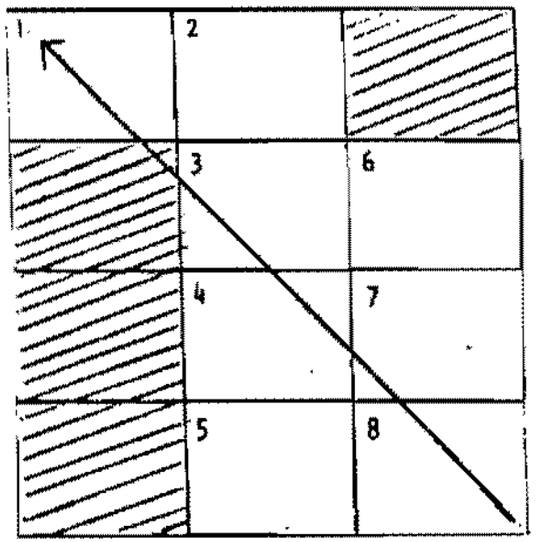
The F ratio is statistically significant at 0.0076 level (two tail test).

Exhibit Eight

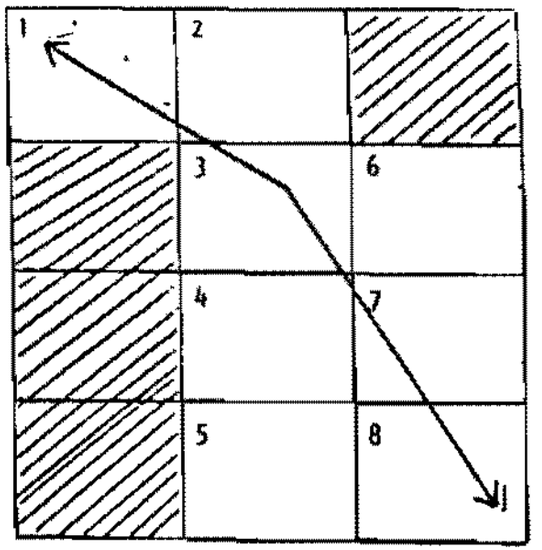
Importance of the Three Competition Modes (Quality, Cost, Delivery) Across The Typology Cells



Product Quality Competition is maximum in cell one and decreases in the direction of cell eight.



Product Delivery Competition is maximum in cell eight and decreases in the direction of cell one.



Product Cost Competition is maximum in cell three and decreases both in the direction of cells one and eight.

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