A Cross-Impact Simulation of Corporate Susceptibility to Crisis: The Case for Organizational Reform

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ABSTRACT

A simulation model of corporate crisis is described. The model depicts the interrelationships between executive attributes, the strategic posture of the corporation, and the state of organizational structure and resources. The impacts of these three clusters of variables on organizational vulnerability to crisis is studied. The simulation is then used to explore alternative organizational reform measures that attempt to reduce corporate vulnerability to crisis and improve effectiveness. The reform strategy which was found to be the most effective consisted of (1) a program to retrain executives and provide incentives to increase risk taking and reduce rigid application of standard programs, combined with (2) structural change instituting decentralization and reduction of hierarchical depth.

INTRODUCTION

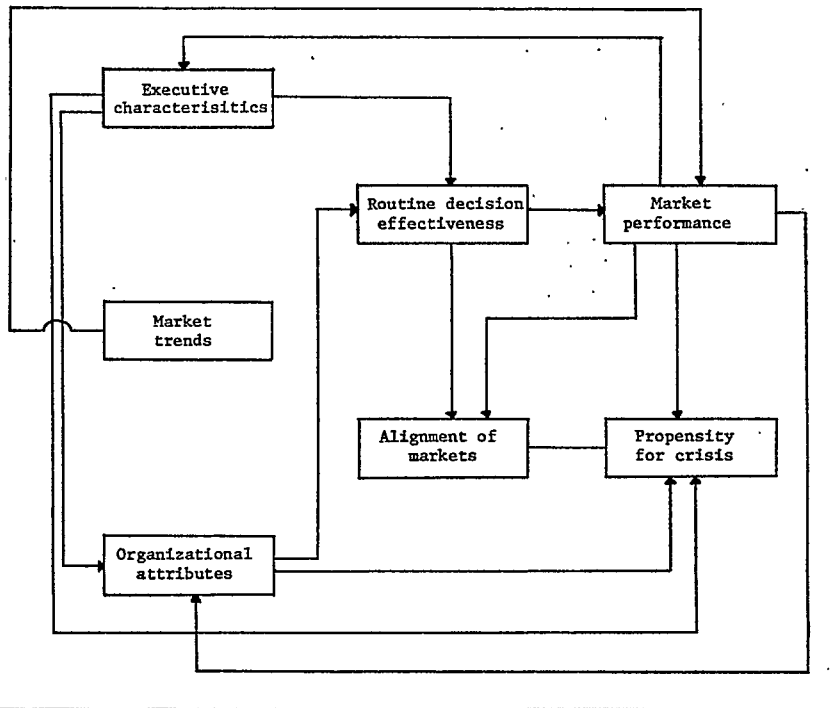
In a previous paper we developed a diagnostic instrument for identifying those configurations of attributes that increase or decrease the susceptibility of organizations to crisis (1). The instrument consisted of a general conceptual model of corporate crisis and a geometric simulation that provided a vehicle to test alternative design propositions.

THE CONCEPTUAL MODEL

There are three strategic clusters of variables in the model (Figure 1). The first is concerned with executive characteristics, such as individual abilities and management styles. The second is concerned with 'the business the organization is in', as exemplified by stability factors and market trends. The third cluster is concerned with organizational attributes such as internal structures and resources. The evaluation of different strategic configurations is made in terms of two indicators: an indicator of a firm's market performance, and an indicator of a firm's propensity for crisis.

Figure 1

A CONCEPTUAL MODEL OF CRISIS



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Routine decision effectiveness is a mediating variable between the strategic input variables and the evaluation indices. The initial executive recruitment patterns of the firms determine the base level of decision effectiveness. This base level is modified by the effect of organizational attributes on decision-making processes. Routine decision effectiveness in turn contributes to market performance by affecting a firm's ability to avoid threats and seize opportunities. In addition, routine decision effectiveness contributes to alignment between factor and product markets and, therefore, to amelioration of crisis-inducing imbalances.

Six variables are included in the executive characteristics cluster. These variables are: degree of adherence to democratic rather than autocratic management principles (AUT/DEM); degree of reliance upon advocacy as opposed to negotiation as a principle of management (NEG/ADV); degree of preference for a defensive rather than an aggressive entrepreneurial posture (DEF/AGG); propensity to support the development of highly structured decision procedures (BURS); propensity for risk-taking (RISKS); and susceptibility to cognitive biases (C BIAS).

The 'business the organization is in' (market trends) is described by external threats and opportunities in: product markets (PROD M); factor markets (FACT M); and labor markets (LABOR M).

The cluster of organizational attributes consists of eight variables: degree of centralization (CENT); information processing and transmission capabilities (INFOP); degree of routinization and institutionalization of standard operating procedures (INST); size of management group (SIZE); the mobilizable idle resources possessed by the organization (SLACK); degree of diversification of product lines (DIVERS); degree of vertical integration (VERT I); and hierarchical depth (H DEPTH).

Propensity for crisis (P CRISIS) and market performance are the two outputs in the model. Propensity for crisis is affected by the degree of inter-market misalignment; degree of difficulty the organization encounters in implementing decisions (IMP PATH); and pathologies affecting routine decision effectiveness (RDCP) in stressful situations (GTHINK).

RELATIONSHIPS BETWEEN VARIABLES

The patterns of relationships between variables in the conceptual model are summarized by the interaction structure matrix (Table 1). The network of interactions was derived from an extensive review of case studies and from the academic and professional literature. Table 1 depicts the effect of column variables on row variables. The upper left portion of each cell describes the impact of a given level of a variable over time on another variable (level impacts). The lower right portion of a cell describes the impact of a change in the column variable on another variable (derivative impacts). Plus (+) or minus (-) entries represent positive or negative relationships between variables. A blank indicates there is no relationship.

Capital letters in the matrix signify more complex relationships between variables. Capital T indicates a threshold function. For example, organizational size tends to grow, once a critical threshold has been reached (2). The letter A represents an alignment function. Alignment between markets is an important determinant of susceptibility to crises. When alignment between product markets and factor or labor markets is poor, propensity for crisis increases. U represents a unidirectional or asymmetric function. For example, changes in the size of the labor pool are sticky, but only in the downward direction. The degree of stickiness will depend upon the bargaining strength of labor as provided by its organization and resources. I represents an inverse function. For example, a low level of information processing capabilities leads to involuntary decentralization as noisy and untrustworthy communication channels increase insularity of units and reduce effectiveness of controls. D represents a divergent function (opposite effects on opposite sides of a threshold). Thus as an organization grows, there is an accompanying growth of controls and procedures. These controls are developed to ensure coordination between the various divisions of the firm (3,4). Growth in organizational size affects centralization in one of two opposite ways. If the organization subscribes to democratic values, the requirement for extended controls will lead to increased decentralization. If the organization is autocratic, the requirement for extended controls will lead to increased centralization. H represents a hybrid, a combination of the above functional forms.

Table 1

INTERACTION STRUCTURE MATRIX

Impact of column variable on row variable	AUT/DEM	NEG/ADV	C BIAS	DEF/AGG	BURS	RISKS	CENT	INFO P	INST	H DEPTH	SIZE	DIVERS	SLACK	PROD M	FACT M	LABOR M	RDCP	PCRISIS	GTHINK	IMP PATH	VERT I
Autocratic/democratic style (AUT/DEM)	+ / +	- / -												H	H	H				-	
Negotiator/advocate style (NEG/ADV)	- / -	U					+			+	+					U					
Cognitive bias (COG BIAS)	-	I			-	-		-	+ / -	+	U								+		
Defensive/aggressive style (DEF/AGG)				- / +		H / +			-		U			U	U	U			+		
Bureaucratic style (BURS)		-				I															
Risk-taking propensity (RISKS)				D				+			-			A / +	A / +	A / +			+		
Degree of centralization (CENT)	H	T		+				I			D									+	
Information processing capabilities (INFO P)			-				+			-	-	-	T				+		-		
Degree of institutionalization (INST)	+				A				+	+	+						H				
Hierarchical depth (H DEPTH)	-						+				U	+									
Management size (SIZE)											T			H / +							
Product diversification (DIVERS)											+			+							
Slack (SLACK)				H		-	-			+	+	-		U / +	U	U					
Product market (PROD M)				H / T								H	H		A	A	D / +	T	T	T	
Factor market (FACT M)											+		A	H	-		D / +	T	T	H	H
Labor market (LABOR M)	U										+			H		U	D / +	T	T	I	
Routine decision effectiveness (RDCP)			-					H / +											-		
Propensity for crisis (P CRISIS)			+	+				-	D			-	I / -	A	A	A	-		T / +	T	
Propensity for groupthink (G THINK)	-	+			+		+														
Implementation pathologies (IMP PATH)	U				+		-	-	D	+	+						D				
Degree of vertical integration (VERT I)														A	A						

Blank = no effect
\+ = positive effect
\- = negative effect

T = threshold function
A = alignment function
U = unidirectional function

I = inverse function
D = divergent function
H = hybrid function

THE SIMULATION

Two basic approaches to constructing simulation models can be identified. One can develop a simulation with the objective of providing precise numerical predictions about key parameters of a system, for example, simulations of a new oil refinery to provide detailed information to an engineer who is adjusting the valves controlling the system. This class of simulations has been identified as arithmetic modelling (5). They are designed for tactical/line decision-making and rely upon precise estimation of system parameters. In contrast, the geometric simulation is policy oriented. It attempts to capture the key variables of a system, trading precision for a higher degree of comprehensiveness. It focuses upon the general shape of present and future systems, rather than their numerical specification.

The distinction between the two types of simulation is parallel to the distinction made between information inputs for implementation, which place emphasis on sophisticated measurement and statistical analysis, and information inputs for policy-making, which focus frequently on verbal, qualitative analysis. The diagnostic model for crisis prevention developed in this paper is for use in policy formation, therefore, a geometric approach was adopted that emphasizes interrelationships between components. To this extent the simulation is an extension of verbal qualitative analysis, but some quantitative estimation of impacts has been added.

The specific simulation language used is KSIM (6,7). The general assumptions of KSIM are the following:

1) All system variables are bounded (our world is finite);

2) Variables change according to the net impact of all variables;

3) A variable's response to a given impact goes to zero as the variable approaches either bound (floor and ceiling effects);

4) All else being equal, a variable produces greater effects upon the system when it is larger.

Complex interactions are typically described by an array of binary interactions, but introduction of functions to the simulation enriches the domain of the qualitative statements which can be incorporated into the model.

The basic structure of KSIM suggests that the world is finite and that an "explosion" in a growth curve of a variable is a function of error in model specification rather than a feature of reality. It also suggests that there is a ceiling and floor impact. When a variable is close to its upper saturation level, further upwards movement triggers a strong friction. Impacts depend on strength - elephants can easily move flies, but flies will encounter some problem in pushing elephants. The numerical values and specific functions used in the simulation are given in a previous paper (1).

SIMULATION EXPERIMENTAL DESIGN

In an earlier study (1) KSIM was used to test the fitness of organizations with different management styles and structures in various market environments (Figures 2 and 3). Fitness was measured in terms of propensity for crisis and market performance. Eight hypothetical organizations were tested in five environments. Of these the democratic-effective-aggressive (DEA) organization performed better than the others for most market conditions. This superiority was both in terms of market performance and propensity for crisis. The inferior performance of the autocratic-effective-defensive (AED) organization when markets fluctuate suggests that executive style and organizational structure are critically important in maintaining effective performance under market stress (see Table 2). As shown in Figures 2 and 3, even with cycles and random fluctuations in markets, the DEA organization is fairly successful in maintaining good market alignment. The AED organization is not able to maintain market alignment, thus losing its share of the product market and growing very vulnerable to crises.

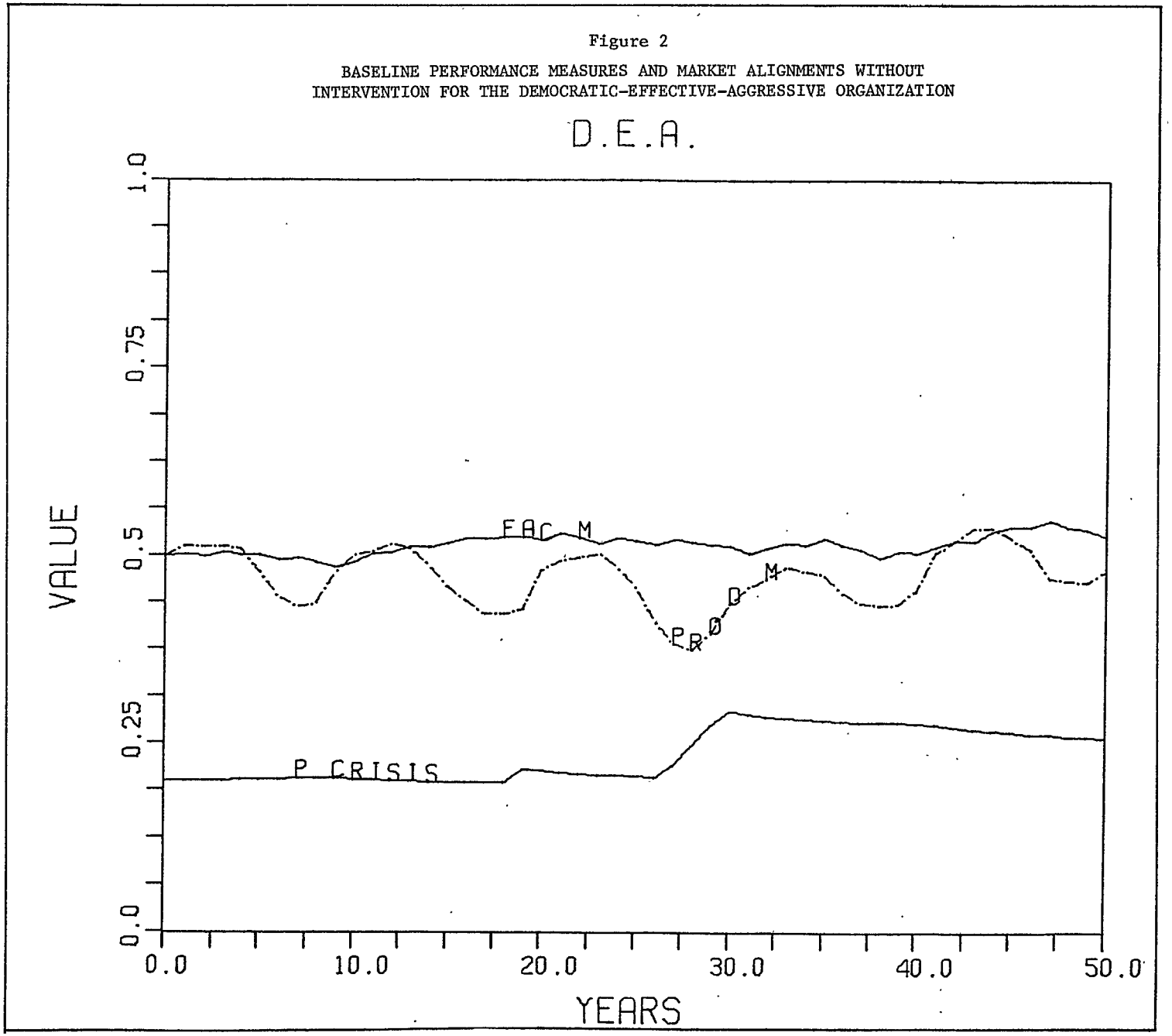
Table 2

ORGANIZATIONAL ATTRIBUTES

	AUT/DEM	NEG/ADV	DEF/AGG	BURS	RISK	CENT	INST	H DEPTH
Democratic-Effective-Aggressive (DEA)	.8	.2	.6	.3	.8	.2	.3	.2
Autocratic-Effective-Aggressive (AED)	.2	.8	.4	.4	.4	.6	.6	.3

Figure 2

BASELINE PERFORMANCE MEASURES AND MARKET ALIGNMENTS WITHOUT INTERVENTION FOR THE DEMOCRATIC-EFFECTIVE-AGGRESSIVE ORGANIZATION



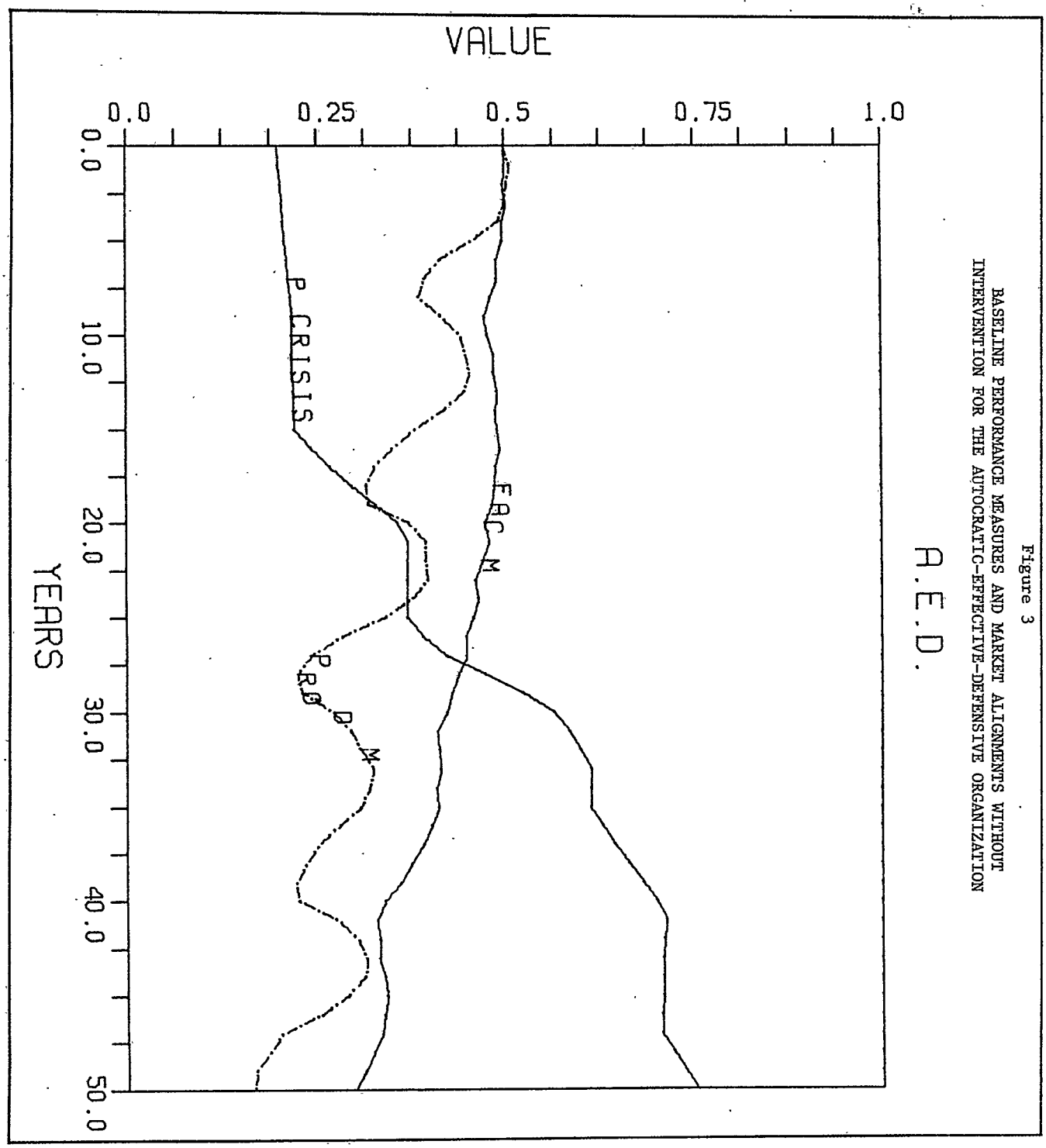


Figure 3

BASELINE PERFORMANCE MEASURES AND MARKET ALIGNMENTS WITHOUT INTERVENTION FOR THE AUTOCRATIC-EFFECTIVE-DEFENSIVE ORGANIZATION

The simulation experiments which follow examine various strategies for reforming the AED organization to improve its performance. Two approaches are explored. The first is an "experimental design" approach whereby we change a single characteristic to determine its effect on performance. While this approach is quite reasonable when dealing with a model, in reality it is generally impossible to implement. The second approach recognizes the interrelationships between control variables, and, hence, represents strategies of reform that organizations may employ.

SIMULATION EXPERIMENT RESULTS

Table 3 provides long-term values for market performance and propensity for crisis for each experiment. In each case a single characteristic of the AED organization was altered in the fifth simulated year to match the DEA organization. Four of the remedial interventions (H DEPTH, RISKS, INST, and BURS) made no appreciable impact on market performance or propensity for crisis. The other four interventions yielded a noteworthy improvement in market performance and a small reduction in propensity for crisis. In addition, the structural change (CENT) was more effective in improving performance than the attitudinal modifications (AUT/DEM, NEG/ADV, and DEF/AGG). This is hardly surprising since an attitudinal variable tends to shift back towards its previous value when unsupported by a compatible infrastructure of other attitudinal variables.

Table 3

SINGLE ATTRIBUTE STRATEGIES OF REFORM

	DEA	AED	AUT/DEM	NEG/ADV	DEF/AGG	BURS	RISKS	INST	CENT	H DEPTH
Market Performance	100	35	51	49	53	36	39	35	51	36
Propensity for Crisis	100	293	263	268	258	289	280	291	244	289

The next set of simulation results are those representing the second approach (Table 4). Here we have several options available. The first is for a firm to replace its senior management; two such experiments were tried (X1 and X2). In X1 the new executives strongly favor democratic procedures and negotiation. Surprisingly, this combination of attitude modification is only slightly better for the firm than modifying either attitude alone. In X2, the new executives are still autocratic advocates, but highly aggressive risk takers. Their impact on the firm is substantial. Market performance is increased significantly and propensity for crisis, while still high, is sharply reduced.

Table 4

MULTIPLE VARIATE STRATEGIES

	DEA	AED	X1	X2	X3	X4	X5
Market Performance	100	35	55	71	59	70	84
Propensity for Crisis	100	293	249	216	246	188	116

X1: Democracy up; Advocacy down - sharply

X2: Risk up; Aggression up - sharply

X3: Risk up; Institutionalization down - gradually

X4: Risk up; Institutionalization down - gradually Centralization down; Hierarchical depth down - sharply

X5: Risk up; Institutionalization down - gradually Centralization down; Hierarchical depth down; Democracy up; Advocacy down - sharply

The next option examined is one of gradual internal reform, that is, developing appropriate managerial attitudes. Through retraining and implementing a new reward system, risk taking is increased and the rigidity of standard operating procedures (institutionalization) is decreased to DEA levels over eight years (X3). This strategy proved much more effective than shifting either characteristic alone, as the two interact synergistically. Where individual shifts in RISKS and INST produced 11% and 0% gains in market performance respectively, together they produced a 69% improvement. There was also a reduction in propensity for crisis, but it was not dramatic.

The third option tested was to combine gradual internal reform with structural changes; decentralization and reduction in hierarchical depth (X4). This strategy improved market performance substantially over the reform and structural changes carried out separately. The most impressive improvement, however, is the large reduction in propensity for crisis (35% reduction). It is noteworthy that this gradual reform and structural shift without replacement of executives matched the radical strategy X2 in market performance and led to lower propensity for crisis.

The fourth option tested was to combine the above reform and structural shifts with the replacement of executives by new managers favoring democratic procedures and negotiation (X5). This combination had a market performance better than that produced in X2 or X4. In addition there was a tremendous reduction in propensity for crisis. Comparing X1 and X5 we see that the democratic, negotiating style of leadership can have a major impact on a firm, but only when other characteristics of the firm are properly aligned.

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