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A New Approach to
Industrial Market Segmentation

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Abstract

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.

Markets and customers are heterogeneous, and successful marketers are wise enough to realize they cannot satisfy all of the people all of the time.

As a marketing strategy, market segmentation involves:

- identifying groups of potential customers, similar in some aspect of their buying behavior, and
- developing marketing programs targeted at each of these segments.

Historically, due to the difficulty and cost of transportation, marketers addressed geographically concentrated groups of customers (geographic segmentation). Demographic differences (age, education, family size for example) 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 (energy-consciousness, opinion-leadership, etc.) have provided even finer bases for segmentation (psychographic segmentation).

Market segmentation, then, is an important tool in developing marketing strategy, aimed at 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 (see Frank, Massy and Wind [6] for a review). 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 actionable 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 [3] finds little evidence of a relationship between observable characteristics of industrial organizations and their purchasing behavior. These variables, however, have traditionally been used by industrial marketers as bases for market segmentation (see Cardozo [2] for a review).

Classification schemes proposed in organization theory are of little help. McKelvey [8] notes that "there is not even agreement about terms, let alone agreement about a theory of classification."

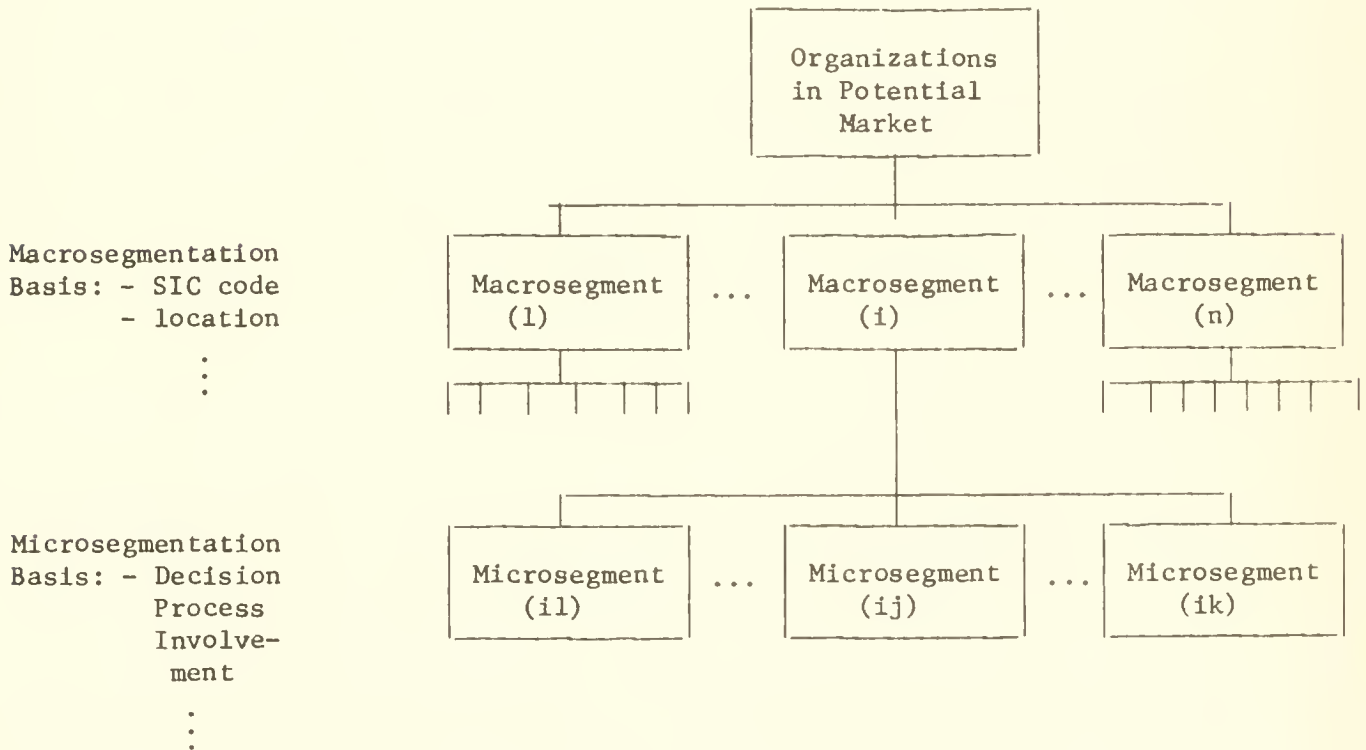
Few industrial segmentation schemes are reviewed in the marketing literature. Wilson et al. [11] propose segmenting industrial markets on the basis of buyers' decision-making styles. Faris [4] suggests grouping industrial organizations on the basis of "buying situations." These two studies are of limited practical value as they do not clearly address the issues associated with implementation.

Wind and Cardozo [12] review segmentation practice in industrial markets. They suggest that segmentation strategies are used, but mainly to explain past performance rather than to develop more effective marketing 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 Wind and Cardozo [12] and is illustrated in Figure 1. The first step, macrosegmentation, characterizes those organizations that are likely to react to a product offering differently because of their industry, geographic location, or other observable characteristics. Most data needed for this screening can be drawn from secondary sources.

FIGURE 1: OUTLINE OF INDUSTRIAL MARKET SEGMENTATION STRATEGY



Once macrosegments are developed, they are further divided on the basis of similarities between decision-making units. This second step of analysis requires the procedure proposed here.

Measuring Decision-Making Unit (DMU) Composition

To apply the microsegmentation procedure, we must determine the structure of DMU's 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. (Scientific American [9], Buckner [1], Stevens and Grant [10]). None of these studies treat interorganizational variation in the involvement pattern, our focus here.

Our procedure uses a "decision matrix" to measure involvement in the buying process. A decision matrix (see Figure 2) 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.

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.

FIGURE 2: OUTLINE OF A DECISION MATRIX

Phases of Purchasing Decision Process Decision Participant Categories	Description of Phase 1	. . .	Description of Phase n
Decision Participant Category 1			
⋮			
Decision Participant Category 2			

The Microsegmentation Procedure

A managerially meaningful microsegmentation strategy should satisfy the following criteria:

- homogeneity: within each microsegment, companies should have similar DMU's.
- 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.
- accessability: one should be able to characterize microsegments by observable variables in order to develop differentiated marketing strategies.

Figure 3 outlines the procedure. The first step involves measurement of DMU composition for a sample of organizations. A decision matrix is used for this purpose.

Step two requires definition of an index of inter-organizational similarity. A large class of "association coefficients" can be used for this purpose.¹

The third step of the procedure uses cluster analysis to identify groups of organization homogeneous in the composition of their buying center. Appendix 1 describes the procedure developed for this purpose.

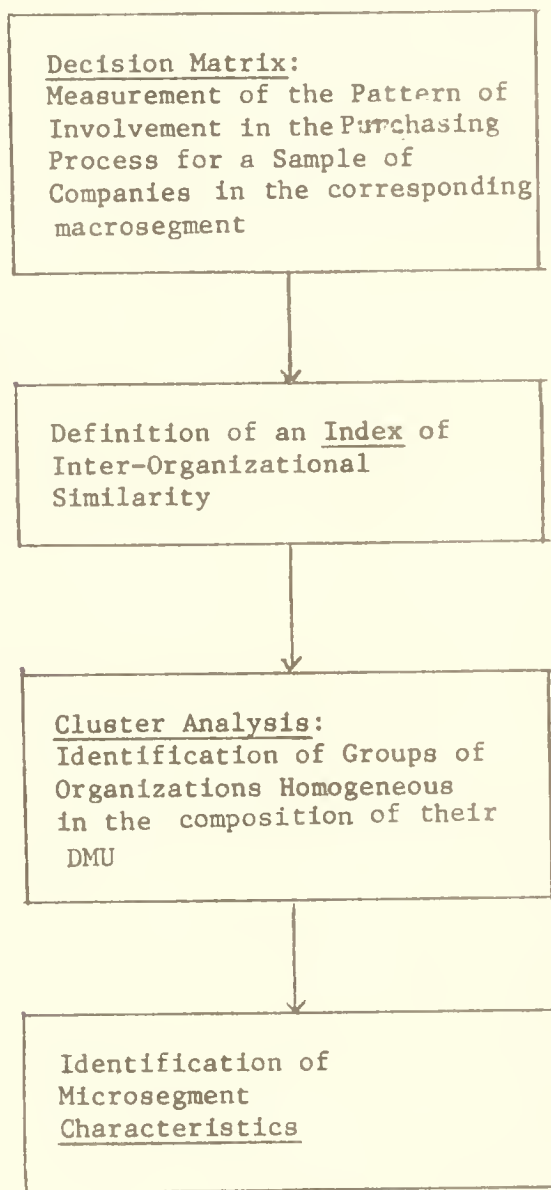
The final step is concerned with the identification of the pattern of involvement in the purchasing process within each microsegment; that is, it identifies those categories of individuals most likely to become involved in the buying process for the companies in each microsegment. It also involves characterizing the organizations in the microsegment on the basis of external characteristics.

Implementation of the Industrial Segmentation Procedure

Lilien et al. [7] report on a United States Economic Development Administration-funded study of the market potential for a new type of industrial air conditioning system. 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.

FIGURE 3: OUTLINE OF THE MICROSEGMENTATION METHODOLOGY



3. Search for alternatives and preparation of a bid list.
4. Equipment and manufacturer evaluation.
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
Top Management

- External Personnel

HVAC/Engineering firm
Architects and Building contractors
A/C equipment manufacturers.

Figure 4 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:

- 10 companies were fundamentally different from all other organizations in the composition of their DMU. 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;

FIGURE 4: DECISION MATRIX FOR THE INDUSTRIAL AIR CONDITIONING STUDY

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	X	X	X	X	X
	Plant or Factory Manager	X	X	X	X	X
	Financial controller or accountant	X	X	X	X	X
	Procurement or purchasing department	X	X	X	X	X
	Top Management	X	X	X	X	X
EXTERNAL PERSONNEL	HVAC/Engineering firm	X	X	X	X	X
	Architects and Building Contractor	X	X	X	X	X
	a/c equipment manufacturers	X	X	X	X	X
	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.

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 frequency 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 process, 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

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

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

Table 2: CHARACTERISTICS OF ORGANIZATIONS IN EACH MICROSEGMENT

	<u>Micro- Segment 1</u>	<u>Micro- Segment 2</u>	<u>Micro- Segment 3</u>	<u>Micro- Segment 4</u>
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

needs and are more concerned with 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 let these decisions be taken more 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 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 tells 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 micro-segments. 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 these 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 perceptions 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.

Compare Top Managers with HVAC consultants: Top Managers are interested in Modernness, Operating Costs and Energy Savings, precisely those issues

Table 3: ISSUES OF IMPORTANCE FOR EACH CATEGORY OF DECISION PARTICIPANT

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

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, a manufacturer must very carefully target his 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 suggest relationships between a firm's purchasing process and its size, its purchasing needs, its satisfaction with past purchase 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 [4] 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.

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 what 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 dendograms.

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 re-computed to express the relationships between the new clusters and the remaining entities.

Figure 5 outlines the steps of the procedure. A detailed account of the procedure is developed by Choffray [3]. 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 center.

The next step in the analysis (B) involves identification of outliers, that is, organizations whose decision process shares little resemblance with 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.

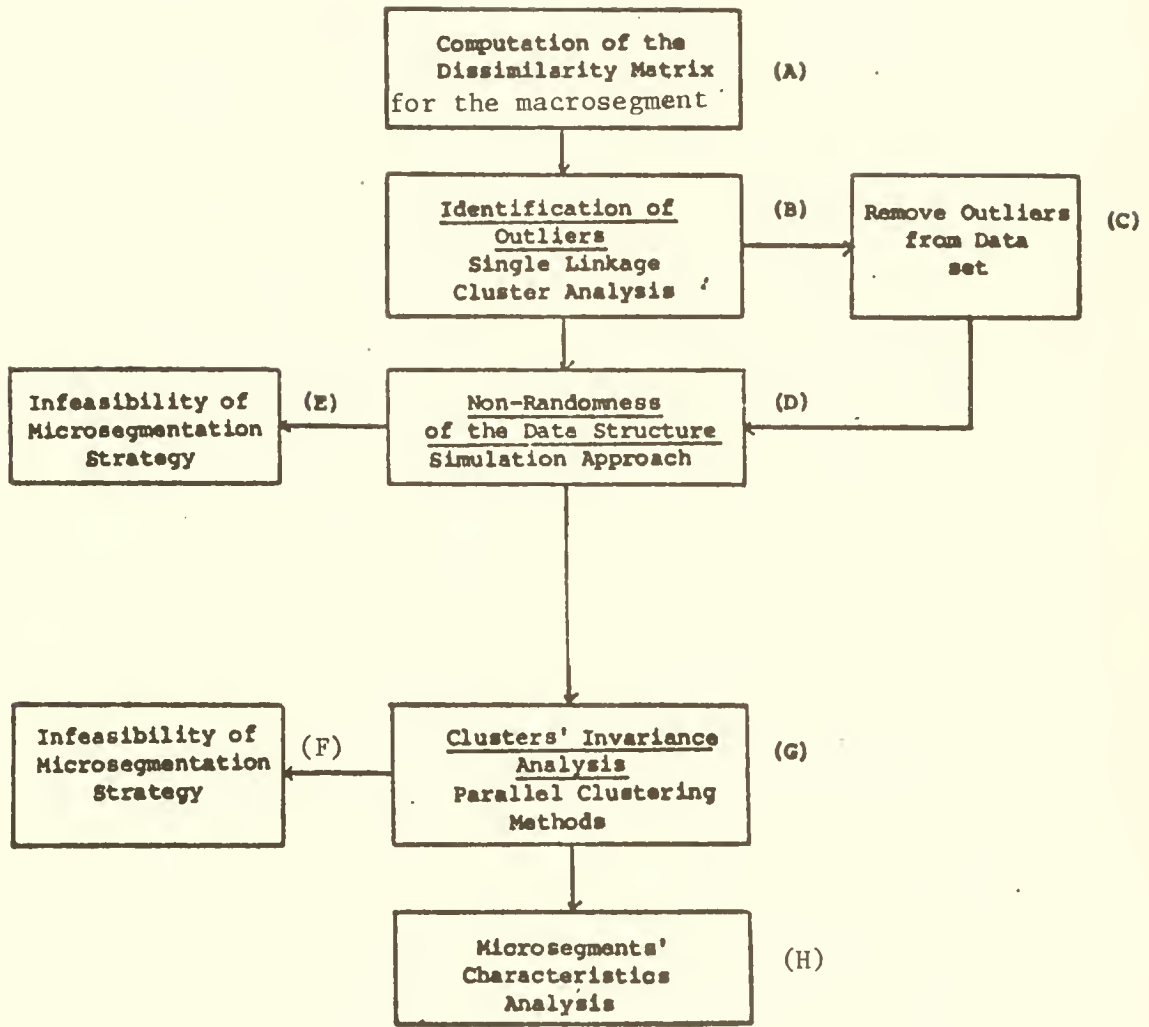
After the dissimilarity matrix has been freed from extreme observations, the non-randomness of the structure observed is investigated (D). Here, we

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 (G). 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 (H) investigates the composition of the buying center within each microsegment retained and assesses the relationship between microsegment membership and other characteristics of industrial organizations.

FIGURE 5: OUTLINE OF CLUSTER ANALYSIS METHODOLOGY



FOOTNOTE

¹Choffray [3] proposes the following measure to assess the dissimilarity between two organizations. r and s, using the decision-matrix data:

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

with

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

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

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