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How to Suceed in Industrial Marketing Management

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RESUME

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I - INTRODUCTION

Empirical research was conducted within the mature industrial context to test the hypothesis:

1 - *Different types of products have different key success factors* . By "key success factors" is meant those tasks or variable characteristics which must be performed particularly well for an organization to outperform its competition - Andrews, [3]; Christensen [8].
2 - For each type of mature industrial product, *organizations whose strengths match the key success factors will outperform their competition.*
3 - *The importance of the various organizational departments change* from technology type to technology type.
4 - *As technology changes, so do the attributes which are most important to assure performance* WITHIN *any given department.*

The study focused on mature industrial products because it was hoped that by limiting the study's domain to a specific type of product, it would be possible to asses 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]).

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 United States *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 in the United States of America (from a survey of 190 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 is especially important for industrial products since 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 primarly, and their intangible and perceived aspects only secondarly. 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.

The other typology dimension was transaction complexity, which in a particularly significant dimension of the task environment of industrial products.

Transaction complexity is an index which consists 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]) infrequency of purchase and buyer-seller interaction - are strongly correlated. Goods which are typically purchased frequently, such as office supplies, abrasives and heating fuel 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 (Dodge [9], Lilien [19], Levitt [17]).

The third component of the transaction complexity index 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 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 close correlation between purchase infrequency, buyer-seller interaction, and product risk. This supports their treatment as a singular concept - our transaction complexity .

Exhibit 1 presents the typology to be used in this study. The horizontal dimension represents technology (unit-mass-process). The vertical dimension 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 sparsely 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, the main reason being that 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 product 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 a single 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 initial 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.

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 35621/2/3) (only standard bearings manufactured in large batches - speciality 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 speciality 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, the most important of which were *availability of published financial data* (annual reports or SEC line-of-business data on the specialized organization or on the busines unit of interest), and *concentration* by the entire firm *of sales* (over 70%) in the industry of interest.

Once these criteria were decided upon, there still remained the choice of how large the firms sample in each industry should be.

The choice should reflect two conflicting factors: 1) On the one hand the larger the sample of firms per industry, the larger the total sample and, consequently, the lower, the probability of sampling errors. 2) On the other hand to work with a large number of organizations in each industry would imply two risks:

A) Some of the selected firms migth not satisfy all of the above stated criteria.
B) Employing a large sample of firms would also increase the length of the questionnaire, thus reducing the response rate and eventually the quality of the answers of the expert panels.

In the end, the number of five organizations for each industry was decided upon. This meant that thirty firms (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, best and kahle [6] state that image is a specially important tool to manege 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. Exhibits 3 and 4 present the results of the research. The results are based on information supplied by panels of experts 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 firms. 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 firm is its performance rating 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* for success within the mature industrial context.
2 - Those *critical variables for success change* from product to product.
3 - *The importance of the various organizational departments change* from product to product.
4 - *As technology change so do the attributes which are most important to assure performance* in any given department.

We shall briefly analyze each of these conclusions below.

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

This research points to three 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. The first indication for the existence of key variables is provided by the data provided by 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). The variances were: 1.6 (machine tools); 1.3 (compressors); 1.0 (bearings); 0.8 (valves); 1.8 (coal) 1.2 (iron ore).

2. To test for the statistical significance of the difference among the variables' ratings in each product, several *T tests* were performed. Exhibit 5 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 (0.26x2 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 5).

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*. As section II.5 indicated, 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)

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(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, 5.8, 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 5.8) plus (4.71 multiplied by 5.0) plus (5.38 multiplied by 5.4) which equales 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).

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 an organization 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 obervations (firms) for each cell of the typology (cell number one - machine tools and compressors; cell number three - valves and bearings; cell number seven - iron one and coal) - please see Exhibit six - 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 low sample size (ten firms) and, consequently, the low number of degrees of freedom (eight). In order to enlarge 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

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(1) Continuation from previous page

In the former case the 70 is good - in the latter case, it is bad. That is, one must take into considerations 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 formar case, it is, of course, worse.
- Finally one multiplies by 100 to work in terms of percentage values.

dummies.The r^2 was 0.87 (P < .001).

The results indicate that there is a close 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. Exhibit six presents the plots for cells one (machine tools and compressors), three (bearings ans valves) and seven (coal and iron ore).

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 every type of mature industrial product. 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 study suggest that the variables which are critical for performance in one product are different from the variables which are critical for performance in another product.

Using data from the first set of panels, T tests were made to compare the variables' ratings in each pair of cells: cells one and three; cells three and seven; cells one and seven. Exhibit 7 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 7 indicates, the importance of almost all variables changes considerably from cell to cell. This fact lends further support to the notion of a contingency theory of key success factors.

III. 3. The importance of the various organizational departments change from technology type to technology type.

As woodward had previously hypothesized when technology changes there is a change regarding which departments are critical. Wooddward had suggested that in unit technology, applied research and development was the critical department; in mass technology the most important department would be manufacturing; in process technology distribution and procurement became critical.

Empirical support for these hypotheses can be gathered from exhibit three: product research and development received their highest ratings in compressors and machie tools (unit technology); distribution, location and procurement achieved their highest importance in iron ore and coal (process technology); variables related to the manufacturing department such as production management and quality control systems were rated highest in values and bearings (mass technology).

III.4. Finally, the change in technology brings about a change not only in which department is critical but also regarding which attributes are most important to assure performance in any given department.

Focusing on the manufacturing department, the most important attributes in unit technology (compressors and machine tools) are the conceptual and manual skills of the workforce - rating of 6 and 5.6 in a 7 point scale (Exhibit three).

In mass technology (valves and bearings) performance in the manufacturing department depends basically upon production management, and the quality control system, 5.6; 5.8; 6; and 5.4 in a 7 point scale (see Exhibit three) .

In process technology (iron ore and coal), the critical attributes in the manufacturing department are the level of job satisfaction of the workforce (labor relations), and the technical sophistication of the equipment, 1978; respectivelly 5; 6.5; 4.6; 5.1; 5.4; and 5.4 (Exhibit three).

IV. IMPLICATIONS FOR INDUSTRIAL MARKETING MANAGERS

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

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

Managers must dedicate most of their time, their best personnel and the bulk of their organization's budget to the few critical tasks in which excellence is required. They should focus their efforts on perfoming 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 sum, avoid global marketing mediocrity.

From Section III.2., III.3 and III.4. (key success factors change from product to product and that both departments and variables within them vary in importance from technology to technology type) 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 to the market, whereas a negative one indicates to management the need to re-evaluate its plans with care. It may however happen that a potential new product is so attractive (in terms of potential growth profits, etc.) that in spite of lacking the required

strengths, an organization decides to so ahead and market 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.

CONCLUSION

This study 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 *key success factors change* from product to product; *that organizational departments vary in importance* from technology type to technology type; and that *within each department there are also changes regarding which attributes are most important* to assure performance as technology varies.

These conclusions lead to several implications: the need for industrial marketing managers to *focus* on each product' s critical success variables; *and the need for careful evaluation of one's company's strengths* before extending the product line.

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

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EXHIBIT ONE

Technology Type:

Task Environment: Transaction Complexity

	UNIT	MASS	PROCESS
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* (good will, prestige, reputation; the name of the organization creates a general [illegible] 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 need 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* (engineerings 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).

EXHIBIT TWO

(continued)

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 production; 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
Production 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 Knowledge	2nd	6.5
Image	3rd	5.9
Product R&D	4th	5.8
Working Force Technical Knowledge	5th	5.6
Personal Sales Marketing knowledge	6th	5.5
Quality Control System	7th	5.3
Technical Sophistic Equipment	8th	4.9
Process R&D	9th	4.8
Product Management	10th	4.2
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

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

EXHIBIT THREE

FIRST PANELS DATA

(continued)

Bearings		
Attribute	Ranking	Rating
Quality Control System	1st	6
Distribution	2nd	5.9
Process R&D	3rd	5.9
Porduct Management	4th	5.6
Personal sales Marketing Knowledge	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
Working 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

Valves		
Attribute	Ranking	Rating
Distribution	1st	6.1
Process R&D	2nd	6.1
Personal Sales Marketing Knowledge	3rd	6
Production 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	10th	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

EXHIBIT THREE

- FIRST PANELS DATA

(continued)

Iron Ore		
Attribute	Ranking	Rating
Location of Reserves	1st	6.7
Quality of Reserves	2nd	5.8
Distribution	3rd	5.8
Technical sophistic.	4th	5.4
Labour Relations	5th	5.
Production Management	6th	5.
Quality Control System	7th	5.
Process R&D	8th	4.8
Working Force; Technical Knowledge	9th	4.8
Personal Sales Tehnical 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	1st	6.7
Quality of Reserves	2nd	6.6
Labour Relations	3rd	6.5
Distribution	4th	5.7
Personal Sales Marketing Knowledge	5th	5.6
Technical Sophistic. Equipment	6th	5.4
Production 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	Local Reserv	Qlty Reserv	Distr	Labor Rela	TSE	Service	PS Tech	Image	PR R&D	VF Tech	Proc R&D	Distr	Qlty CS	PM	PS Mkt
IRON ORE	(1)	- 5.08	6.25	4.19	4.66	4.71	5.88										
	(2)	- 50.28	4.86	4	4.11	5	4.5										
	(3)	- 22.95	5	4.48	4.75	5.88	4.71										
	(4)	. 88.18	5.5	4.48	5.68	5.88	5.71										
COAL	(5)	- 877.18	2.75	3	4	3	2.5										
	(6)	. 987.16	5.58	4.86	5	3.8	5.27										
	(7)	. 188.85	5.5	5.58	5.1	4.45	5.38										
	(8)	- 267.08	3.25	3.88	4	5.17	3.28										
	(9)	. 578.32	5.08	5.18	4.77	6	5.79										
	(10)	. 1.09	4.92	5.08	3.8	3.79	4.17										
COMPRESSORS	(11)	- 49.95						4.18	4.25	3.8	3.22	4.29					
	(12)	- 12.57						5.6	5.44	6.18	6.09	5.5					
	(13)	- 46.98						5.6	4.44	4.55	4.86	4.5					
	(14)	. 74.99						5.3	4.89	5.86	5.18	5.25					
	(15)	. 27.82						4.71	4.71	5.25	4.68	4.88					
	(16)	- 112.29						3.98	3.98	3.86	3.5	4					
	(17)	- 197.19						5.5	6	5.86	5.48	5.42					
	(18)	. 32.68						4.5	5.08	5.29	5.48	4.42					
	(19)	- 10.55						5.28	4.75	5.45	4.42	4.91					
	(20)	- 46.97						3.77	3.69	3.71	2.98	3.75					
BEARINGS	(21)	. 62.88											5.1	5.7	4.4	4.56	5.09
	(22)	- 152											2.2	2.7	2.6	3.18	2.45
	(23)	. 42.15											4.3	4.4	4.6	4.67	4.09
	(24)	- 4.88											3.32	4.88	4.18	4.17	4.1
	(25)	. 42.14											5.67	5.27	4.91	5.88	5.25
VALVES	(26)	- 86.99											3	4.11	4	3.48	3.56
	(27)	. 51.											3.58	4.89	4.86	4.83	4.25
	(28)	. 79.92											5.25	5.88	5.91	5.78	6.33
	(29)	- 106.93											3	3.42	5	5	4
	(30)	. 68.99											3.88	3.42	4.67	4.1	4.69

Notes:

Local Reserv - Location of Reserves; Qlty Reserv - Quality of Reserves; Distr - Distribution; Labor Rela - Labor Relations; TSE - Technical Sophistication of the Equipment; Service - Service; PS Tech - Personal Sales Technical Knowledge; IMG - Image; PR&D - Product R&D; V.T. Tech - Working Force Technical Knowledge; Process R&D - Process R&D; Distr - Distribution; QCS - Quality [illegible]; PM - Production Management; PS

EXHIBIT FIVE

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
WETPUR	5.99	0.0001
WFTLAG	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	6.64	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

Variables	T	Pr> T
PQTDIST	-3.08	0.0052
PQTLOC	5.39	0.0001
PCTLOC	7.33	0.0001
DISTLOC	8.31	0.0001
WFTQCS	-6.91	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	-3.59	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

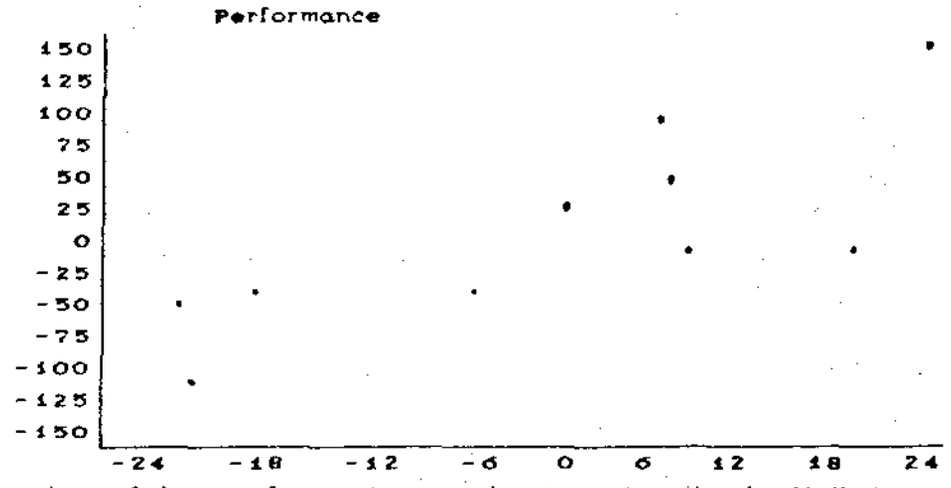
Variables	T	Pr> T
PQTDIST	-3.88	0.0026
PQTLOC	-8.31	0.0001
PCTDIST	-3.29	0.0072
PCTLOC	-5	0.0004
WFTLOC	-7.61	0.0001

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

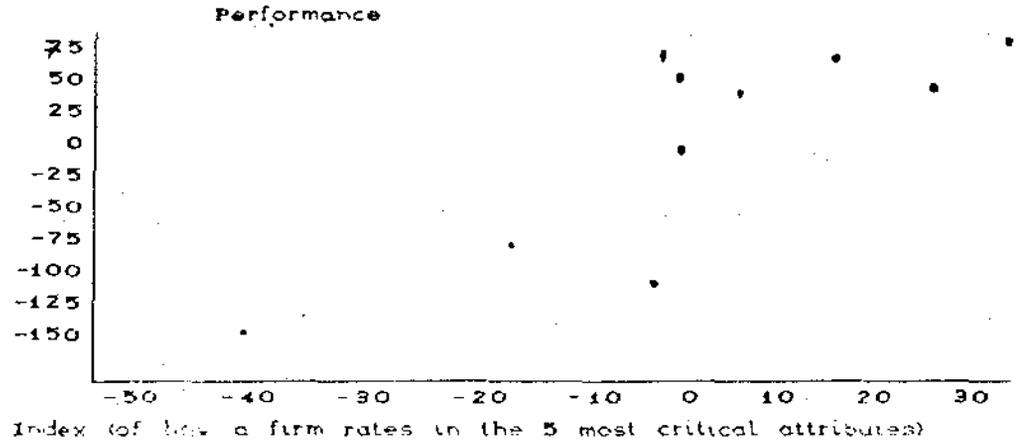
Exhibit Six
Plots For the Three Cells

PLOTS FOR CELL ONE (MACHINE TOOLS AND COMPRESSORS)



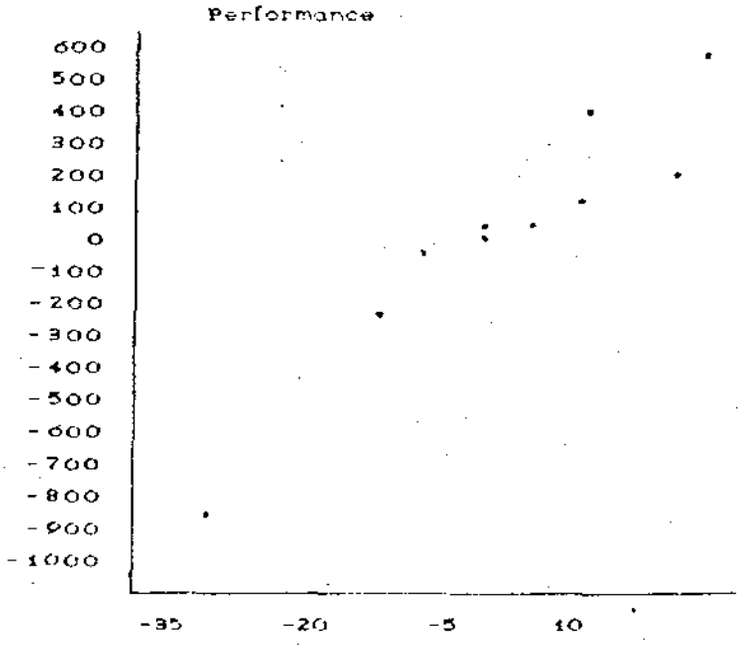
Index (of how a firm rates in the 5 most critical attributes)

PLOTS FOR CELL THREE (BEARINGS AND VALVES)



Index (of how a firm rates in the 5 most critical attributes)

PLOTS OF CELL SEVEN (IRON ORE AND COAL)



Index (of how a firm rates in the 5 most critical attributes)

EXHIBIT SEVEN

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 Competition(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. Equ.	↗ (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).