

THE FEEDBACK VIEWPOINT IN BUSINESS
STRATEGY FOR THE 1980'S

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ABSTRACT

This paper presents a flexible, model-based approach to strategic program design--the process of putting together consistent business programs and policies to support new strategic initiatives. The new approach combines ideas from administrative theory and feedback theory. Administrative theory reveals the organizational and diffusion processes that connect business programs and customers. Feedback theory reveals patterns (feedback loops) in the connections between the programs and policies of a business and its market. This conceptual framework is applied to strategic program design in a two-phase analysis which is much more flexible than traditional system dynamics business modeling. Phase 1 is a descriptive analysis that explores business-market structure in terms of organizational and diffusion processes, showing where conflicts of responsibility, confused incentives, misinformation, and administrative inertia may degrade business performance. Phase 2 uses simulation modeling and the descriptive information from phase 1 to debate policy options and program design. The style of analysis is illustrated with business cases and applications projects.

INTRODUCTION

There is a need in strategic planning and business policy for tools that aid strategic program design, the process of putting together consistent business programs in marketing, distribution, manufacturing, and product development that support new strategic initiatives. Such new tools would complement established and successful portfolio and competitive analysis techniques (Hammond and Allan [1], Hax and Majluf [2], Porter [3]). But instead of analyzing the competitive and cost structure of a business, tools for strategic program design would analyze the firm's administrative structure--its operating units, channels of communication, diffusion processes, division of responsibility, control systems, targets, incentives, traditions and routines.

This paper presents a flexible, model-based approach to strategic program design that combines ideas from administrative theory and feedback theory. Administrative theory provides a conceptual lens for viewing the organizational and diffusion processes that interrelate business programs and customers. Feedback theory provides a second lens, which reveals patterns (feedback loops) in the connections between the programs, policies, and decision functions of a business and its market.

This conceptual framework is applied to strategic program design in a two-phase analysis. The first phase, an analysis of business-market structure, examines the existing programs and

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policies that link a firm and its market. For example, an analyst looking at a company's new product-market strategy might examine the importance of sales-force persuasion, word of mouth, and advertising in the diffusion of product knowledge in order to understand the forces of market growth. He might also examine the company's procedures for distributing and marketing existing product lines to understand how well the old procedures match the needs of the new market (in the belief that old business habits shape new strategic thrusts). He would explore the company's many "market intelligence channels" to learn how the company interprets and responds to customer needs.

The second phase is dialectical simulation modeling. A system dynamics simulation model is built from the descriptive "process" information of phase 1. The model is used to debate program design with managers responsible for the different programs.

Two-phase strategic program design is a marked departure from standard system dynamics business modeling. It is much more flexible. Phase 1, business-market structure analysis, is a descriptive data-rich survey of the organization and its market. It is a stand-alone analysis, useful for policy debate but involving no formal model. Phase 2, dialectical modeling, uses the data gathered in step 1 to build a company or industry-specific model to refine program design. Phase 2 may not always

be necessary or desirable in a model-based analysis, depending on the experience of the analyst and the uniqueness of the business-market structure.

CONCEPTUAL FRAMEWORK FOR STRATEGIC PROGRAM DESIGN

Strategy is defined here as a set of interlocking programs and policies in marketing, distribution, manufacturing, and product development that are intended to support a strategic initiative. For example, a strategy might consist of programs for the launch of a new product line, the introduction of new manufacturing methods, the startup of a new distribution channel, or the defense of a market under changing competitive conditions. This definition of strategy best fits Wheelwright's [4, p. 20] business and functional levels of strategy and is clearly narrower than Andrews' [5, p. 18] commonly accepted definition of corporate strategy:

...the pattern of decisions in a company that determines and reveals its objectives, purposes or goals, produces the principal policies and plans for achieving those goals, and defines the range of business the company is to pursue....

It is common for companies to define their business strategy in terms of interlocking programs. For example, the Bell Operating Companies viewed their PBX migration strategy (to convert customers from electromechanical to electronic switching systems) in terms of policies and programs for pricing, sales quotas, compensation and sales-force sizing (Cleary and Morecroft

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[6]). A well-known computer manufacturer viewed its desktop computer strategy in terms of programs and policies for manufacturing launch, expansion of the dealer network, advertising, sales-force sizing, and compensation (Paul and Strother [7]). The strategic problem facing these companies was not what range of businesses they should consider but rather how they should use their existing marketing, production, and technical resources to respond to a new business opportunity. Strategic program design is intended to address this problem.

To examine the design and consistency of a set of business programs, it is necessary to look at the micro-organizational and diffusion processes of a firm and its market. Two conceptual lenses are used to bring these processes into focus.

Lens 1. Bounded Rationality and Administrative Theory

Lens 1 reveals the limitations that exist in the way markets learn about the products and services offered by firms and the way firms process information about their markets. When a firm introduces a new product, changes its prices, enhances a service or offers extended warranty, its customers (and potential customers) are not instantly aware of the change. There are many channels by which product and service information reaches customers, some fast-acting and others slow-acting. For example, a firm that wishes to increase sales by establishing an excellent service reputation may spend years doing so. Greater service

effort translates only slowly into a higher reputation. Just as customers have imperfect knowledge of product programs so firms have imperfect knowledge of customer preferences. Although there are many channels for firms to monitor customer preferences, these channels connect to different organizational sensors. There is no "central brain" that combines the intelligence of all these sensors into a comprehensive, timely picture of the market's overall perception of the firm's products and services. These information limitations derive from the bounded rationality of customers, executives, managers, and staff in the firm-market system.

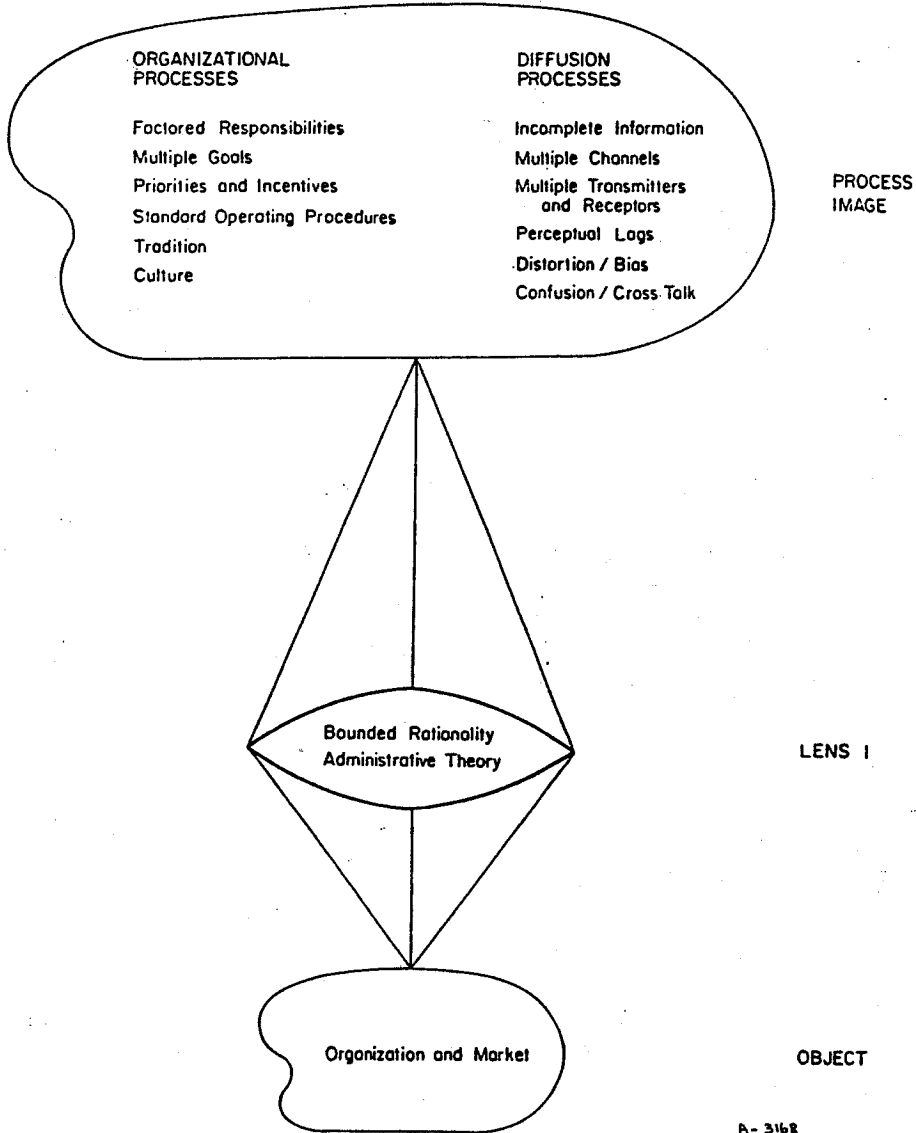
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Bounded rationality is a precise way of describing the frustrations we all feel as decisionmakers (Simon [8], [9], and [10]). We never know all the options open to us; they are too many to consider. We never have enough information to form a "best" judgment, and we haven't the mental wherewithal to compute the consequences of the few options we may consider. These features of everyday decisionmaking are so commonplace they are often taken for granted. Yet by viewing a firm and its market in terms of a set of actors with bounded rationality, we develop a fine appreciation for the inconsistencies of policy that routinely occur, the likelihood of programs being at cross-purposes, and the prevalence of policy myopia (Allison [11], Cyert and March [12]).

When a firm and its market are viewed through the lens of bounded rationality and administrative theory, an image is formed of organizational and diffusion processes that interrelate business programs and customers. Figure 1 shows the factors that are emphasized by this lens. The firm is seen as a loosely connected set of actors with their own responsibilities, their own programs, and their own criteria for success. Consider the case of a computer manufacturer that is entering the personal computer market having been dominant in the minicomputer business. There are two channels for selling the new product, the direct sales force which has been the primary channel for selling minicomputers, and a newly established and growing dealer network. A key objective of the company is to establish a presence in the rapidly growing personal computer market. But how is this objective to be realized through sales and marketing programs?

The administrative lens brings into focus the factored responsibilities of the direct sales force and dealer networks. Both take part in selling the product, but organizationally they are quite separate, and the actors in each channel have quite different goals and incentives. The primary task of the direct sales force is selling the minicomputer product lines which are big revenue earners and the core of the business. Selling personal computers is regarded as a distraction. The incentives, procedures, and traditions that have evolved in the direct sales

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Figure 1. Organizational and Diffusion Processes Seen Through Lens 1

force discourage aggressive selling of low-end product. Compensation systems favor the sale of items that yield high revenue per salesman hour. Force planning is geared to historical measures of salesman productivity derived from experience in the minicomputer business. It is difficult to justify the additions to force that would be necessary for an aggressive expansion of personal computer sales.

The dealer network is altogether different. It comprises the manufacturer's franchising and dealer support programs and a set of semiautonomous retail outlets that are selling a variety of competing desktop and personal computers. This organization is less entrenched in its ways than the direct sales force, but it is also much smaller. Close observation of the dealer organization through the administrative lens reveals a variety of goals, incentives, and procedures whose resultant may not always produce a clear thrust in the sales of the company's personal computers. The primary objective of the franchising and dealer support program is to establish a national dealer network. The procedures for selecting retail outlets and negotiating terms of sale almost certainly reflect the traditions and the image of the company. These selection procedures determine the rate at which geographic retail coverage grows and therefore the rate at which personal computer sales grow.

The retail outlets themselves have a simple set of economic incentives to grow. But the incentives for growth may translate very unevenly across the range of competing product lines, depending on such procedural issues as the terms of sale (the margin a dealer or salesman makes on the sale of a particular product line), the shelf space allocated to a product line, and the salesmen's technical knowledge. In short, there are many administrative and organizational processes between a company's desire to gain a foothold in a new product market and the realization of that desire.

The administrative lens also brings into focus the diffusion processes by which information travels through the market and the firm. All decisionmakers in a business-market system (customers, executives, program managers, salesmen, buyers, production-line foremen, planners) have incomplete information with which to make choices and to take actions (Forrester [13], chapter 10). There are multiple channels that transmit information from the firm to the market and vice versa. The administrative lens forces us to ask how customers become informed. Perhaps they see advertisements, perhaps they hear by word of mouth, or by seeing the product in a store, in an office, or on the street. Perhaps they hear about new product from a salesman. The dominant channels for informing customers about products and services differ from product to product. Rubick's cubes, for example, sold almost entirely by word of mouth and visibility. One would

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not expect to sell specialized industrial products, such as electronic capacitors or needle bearings, in this way.

There are multiple transmitters and receptors of information in a business-market system. A market may consist of hundreds, thousands, or even millions of customers and potential customers. The most tangible signal these customers send to a firm are orders for its products. They also send more subtle information. They make inquiries about products which may or may not be translated into firm orders. They express their satisfaction or dissatisfaction with the product's quality, its reliability, and its maintenance. There is a colossal amount of information in these channels (Forrester [14]). If taken as a whole, it would provide a comprehensive picture of the market's view of the products and services it receives from a given company. But the information cannot be comprehended as a whole. Different organizational receptors are responsible for processing parts of the market feedback. Dealers and retailers often receive customer orders and customer inquiries. The warranty department of a company receives much feedback information on product quality and reliability. The marketing and sales department has information on the competitive status of products. The coherence with which a company responds to all this information depends on the policies and procedures that filter the information and translate it into production schedules, capacity acquisitions, advertising programs, pricing programs, service and warranty programs.

Information channels contain perceptual lags, distortion, and bias. The administrative lens brings these imperfections into focus. For example, in a study of customer purchasing in the PBX (private branch exchange) market, it was found that customers perceive the prices of the leading PBX supplier to be only twenty percent higher than the competition's. In fact, direct comparison of list prices showed the price premium to be fifty percent. This customer misperception is important for understanding the competitive behavior of the PBX market. Distortion can also occur as information travels through the standard procedures of an organization. The orders that a firm receives from its dealer network are customer orders and inquiries filtered through the selling and administrative procedures of the dealers. The orders that a supplier receives from an original equipment manufacturer (O.E.M.) are customer orders filtered through dealers' policies and the production scheduling, forecasting, and ordering procedures of the O.E.M. As system dynamics models have adequately shown, (Forrester [13], chapter 15, Lyneis [15]) these administrative filters inevitably distort market demand, leading to production and procurement schedules that fluctuate and that amplify demand variations.

Confusion and cross talk frequently occur in the information channels of a business-market system. For example, in the case of the computer manufacturer entering the microcomputer market, cross talk between the direct sales and dealer channels is very

likely. Increasing awareness of the firm's microcomputers (caused by growth in dealer sales) could lead to an unexpectedly high volume of inquiries to the direct sales force. If the incentive structure of the sales force results in a very low priority being given to microcomputer sales, then the channel cross talk will be dysfunctional, and retard the growth of the microcomputer business.

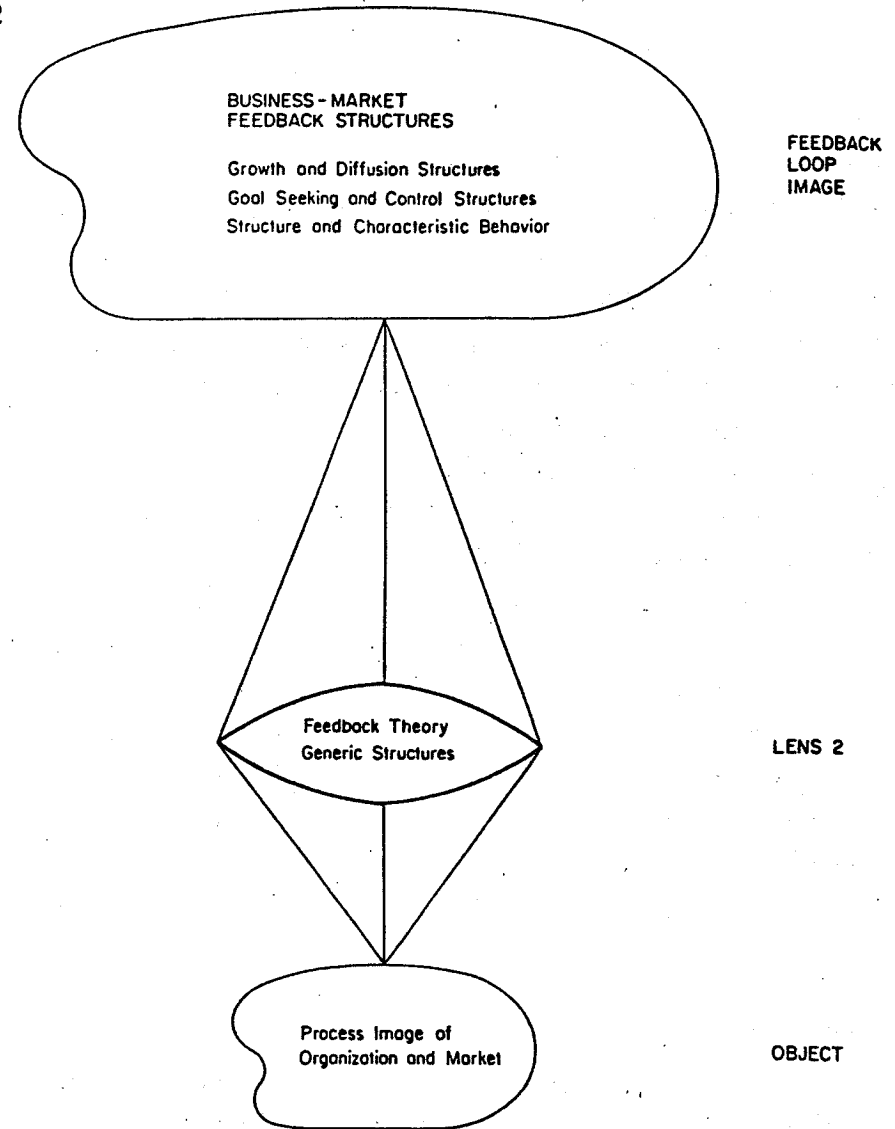
Lens 2. Feedback Theory and Generic Structures

Lens 2 reveals patterns in the connections between the programs, policies, and decision functions of a business and its market. These patterns take the form of feedback loops which if sufficiently general are labeled generic feedback structures (Forrester [16], Richardson and Pugh [17], and Roberts [18]). For example, in many consumer markets, word of mouth is an important channel by which customers learn about a product (Dodson and Muller [18]). A prospective customer hears about a new product from an acquaintance, encounters the product at work, or by chance sees it in a retail outlet. The customer later buys the product and becomes a "salesman" for future products by spreading the word among his circle of friends. Moreover, the newly purchased product becomes its own "salesman" by being seen in the marketplace. The word-of-mouth diffusion channel forms a closed circuit or positive feedback loop that generates growth in product sales independently of the firm's direct sales effort or advertising. More sales generate more awareness, which in turn

generates more sales. This common reinforcing cycle of consumer awareness is a good example of a generic feedback structure.

Figure 2 shows the feedback lens converting the process image of an organization and market into business-market feedback structures. There are many generic growth and diffusion structures in a market that determine how the market will perform over time, whether it will grow explosively or gradually, whether it will fluctuate, whether and when it will saturate or decline. These structures depend on the information channels that most influence customer purchase and on physical characteristics of the product such as complexity and lifetime. For example, chain saws are simple consumer durables. Word of mouth is an influential selling channel. The resulting positive feedback loop can produce explosive growth in demand as occurred between 1972 and 1974, when sales of gas chain saws went from 900 thousand to 1.9 million units per year (Porter [20] and [21]). The long lifetime of saws (ten years for casual users) results in low replacement demand. The feedback structure of the chain saw market produces rapid growth, saturation, and decline, as seen in the ten-year interval between 1971 and 1981. By contrast, specialized industrial products such as electronic components or needle bearings sell in a very different way, and their market growth and diffusion are governed by different feedback loops. Typically, salesmen tout the product among large industrial customers, aided by advertisements in specialized trade journals.

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Figure 2. Seeing Feedback Loops and Generic Structures Through Lens 2

Customers become aware of the product through sales-force persuasion and advertising. In this industrial market, more sales create more revenue, which permits expansion of the sales and marketing budget. With a larger budget more salesmen are hired, leading to more customer contact and more sales. This positive loop couples the decision process of the customer to the budgeting and hiring procedures of the firm. (A similar positive loop is described in Forrester [22].)

Within the firm, lens 2 reveals feedback structures that regulate prices, sales effort, distribution capability, inventories, backlogs, production capacity, engineering capability, and financial resources. Many of the structures are goal-seeking, negative feedback loops. To take a simple example, suppose salesmen are set a goal for annual sales revenue to which their compensation is tied. If a salesman's current performance falls below the goal, he will probably work harder and reallocate his time toward revenue-generating activities. If the salesman's efforts are successful, the discrepancy between his revenue performance and revenue goal will be reduced. A closed circuit or negative feedback loop exists. When revenue is below the goal, salesmen take actions to reduce the revenue discrepancy.

Much more subtle goal-seeking and control structures exist in a firm. Some structures determine how well the firm reads market signals, whether its policies attenuate customer demand,

inhibit or encourage customer inquiries and customer feedback, or amplify variations in orders. Other structures determine how effectively the firm marshalls its resources in response to changing market conditions, whether reserve production and sales capability are available to exploit unexpected surges in demand, whether the firm is prone to cycles of over- and undercapacity. Other structures affect the productivity of employees, and ultimately the costs and competitive position of the business.

Goal-seeking and control structures in a firm are most easily seen when the modeler has a good knowledge of organizational and diffusion processes. For example, an appreciation of cross talk, goal formation, standard procedures and local priorities was essential for analyzing the PBX migration strategy of a Bell Operating Company (Cleary and Morecroft [6]). The company was converting business customers from electromechanical telephone switching systems (PBXs) to more sophisticated electronic switching systems. A model-based study showed that salesmen's priorities and incentives were at cross purposes with the firm's objectives of converting the market quickly and retaining high market share. As migration proceeds salesmen spend less and less time in proactive selling (converting loyal customers to new equipment) and more and more time in reactive selling (preventing customers switching to competitors).

Figure 3 shows the feedback structure that produces this behavior. Salesmen are motivated to migrate customers by product quota. The lower half of the figure shows how. If performance against quota is low, salesmen put in more proactive sales effort, thereby generating more customer awareness and more conversions, so improving their performance. But quotas, though seeming to encourage proactive selling are in fact very ineffective. The upper half of the figure shows why. The salesman's highest priority is reactive sales effort--trying to prevent competitor conversions that are embarrassing and erode the revenue base. But competitor conversions are growing, fueled by a positive diffusion loop. Conversions enable competing companies to place more resources in their sales force and so generate more sales effort, more awareness and even more conversions. As a result Bell salesmen spend a greater proportion of their time in reactive selling and less in proactive selling. The quota mechanism is unable to prevent the decline in proactive selling because cross sales generated by competitor growth tend to keep performance against quota misleadingly high. Moreover, as the quota itself is set on the basis of past conversions there is nothing in the control structure that signals Bell's declining influence in the market. The priorities and incentives of the sales force unintentionally allow the competition to take the initiative in informing customers of new-technology products, and so gain market share.

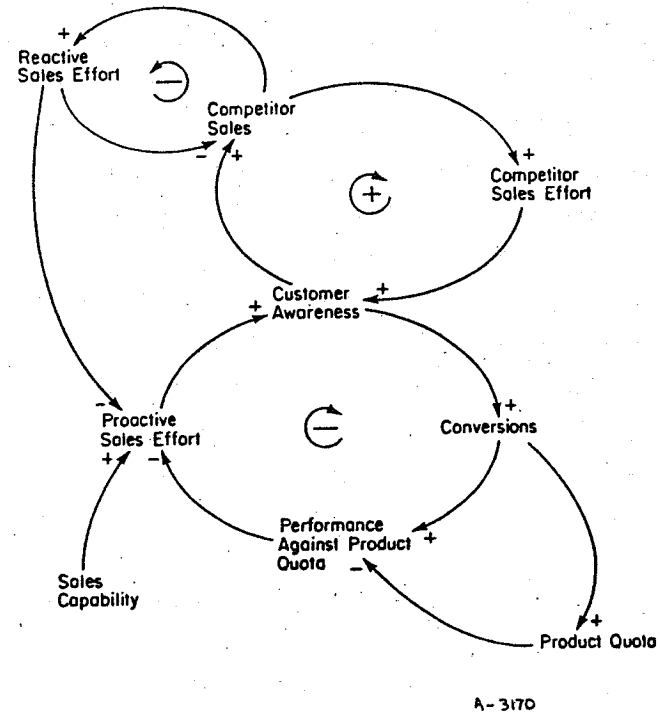


Figure 3. Feedback Structure Causing Loss of Market Share in a Migration Strategy

Power of the Lenses in Conjunction

The administrative and feedback lenses in conjunction provide a sharp image of business-market structure that can be used to probe the design and consistency of business programs (Morecroft [23]). Feedback loops are a concise, visual representation of organizational and diffusion processes. Simulation models reveal the characteristic behavior of feedback loops, showing the processes that regulate growth of sales, market share, productivity, product attractiveness, production efficiency, and profitability. With the aid of feedback loops and simulation runs, one can explain how seemingly reasonable policies and procedures can work at cross purposes, failing to bring about growth when growth opportunities exist, distorting minor changes in customer demand into volatile and fluctuating production schedules, discouraging proactive selling in a competitive market, depressing productivity in R&D or sales, and choking product supply in a market that is known to be sensitive to availability.

The two lenses in conjunction are much more useful than either alone. Lens 1 lacks the resolution to detect program inconsistencies and design flaws before they cause problems. Instead, it provides an interesting ex-post perspective on organizational choices and actions.

Allison's ([11], chapter 4) famous process analysis of the Cuban Missile Crisis is a good example of the unique interpretation of events viewed through lens 1. During the buildup of Soviet SAM missiles in Cuba, there was an intriguing contrast between the secrecy with which missiles were shipped and the openness with which they were installed. What could such a cloak-and-dagger operation mean? What message were the Soviets trying to convey to the United States? The administrative lens suggests there was no message, no subtle motive or threat implied by the contrasting styles of shipping and installation. The contrast was a natural outcome of organizational processes. The intelligence agency had responsibility for shipping the missiles, and secrecy was its normal mode of operation. Air Defense Command had responsibility for installing the missiles. The missile sites were

...constructed in a typical trapezoidal patterns for no better--and no worse--reason than that this was the way Soviet SAM construction teams position SAMS. Nothing in the organization's repertoire reflected any awareness of the possible clues this pattern might present to foreign intelligence. (Allison [11], p.110)

Lens 2 alone shows structure in compact diagrams and relates structure to behavior. But it is an inadequate basis for creating business structure. The information channels that connect business programs and customer decisions, the methods used to select and interpret information, and the factors that condition business choices and actions (goals, routines, culture) are the outcome of organizational processes (Forrester [1],

chapter 10, Simon [8], chapter XI, Morecroft [24]). Feedback loops are seen much better when an administrative lens is first used to "scope out" the policies and decision functions of the organization and market. Without the administrative lens, one's attempts to capture realistic business-market structure are limited. Feedback theory provides only a few "process" concepts which stress for example that policies should use only available information and that proper account should be taken of perceptions, information lags, distortion and bias. These concepts don't readily lead to a model that captures the bounded rationality of organizational decisionmaking, except in the hands of individuals with considerable administrative and modeling experience. The repeated surprise generated among students by an Allison-style administrative analysis is ample evidence that people rarely identify with the processes that shape the choices and actions of organizations.

TWO-PHASE ANALYSIS OF STRATEGIC PROGRAM DESIGN

There is a clear need for tools that assist businessmen in designing programs, policies, and administrative procedures which support new strategic initiatives. There is ample evidence that seemingly good strategies have, in the past, foundered due to confusion in business responsibilities, inadequate or inappropriate incentives, misinformation, lack of clear goals, and lack of clear standards for productivity and expected performance. These are all symptoms of administrative ills. A

216 good example is provided by the failure of the Du Pont company's diversification into varnishes and paints at the end of World War I (Chandler [25], chapter 2). Diversification was justified on the grounds that the explosive powder business (the company's dominant product line) would shrink dramatically at the end of the war, leaving excess plant and equipment. The varnish and paint business provided a new market to which the powder plants could adapt their output. Though logical from a manufacturing standpoint (the new lines used many of the same materials and processes as explosives), the strategy ran into marketing difficulties. The vice-president of sales, Frederick Pickard, expressed the problem in the following way (Chandler [25], p. 92):

The expansion of the Du Pont organization (into varnishes and paints)...has produced a sales condition which compels consideration of a wider variety of products which have no logical sales connection with one another.

The new product lines required quite different methods of selling than the explosive powder products the company had traditionally sold. This shift in methods of selling and the corresponding change in costs made it very difficult to apply standards of performance in a centralized, functional organization. There were no clear historical standards by which to gauge the efficiency of sales. Standards changed as the product mix of the business changed. Although the paint and varnish business grew (from \$1.3 million to \$4.0 million between 1917 and 1919), it lost progressively more money (\$0.1 million in

1917 and \$0.5 million in 1919). In response to these losses, Du Pont executives carried out a methodical business analysis which included a survey of competitors. The analysis showed that competing firms, though much smaller and therefore lacking large economies of scale in production, were nevertheless profitable. Moreover, the competitors appeared to have no advantage in the purchase of raw materials and no secret processes or patents to provide manufacturing advantage. Their sole advantage lay in the fact that they specialized in the manufacture, distribution, and sale of varnishes and paints. This focus provided them with clearer responsibilities and clearer standards for administering sales and distribution. With a better administrative design it was easier to hold individuals accountable for goals which produced profits.

But what kind of tool is needed to probe the administrative design of an organization? In traditional system dynamics the answer has been to find a business problem, build a monolithic simulation model that captures the essential feedback structure, and experiment with the model to design new policies that improve business performance. Here we suggest there is a need for a new, more flexible model-based analysis of business strategy.

The analysis should comprise two phases. First, there should be a business-market structure analysis that takes the form of a descriptive report of key organizational and diffusion

processes. Second, a compact model should be built for the purpose of debating policy options and program design. The second phase is known as dialectical modeling. The first phase should be regarded as a stand-alone analysis that may provide value to an organization even when it is not followed by phase 2. (Wolstenholme [26] has also argued for a two-part approach in model-based analysis of general systems. The first part he refers to as "qualitative system dynamics," which includes problem identification, qualitative problem analysis and recommendations for change. The second part he refers to as "quantitative system dynamics," which includes mathematical modeling simulation and dynamic analysis for the design of system structure and control.)

Business-Market Structure Analysis

The business-market structure analysis is best thought of as an extended form of model conceptualization (Richardson and Pugh [17], chapter 2). It is the traditional conceptualization process fleshed out with the additional detail that is available from viewing a business through the administrative and feedback lenses. The analysis begins with a business problem or issue. Then, through field work, interviews, and industry analysis, the structure of the programs most relevant to the issue are described in terms of underlying organizational and diffusion processes. Diagrams of feedback structure are used to illustrate the connections between programs and policies. Small generic

models are used to interpret the behavior of known feedback structures.

Business-market structure analysis goes beyond traditional conceptualization. It results in a conceptual model comprising a combination of prose and figures, explaining how the business is structured, the division of responsibilities, key goals and success factors for programs and functions, standard operating procedures and routines, the traditions and habits of the organization as influenced by its history and its leaders, the channels by which customers learn about products and services, and the channels by which the firm learns of customer needs. The description of the conceptual model would read more like a case study than the preamble or overview of a mathematical simulation model. Business-market structure analysis is a "process" style of analysis and, even in the absence of a formal simulation model, can be expected to provide new and useful insights into the structure and operation of the business. There is a need to recognize the inherent value of an analysis that looks at an organization through an administrative lens. System dynamicists, by neglecting the administrative lens, have undervalued the conceptual phase of their work, seeing it is a means to the end of modeling rather than an end in its own right.

Business-market structure analysis also goes beyond traditional conceptualization by exploring the likely behavior of

218 the business insofar as it can be deduced from the conceptual model. This intuitive analysis obviously lacks the rigor of a formal, model-based behavior analysis, but can nevertheless provide insight because it builds on understanding of the organizational processes and generic structures present in the conceptual model.

In an M.I.T. master's thesis for example, Joseph Maffione [27] examined a manufacturing policy problem for Millipore Corporation, a leading company in the water filtration and purification market. The company wished to reduce its finished inventory investment and proposed to cut inventory coverage on a wide range of product lines whose customers were insensitive to product availability. A model was created that examined the administrative structure of manufacturing (the policies and procedures governing the scheduling of production and the priorities given to different product lines) and the ordering behavior of customers. The analysis produced the interesting result that a reduction in inventory investment for delivery-insensitive product lines would result in longer lead times for delivery-sensitive product lines. The reasoning to support this argument does not require a formal simulation model. Rather, it requires a good appreciation of the firm's manufacturing policies and procedures and their linkage to the market. It is an argument that proceeds smoothly once the administrative and feedback lenses are used to interpret business-market structure.

The firm used dollar value of backlog as the criterion for deciding which product line would be allocated capacity for a batch run. This standard operating procedure was simple to administer, but it upset the logic of the inventory reduction program. Items with low inventory coverage (the delivery-insensitive items) would have high manufacturing priority because the dollar value of their backlog would likely be higher. The delivery sensitive items would therefore have lower manufacturing priority and become less available in the market, thereby causing the company to lose sales. The inventory reduction program, which seems logical from a market standpoint, no longer works when superimposed on standard manufacturing procedures. Since the company valued the administrative simplicity of its manufacturing process, the only sensible course of action was to abandon the inventory reduction program and to recognize that higher inventory carrying costs are the price one pays for the simplicity. This recommendation was well received in the company.

Business-market structure analysis has a much bigger potential market in strategy analysis and consulting than traditional monolithic models. It is a more flexible tool for analysis than a formal model and can therefore be better communicated to a business audience and requires less specialized technical training on the part of the analyst. A good knowledge of business administration, organizational processes, and

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diffusion processes coupled with an appreciation of generic feedback structures and their behavior is sufficient to carry out this kind of analysis.

Ample evidence exists to support the notion that a flexible model-based tool fills a need both for business clients and analysts. In the course of supervising many field projects over the past three years, I have frequently observed the enthusiasm of executives and managers during presentations of the policy structure of a business model. It is not the anticipation of the formal simulation model that generates enthusiasm but the novelty of viewing the organization through the administrative and feedback lenses and seeing business operations linked. I have also seen students who, on the basis of their conceptual models and rough-cut formal models, have pieced together plausible and interesting analyses of business policy. They have leveraged their model-based understanding into policy arguments more sophisticated and subtle than the formal model could strictly justify.

Dialectical Modeling and Program Design

In some situations it may be necessary or desirable to move beyond a descriptive business-market structure analysis to a formal simulation model. Certainly this will be true if one is engaged in research work, looking for new generic business-market structures. A formal simulation model may also be desirable to

clarify the analysis of a business system where intuitive analysis seems inadequate.

A formal model is a natural extension of descriptive business-market structure analysis. The model converts pictures of feedback loops and descriptions of organizational process into a set of mathematical equations. The information gathered in interviews with managers, customers, and dealers is compressed into model parameters and the relationship among policy functions.

Models should be compact and addressed to the purpose of debating policy options, examining the consistency and coordination of business programs and producing cogent arguments for policy change. This style is known as dialectical modeling and is described in more detail in Morecroft [28] and Mass [29]. Models produce opinions about the outcome of business programs that are used to challenge the preconceptions of management.

The operational detail required in dialectical modeling is much less than is ordinarily encountered in business simulation models. One can gauge the appropriate level of model detail from the content of an intuitive business policy argument. For example, when Du Pont was expanding its dyestuffs business after World War I, an executive advanced the following argument for close coordination of production and sales (Chandler [25], p. 70):

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It would be wise to maintain one individual in control of both production and sales, because the relation of the product and its qualities is so mixed up with the demands of the market for the product that to divorce them and segregate the business into a clearly defined production department and an independent sales department would be detrimental to the business.

This argument deals with the administrative structure of the dyestuffs division and the way structure affects the ability of the division to respond to the needs of the market. The argument does not depend on detailed knowledge of dyestuffs product lines, manufacturing process, costs, or geographical arrangement of the distribution network. It is a rather abstract administrative argument cast at a high level of business aggregation, where the responsibilities and interdependencies of production and marketing are brought into clear focus.

If a formal model is simply a refined tool for policy argument and debate, then when is its use justified? After all, a business-market structure analysis provides a conceptual model that can stimulate policy debate as does experience in the form of a mental model. In system dynamics, this question of justifying a formal model (when the administrative insights to be gained are worth the considerable effort required to produce a credible model) is rarely addressed because of an implicit belief that no value is added until a formal model exists. In fact, there are two distinct sources of value added in the flexible model-based analysis. There is value added in the descriptive

analysis of phase 1, the value of seeing the organization through the administrative and feedback lenses. There is further value added in the full-fledged simulation analysis of phase 2, the value of foresight and of additional confidence that can be placed in business opinion when it is consistent.

The relative value to be derived from the two phases is not fixed; it varies greatly from situation to situation. Phase 2 analysis is likely to be least valuable when an inexperienced modeler is addressing a novel business-market problem (one that is not readily described in terms of known generic structures). It is likely to be most valuable when parts of the problem can be modeled with known generic structures or when the modeler is very experienced.

SUMMARY AND CONCLUSION

This paper has shown how ideas taken from administrative theory and feedback theory can be combined to yield flexible, model-based analyses of business strategy. This new approach fills a need in the strategy field, the need to understand how multiple business programs and policies of a strategy interact to influence the strategy's success.

Analysis proceeds in two phases. The first phase is a business-market structure analysis that examines the organizational and diffusion processes linking a firm's business

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programs and customers' decision functions. The analysis is descriptive, using prose and diagrams (rather than formal mathematical equations) to explain business and market operations. It is a "process" style of analysis that emphasizes bounded rationality and information feedback in business decisionmaking.

The second phase of model-based analysis is dialectical modeling and program design. Here a formal simulation model (derived from the descriptive structural analysis) is used to examine the consistency of business programs, to project the consequences of following existing programs, and to debate program design.

A business-market structure analysis has a value independent of a formal simulation model--the value of viewing an organization in administrative and feedback terms. It is a flexible and descriptive form of analysis that may be used to debate business policy, to detect situations where there are conflicts of responsibility, confused incentives, misinformation, administrative inertia, or cultural bias that may seriously degrade the performance of a firm.

Business-structure analysis and dialectical modeling occupy a unique niche in the varied species of strategy support methods. In contrast to competitive analyses (which have become

increasingly common in strategic planning) structural analysis and modeling link the administrative makeup of a firm to the execution of strategy. The approach emphasizes the bounded rationality of administrative systems rather than the objective rationality of perfect markets. The style of analysis has a natural implementation bias, that seeks to understand how a firm, using existing programs and procedures, can realize its strategic aims most effectively.

REFERENCES

- [1] Hammond, J. S. and G. B. Allan. "A Note on the Boston Consulting Group Concept of Competitive Analysis and Corporate Strategy," case number 9-175-175, HBS Case Services, Harvard Business School, Boston, Massachusetts 02163, 1975.
- [2] Hax, A. C. and N. S. Majluf. "The Use of the Growth Share Matrix in Strategic Planning," Interfaces, vol. 13, no. 1, pp. 46-60, 1983.
- [3] Porter, M. E. Competitive Strategy, New York: The Free Press, 1980.
- [4] Wheelwright, S. C. "Strategy, Management and Strategic Planning Approaches," Interfaces, vol. 14, no. 1, January-February 1984, pp. 19-33.
- [5] Andrews, K. R. The Concept of Corporate Strategy, New York: Dow Jones-Irwin, 1971.
- [6] Cleary, J. P. and J. D. W. Morecroft. "Foresight in Business Planning," System Dynamics Group working paper D-3568, Sloan School of Management, M.I.T., Cambridge, Massachusetts 02139, 1984.
- [7] Paul, G. and T. Strother. "Developing a Retail Channel for Multiuser Microcomputers," unpublished master's thesis, Sloan School of Management, M.I.T., Cambridge, Massachusetts 02139, 1984.

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- [8] Simon, H. A. Administrative Behavior, third edition, New York: The Free Press, 1976.
- [9] Simon, H. A. "Rational Decision Making in Business Organizations," American Economic Review, vol. 69, no. 4, 1979.
- [10] Simon, H. A. Models of Bounded Rationality Volume II: Behavioral Economics and Business Organization, Cambridge, Massachusetts, The MIT Press, 1982.
- [11] Allison, G. T. Essence of Decision, Boston: Little Brown, 1971.
- [12] Cyert, R. M. and J. G. March. A Behavioral Theory of the Firm, Englewood Cliffs, New Jersey: Prentice Hall, 1963.
- [13] Forrester, J. W. Industrial Dynamics, Cambridge, Massachusetts, The MIT Press, 1961.
- [14] Forrester, J. W. "Common Foundations Underlying Engineering and Management," in Collected Papers of Jay W. Forrester, pp. 61-80, Cambridge, Massachusetts, The MIT Press, 1975.
- [15] Lyneis, J. M. Corporate Planning and Policy Design: A System Dynamics Approach, Cambridge, Massachusetts: The MIT Press, 1980.
- [16] Forrester, J. W. "Industrial Dynamics--After the First Decade," Management Science, vol. 16, no. 7, pp. 398-415, 1968.
- [17] Richardson, G. P. and A. L. Pugh. Introduction to System Dynamics Modeling with DYNAMO, Cambridge, Massachusetts: The MIT Press, 1981.
- [18] Roberts, E. B., ed. "System Dynamics--An Introduction," chapter 1 in Managerial Applications of System Dynamics, Cambridge, Massachusetts: The MIT Press.
- [19] Dodson, J. A. and E. Muller. "Models of New Product Diffusion Through Advertising and Word of Mouth," Management Science, vol. 24, no. 15, pp. 1568-1578, November 1978.
- [20] Porter, M. E. "The Chain Saw Industry in 1974," case number 9-379-157, HBS Case Services, Harvard Business School, Boston, Massachusetts 02163, 1979.
- [21] Porter, M. E. "The Chain Saw Industry in 1978," case number 9-379-176, HBS Case Services, Harvard Business School, Boston, Massachusetts 02163, 1979.

- [22] Forrester, J. W. "Market Growth as Influenced by Capital Investment," Sloan Management Review, vol. 9, no. 2, pp. 83-105, 1968.
- [23] Morecroft, J. D. W. "System Dynamics: Portraying Bounded Rationality," Omega, vol. 11, no. 2, March 1983, pp. 131-142.
- [24] Morecroft, J. D. W. "Rationality in the Analysis of Behavioral Simulation Models," System Dynamics Group working paper D-3419-3, Sloan School of Management, M.I.T., Cambridge, Massachusetts 02139, 1983.
- [25] Chandler, A. D. Strategy and Structure, Cambridge, Massachusetts, The MIT Press, 1962.
- [26] Wolstenholme, E.F. "System Dynamics: A System Methodology or a System Modelling Technique," Dynamica, vol. 9, part II, Winter 1983.
- [27] Maffione, J. P. "The Role of Safety Stocks in Determining Market Share," unpublished master's thesis, Sloan School of Management, M.I.T., Cambridge, Massachusetts 02139, 1982.
- [28] Morecroft, J. D. W. "Strategy Support Models," Strategic Management Journal, vol. 5, no. 3, 1984.
- [29] Mass, N. J. "Diagnosing Surprise Model Behavior: A Tool for Evolving Behavioral and Policy Insight," System Dynamics Group working paper D-3323, Sloan School of Management, M.I.T., Cambridge, Massachusetts 02139, 1981.