

A New Approach to Industrial Market Segmentation

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Market segmentation strategies are often used successfully in consumer markets. A procedure is presented here which segments industrial markets on the basis of the purchasing process in buying organizations. A measurement tool, called a decision matrix, is developed and used in a segmentation procedure based on cluster analysis. The procedure is applied to a study of industrial air conditioning, leading to results which have direct impact on the development of marketing and communications strategies. Methods of applying the approach to other areas are reviewed. *Ed.*

Introduction

Markets and customers are heterogeneous, and successful marketers are wise enough to realize they cannot satisfy all the people all the time. Marketers may compare the benefits against the costs associated with addressing a certain segment of the market. They then face the strategic questions associated with market segmentation:

- What potential customers or customer groups can be treated in the same way with one marketing strategy?
- Which of these "segments" does it pay to address?
- What marketing programs can be implemented that are most appropriate for each of the target segments?

The third point is key: a market segmentation strategy must have the potential to be used. Knowing that 2 percent of the population of a specific area can be classified as "innovators" or early adopters of a new product is of little use unless there is a way to reach these people differentially. (Do most subscribe to a certain magazine? Are their names available on a list of past purchasers of new devices? Do most live in a certain area of town?)

Segmentation methods have developed in several ways. Historically, due to the difficulty and cost of transportation, marketers addressed geographically concentrated groups of customers (geographic segmentation). Demographic differences (e.g. age, education, family size) among customers are often associated with different consumption patterns and are used for segmentation as well (demographic segmentation). Recent developments in the theory of buyer behavior and in the measurement of customer

attitudes (e.g. energy consciousness, opinion leadership) have provided even finer bases for segmentation (psychographic segmentation).

Market segmentation, then, is an important tool in developing marketing strategy, requiring a careful targeting of product and marketing effort to consumer or user requirements. To date, however, most segmentation analysis has been aimed mainly at consumer markets.¹ Little methodology has been developed that treats problems specific to industrial markets.

This article describes a new approach to industrial market segmentation and reviews the use of the proposed procedure in a specific application. The analysis provides new, directly applicable information for the development and targeting of industrial communication programs and product offerings.

Industrial Buying Behavior and Market Segmentation

Organizational or industrial buying behavior is more complex than consumer buying behavior. For many industrial products, the purchase decision involves:

- Several people, with different responsibilities, who
- Interact with one another in an organization-specific way, and
- Whose choices may be limited by organizational selection criteria.

Choffray finds little evidence of a relationship between observable characteristics of industrial organizations and their purchasing behavior.² These variables, however, have traditionally been used by industrial marketers as bases for market segmentation.³ Classification schemes proposed in organization theory are of little help. McKelvey notes that "... there is not even agreement about terms, let alone agreement about a theory of classification."⁴

Few industrial segmentation schemes are reviewed in the marketing literature. Wilson et al. propose segmenting industrial markets on the basis of buyers' decision-making styles.⁵ Faris suggests grouping industrial organizations on the basis of "buying situations."⁶ However, these two studies are of limited practical value as they do not clearly address the issues associated with implementation.

Cardozo and Wind review segmentation practice in industrial markets.⁷ They suggest that segmentation strategies are used, but mainly to explain past performance rather than to develop more effective marketing

¹ See Frank, Massy, and Wind [7].

² See Choffray [4].

³ See Cardozo [2].

⁴ See McKelvey [9], p. 509.

⁵ See Wilson et al. [12].

⁶ See Faris [6].

⁷ See Cardozo and Wind [3].

programs. They stress the need for new segmentation methodologies that address the characteristics of industrial purchasing decision-making units (DMU) or buying centers. We present such a procedure here.

A Strategy for Industrial Market Segmentation

The segmentation strategy developed here follows that proposed by Cardozo and Wind.⁸ The first step, macrosegmentation, characterizes those organizations that are likely to react to a product offering differently because of their industry (SIC code), geographic location, or other observable characteristics. Most data needed for this screening can be drawn from secondary sources. Once macrosegments are developed, they are further divided on the basis of similarities between decision-making units. This second step of analysis, microsegmentation, requires the procedure proposed here.

Measuring Decision-Making Unit (DMU) Composition

To apply the microsegmentation procedure, we must determine the structure of DMUs in the macrosegment of interest. Past work in this area has generally involved a cross-section of firms for which aggregate frequencies of involvement in the purchasing process were computed for several organizational functions.⁹ None of these studies treat interorganizational variation in the involvement pattern, which is our focus here.

Our procedure uses a "decision matrix" to measure involvement in the buying process. As shown in Figure 1, a decision matrix is a two-way table in which:

- The columns correspond to phases of the purchasing decision process (needs evaluation, product assessment, etc.), and
- The rows correspond to the categories of individuals involved in the process (engineering, purchasing, top management, etc.).

Each survey respondent indicates the percentage of task responsibilities in each phase of the process associated with each participant category. We are interested in the respondent's perception of the relative importance or influence of each decision category in specific phases of the decision process. A category may be involved only a small percentage of the time but be very influential; we seek to measure that influence.

The decision matrix is specific to a product market; its development follows analysis of the decision process in a small pilot sample of customer firms.

⁸ See Cardozo and Wind [3].

⁹ See Scientific American [10], Buckner [1], and Stevens and Grant [11].

Phases of Purchasing Decision Process	Description of Phase 1	• • •	Description of Phase n
Decision Participant Category 1			
⋮			
Decision Participant Category m			

Figure 1 Outline of a Decision Matrix

The Microsegmentation Procedure

A managerially meaningful microsegmentation strategy should satisfy the following criteria:

- Homogeneity — Within each microsegment, companies should have similar DMUs.
- Parsimony — An extreme microsegmentation would have every company as a unique target. To be managerially meaningful, a small set of substantial organizational groupings should be identified.
- Accessibility — One should be able to characterize microsegments by observable variables in order to develop differentiated marketing strategies.

The microsegmentation methodology is a four-step process as outlined below:

- Step 1* — Measurement of the pattern of involvement in the purchasing process for a sample of companies in the corresponding macrosegment. A decision matrix is used.
- Step 2* — Definition of an index of interorganizational similarity. A large class of “association coefficients” can be used here.¹⁰

¹⁰ Choffray [4] proposes the following measure to assess the dissimilarity between two organizations, r and s, using the decision matrix data:

Step 3 — Use of cluster analysis to identify groups of organizations homogeneous in the composition of their buying center. The Appendix describes the procedure developed for this purpose.

Step 4 — Identification of the pattern of involvement in the purchasing process within each microsegment. That is, it identifies those categories of individuals most likely to become involved in the buying process for the companies in each microsegment. It also involves characterizing the organizations in the microsegment on the basis of external characteristics.

Implementation of the Industrial Segmentation Procedure

Lilien et al. report on a United States Economic Development Administration-funded study of the market potential for a new type of industrial air-conditioning system.¹¹ As part of that study, a survey of the potential market was conducted. During open-ended interviews leading to the development of the survey instrument, five major phases of the adoption process for an industrial cooling system were identified:

1. Evaluation of needs and specification of requirements,
2. Preliminary budget approval,
3. Search for alternatives and preparation of a bid list,
4. Equipment and manufacturer evaluation, and
5. Equipment and manufacturer selection.

It was also found that the purchasing process for industrial air-conditioning systems involves individuals whose job responsibilities can be grouped as follows:

- Company Personnel — Production and maintenance engineers
Plant or factory managers
Financial controller or accountant
Procurement or purchasing department personnel
Top management
- External Personnel — HVAC/Engineering firm
Architects and building contractors
A/C equipment manufacturers

with

$$D_{rs}^2 = \sum_{j,h} (\sigma_{rjh} - \sigma_{sjh})^2$$

$$\sigma_{ijh} = \begin{cases} 1 & \text{if } x_{ijh} > 0 \\ 0 & \text{if } x_{ijh} = 0 \end{cases}$$

where x_{ijh} denotes the entry in row j and column h of the decision matrix answered by company i .

¹¹ See Lilien et al. [8].

DECISION PHASES \ DECISION PARTICIPANTS		1	2	3	4	5
		Evaluation of A/C Needs, Specification of System Requirements	Preliminary A/C Budget Approval	Search for Alternatives, Preparation of a Bid List	Equipment and Manufacturer Evaluation*	Equipment and Manufacturer Selection
COMPANY PERSONNEL	Production and Maintenance Engineers	%	%	%	%	%
	Plant or Factory Managers	%	%	%	%	%
	Financial Controller or Accountant	%	%	%	%	%
	Procurement or Purchasing Department Personnel	%	%	%	%	%
	Top Management	%	%	%	%	%
EXTERNAL PERSONNEL	HVAC/Engineering Firm	%	%	%	%	%
	Architects and Building Contractors	%	%	%	%	%
	A/C Equipment Manufacturers	%	%	%	%	%
COLUMN TOTAL		100%	100%	100%	100%	100%

*Decision phase 4 generally involves evaluation of all alternative A/C systems that meet company needs, while decision phase 5 involves only the alternatives (generally 2-3) retained for final selection.

Figure 2 Decision Matrix for the Industrial Air-Conditioning Study

Figure 2 outlines the resulting decision matrix.

Data were obtained from over 100 companies in the potential market for an industrial air-conditioning system. In addition to the decision matrix, the questionnaire measured organizational characteristics, organizational responsibilities, attitudes and preferences for various air-conditioning systems, etc.

A dissimilarity matrix was computed, using the information obtained with the decision matrix. Implementation of the cluster analysis procedure showed that:

- Ten companies were fundamentally different from all other organizations in the composition of their DMUs. These companies were eliminated from the analysis.
- The four microsegments retained were substantially more homogeneous than would be expected at random.
- The four microsegments were very stable in membership when different clustering methods were used.

Three key questions must be addressed to generate managerially meaningful results:

- How do the microsegments differ in terms of the pattern of involvement in the purchasing process for those firms comprising each?
- How does membership in a particular microsegment relate to other characteristics of organizations traditionally used for industrial market segmentation?
- How can the identification of these microsegments aid in marketing decision making?

Table 1 summarizes the differences in the composition of the DMU in the equipment selection phase across microsegments. The two most important categories of decision participants, along with their relative frequen-

	Segment 1	Segment 2	Segment 3	Segment 4
Microsegment Size in Potential Market	12%	31%	32%	25%
Major Decision Participant Categories in Equipment Selection Decision (Frequencies of Involvement)	Plant Managers (1.00)	Production Engineers (.94)	Production Engineers (.97)	Top Management (.85)
	HVAC Consultants (.38)	Plant Managers (.70)	HVAC Consultants (.60)	HVAC Consultants (.67)

Table 1 Major Microsegments of Organizations in the Industrial Air-Conditioning Study

	Micro-Segment 1	Micro-Segment 2	Micro-Segment 3	Micro-Segment 4
Satisfaction with Current A/C System	medium high	low	medium low	high
Consequence If A/C System Is Less Economical Than Projected	medium high	low	medium low	high
Consequence If A/C System Is Less Reliable Than Projected	medium high	low	high	medium low
Company Size	medium	large	large	small
Percentage of Plant Area Requiring A/C	medium large	small	large	medium
Number of Separate Plants	medium large	small	large	medium small

Table 2 Characteristics of Organizations in Each Microsegment

cies of involvement, are identified. Important differences among these microsegments were also registered for the four other decision phases.

Table 2 gives a qualitative comparison of characteristics of the organizations found in each microsegment. Companies in segment 4 tend to be smaller, more satisfied with their current air-conditioning system, and more concerned with the economic aspects of industrial air conditioning. In terms of their purchasing processes, these companies are characterized by a more frequent involvement of managerial functions. Moreover, they rely more heavily on external sources of expertise, such as HVAC consultants to assist them in the assessment of air-conditioning needs, the search for alternatives, and the selection of particular equipment. On the contrary, larger companies represented in segments 2 and 3 use their own engineering capabilities for these same tasks.

The comparison between segments 1 and 3 is interesting as the segments do not substantially differ in terms of size of company. However, our analysis suggests that companies in segment 3 tend to have more plants, larger cooling needs, and greater concern for the reliability of industrial air-conditioning systems than companies in segment 1. It is therefore not surprising to note that companies in segment 3 rely mainly on engineering functions in the process of adopting a new industrial air-conditioning system, while companies in segment 1 involve mainly managerial functions.

Microsegment 2 groups large companies with a small number of plants. Moreover, these companies view little risk in the purchase of an industrial

air-conditioning system. As a result, they generally let these decisions be made at the plant level.

Implications for Formation of Industrial Marketing Strategy

The procedure developed here isolates homogeneous microsegments of organizations and provides a description of the decision process in each microsegment. This information allows industrial marketers to develop marketing strategies aimed directly at those categories of individuals most influential in the various microsegments.

The decision matrix is usually included as part of a personally administered or mailed survey instrument, designed to assess the market for a new industrial product. Respondents must be identified as those individuals within an organization most likely to influence the purchasing decision for a product in that class. More than one individual per organization is studied when the DMU in that organization includes more than one person.

The procedure can be used when the potential market for an industrial product contains a small number of customers. Then, the decision matrix would be administered to each customer individually, providing information to develop specific account strategies. For larger industrial markets, the decision matrix would be administered to a sample of industrial organizations. As the industrial air-conditioning study illustrates, implementation of the procedure yields the relative size of the microsegments and describes the structure of the purchase decision process within each. This information could be used to:

- Concentrate communication efforts on those categories of individuals most often involved in the purchasing process in the largest microsegments. For air conditioning, this might lead to a concentration of communication efforts on production engineers and HVAC consultants who are most influential in microsegment 3.
- Predict the structure of the adoption process for a specific firm on the basis of its external characteristics. Promotional material or salesman calls could then be directed at those categories of individuals most influential in the microsegment.
- Select communication vehicles. The categories of individuals involved in the purchasing process differ in their sources of information and communication consumption. In the industrial air-conditioning study, in microsegment 3, production engineers and HVAC consultants were most influential. Due to their common educational background, there is a substantial overlap in their sources of information and communication consumption patterns, suggesting the use of the same communication channels for both groups.

The results of the procedure are most powerful, however, when they are considered along with the differences in product preferences and per-

	Key Importance	Less Importance
Production Engineers	Operating Cost	First Cost
	Energy Savings	Field Proven
	Reliability	Substitutability of Components
	Complexity	
Plant Managers	Operating Cost	First Cost
	Use of Unproductive Areas	Complexity
	Modernity	Substitutability of Components
	Power Failure Protection	
Top Managers	Modernity	Noise Level in Plant
	Fuel Rationing Protection	Reliability
	Operating Cost	
	Energy Savings	
HVAC Consultants	Previous System Experience	Modernity
	Ease of Installation	Energy Savings
	Modularity/Accessibility	Operating Cost
	Reliability	

Table 3 Issues of Importance for Each Category of Decision Participant

ceptions across categories of decision participants. Table 3 summarizes results from another portion of the industrial air-conditioning study. For each major category of decision participant, it shows the issues that are of key importance in the formation of preferences. For example, compare top managers with HVAC consultants. Top managers are interested in modernity, operating costs, and energy savings, precisely those issues that are of least importance to HVAC consultants. Linking these results with those of the microsegmentation analysis, it appears that segments 1 and 4 have prime decision participants with almost opposite requirements! To be successful in this market, manufacturers must very carefully target their product offerings and communications strategies.

This procedure, then, identifies groups of organizations that exhibit substantial homogeneity in their purchasing process. The analysis of the external characteristics of these organizations suggests relationships between a firm's purchasing process and its size, its purchasing needs, its satisfaction with past purchases, and perceived risks. The consideration of both the microsegmentation results and the issues of importance to each

decision participant category points to opportunities for carefully targeted communications programs and product offerings.

Conclusion

Market segmentation is but one aspect of industrial marketing strategy. Choffray and Lilien show how this new approach to segmentation can be incorporated in a quantitative analysis of industrial markets, with associated implications for product design, product positioning, and the development of communications programs.¹²

The industrial market segmentation procedure presented here, however, stands on its own in value. The case analysis demonstrates that companies in the potential market for an industrial product can be characterized by the structure of their purchasing decision process. The procedure provides new insights into the difficult question of assessing which individuals in an organization are most likely to become involved in the purchasing process for a specific industrial product. This information allows industrial marketers to develop marketing strategies targeted at the key individuals.

APPENDIX — MICROSEGMENT FORMATION BY CLUSTER ANALYSIS

Our microsegmentation approach uses *agglomerative* hierarchical clustering methods. These methods use as input a dissimilarity — or similarity — matrix in which each cell describes the degree of dissimilarity between any two entities in the sample, as measured with the index D_{rs} ² defined earlier. From this matrix, agglomerative clustering methods gradually form clusters by grouping most similar entities in the same cluster. These methods generate solutions which can be graphically presented as hierarchical trees or dendrograms.

At each stage in the clustering process, agglomerative methods form new clusters that *minimize* some function of inter-cluster distance. The dissimilarity matrix is then recomputed to express the relationships between the new clusters and the remaining entities.

Figure 3 outlines the steps of the procedure. A detailed account of the procedure is developed by Choffray.¹³ The first step (A) involves the computation of the dissimilarity matrix. Each entry in this matrix expresses the dissimilarity between organization *i* and organization *j* in the composition of their buying centers.

The next step in the analysis (B) involves identification of outliers, that

¹² See Choffray and Lilien [5].

¹³ See Choffray [4].

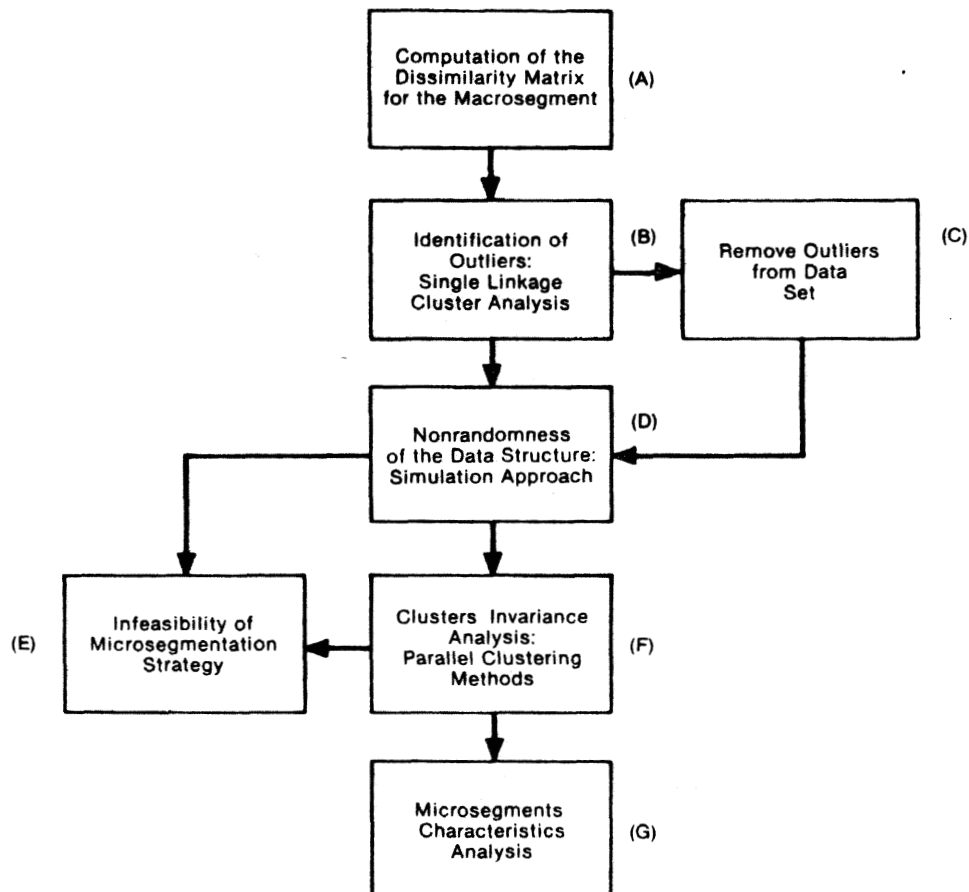


Figure 3 Outline of Cluster Analysis Methodology

is, organizations whose decision process bears little resemblance to that of other organizations. Single linkage analysis is used for this purpose. If extreme observations are identified, they are removed from the data set (C), and the decision process of the corresponding companies is the object of a separate analysis.

After the dissimilarity matrix has been freed from extreme observations, the nonrandomness of the structure observed is investigated (D). Here we assess the degree of similarity between organizations and compare it to the degree of similarity expected from random data. A range of meaningful clustering solutions is then determined. If the observed data structure does not significantly depart from the random model at *any* clustering level, no attempt is made at microsegmenting the potential market (E).

The analysis concludes at the existence of meaningful microsegments of organizations only in those cases where several clustering algorithms converge in terms of the composition of the clustering solution retained (F). When a substantial degree of agreement in the composition of the clustering solution retained is observed across clustering methods, one can be confident in the microsegments identified.

The last step in the methodology (G) investigates the composition of the buying center within each microsegment retained and assesses the relationship between microsegment membership and other characteristics of industrial organizations.

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