



Assessing Operations Management from a Strategic Perspective

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Manufacturing strategy research, together with service operations and strategy research, form the background for an examination of operations management. Although much of the assessment and critique is directed at operations strategy, traditional operations management issues such as technology, productivity, and quality also come under scrutiny as to their role in strategy. This review identifies three common themes and seven missing themes in the literature, contrasting the "content" variables so frequently investigated within operations management—quality, cost, delivery, and flexibility—against strategic "process" variables. Conclusions include the partial indictment of operations management literature through the missing themes, an indictment that can be shored-up through increased empirical research in operations strategy that focuses on content, process, and performance.

Background

Operations strategy (OS) is attracting increasing attention from researchers and practitioners within the operations management (OM) area. The strategic view of operations management dates back to Skinner's pioneering work (1969, 1974) in which he advanced these major ideas: (a) the manufacturing function can and should be employed as a competitive weapon, (b) cost and efficiency are inadequate goals for manufacturing, (c) "a factory that focuses on a narrow product mix for a particular market niche will outperform a conventional plant" (Skinner, 1974, p. 114), and (d) the successful formulation and implementation of manufacturing strategy is a top-down process that requires manufacturing to conform to a manufacturing task derived from competitive strategy.

This article critically assesses operations management from a strategic perspective, with a review of manufacturing strategy (MS) and the literature on service operations, especially as it relates to strategy. We use the themes commonly found in the operations strategy literature (including manufacturing and services)

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and the themes missing from it to structure our review. The significance of using missing themes in literature as a yardstick for review is that this approach serves as both an indictment of the literature as well as a guideline for the direction of future research.

Manufacturing Strategy Research from 1969-1988

A Thematic Approach

Several possible frameworks could be employed in reviewing the last 20 years of manufacturing strategy research. We have chosen to evaluate manufacturing strategy research on the basis of progress made against key themes. What, then, is the source of these themes? The themes used in this review fall into two groups. The first group consists of commonly found themes in the manufacturing strategy literature. The second group consists of important themes that are found in the business strategy literature or in the operations management literature, but ignored or inadequately developed in the manufacturing strategy literature. The two groups of themes are labeled, "common themes" and "missing themes" respectively. The common themes in the manufacturing strategy literature reflect manufacturing strategy *process* (i.e., the process of formulation and implementation) and *content*.

Themes Commonly Found in the Manufacturing Strategy Literature

Common Theme 1: The process of formulating and implementing manufacturing strategy is important for guiding manufacturing.

Skinner (1969) and Hill (1985) stressed the importance of the process of manufacturing strategy (MS) formulation and implementation and made specific recommendations concerning it. One identifiable theme is attributed to Skinner's work, which suggests a top-down approach for defining and implementing MS. His theme may be summarized as (a) develop a manufacturing task based on business strategy, (b) conform manufacturing infrastructure policies and efforts to the manufacturing task, and (c) give a substantive role for manufacturing managers in defining and implementing MS.

Table 1 summarizes the process variables identified in the manufacturing strategy literature. The process variables identified in Table 1 are defined in the books or papers cited in the table; however, a brief description of the less familiar variables are included here. The variable Manufacturing Infrastructure is the "internal systems" including "organizational levels, wage systems, supervisory practices, production control and scheduling approaches, and job design..." (Skinner, 1978, p. 45) through which actual production is carried out. Manufacturing Task is a clear and concise statement of "what the manufacturing function must accomplish," which includes specific goals and priorities for the manufacturing function in terms of cost of production, quality, etc. (Skinner, 1978).

The variable Order Winning Criteria was proposed by Hill (1985) as essential to manufacturing strategy process. These are manufacturing criteria surrounding product cost, quality, etc., that help manufacturers to win orders against competitors. Readers may notice much similarity between the two concepts Manu-

facturing Task and Order Winning Criteria. The variable Role of Manufacturing Managers in Table 1 refers to the importance of the role of manufacturing managers in strategic decision making (Skinner, 1978; Swamidass & Newell, 1987).

There is no apparent pattern in the frequency of variables in Table 1, indicating limited consensus among the various writers. Further, a wide variety of terms are used by writers to describe process variables in manufacturing strategy. In isolating the process variables in Table 1, we used our judgment to group together several different terms into a single variable. For example, in the table, the term *manufacturing task* proposed by Skinner (1969) is substituted for the terms *manufacturing mission*, *manufacturing objectives* and *manufacturing criteria* used by other writers. There appears to be a tendency to create new terms without materially adding to the conceptual inventory.

Particularly lacking in the manufacturing strategy process literature is the twin focus on strategy formulation and implementation found in the business strategy literature (Andrew, 1971). Additionally, although business strategy literature investigates strategic planning, planning processes, and planning models, manufacturing strategy literature does not. There is an urgent need to develop a body of literature on the manufacturing strategy planning process. It should be noted that the effectiveness of strategic planning in corporate strategy has been mixed. Ackoff (1981) observes, "Most corporate planning is like a ritual rain dance: it has no effect on the weather that follows, but it makes those who engage in it feel that they are in control. Most discussions of the role of models in planning are directed at improving the dancing, not the weather" (p. 359). Even so, there are enough reported benefits from management's involvement in strategic planning that the need for the formal study of strategic planning for manufacturing strategy is not diminished.

If business strategy literature is an indicator, there are several variables and is-

Table 1
Manufacturing Strategy Process Variables in Literature

Process Variables	Authors					
	Hill 1983 1985	Miller Roth 1988 ^a	Schroeder et al. 1986 ^a	Skinner 1978	Swamidass Newell 1987 ^a	Wheelright 1984
Infrastructure	yes			yes		
Manufacturing task			yes	yes		
Order winning criteria	yes					
Role of Manufacturing managers				yes	yes	
Defining manufacturing strategy		yes		yes		yes
Consistency between:						
Manufacturing and business strategies	yes					yes
Manufacturing and other functional strategies	yes					yes
Manufacturing task and infrastructure				yes		yes

^aEmpirical studies.

sues relating to strategy process that have not yet caught the attention of operations strategy researchers. The research relating to manufacturing strategy process should include, but not be limited to: (a) planning, (b) implementation, (c) decision aids, (d) structure, (e) modeling, (f) cognition and perceptions, (g) political and bureaucratic factors, (h) leadership, (i) organization, and (j) integration.

In the list above, issues such as perceptions, leadership, and organization have a rich body of knowledge in the social sciences, organizational behavior, and organization theory disciplines. The manufacturing strategy scholars need not duplicate, but must integrate relevant items from sister disciplines to make their research broader, richer and more complete. The work of Swamidass and Newell (1987) is an example of how organization theory, business strategy, and manufacturing strategy literatures can be bridged and integrated.

Common Theme 2: The core content of manufacturing strategy includes cost, quality, flexibility, and technology.

Strategy content “focuses on the specifics of what was decided, and process addresses how such decisions are reached in an organizational setting” (Fahey & Christiansen, 1986, p. 168). Historically, the *Harvard Business Review* has been a leading outlet for manufacturing strategy writings. In the 1980s, however, the topic is addressed more widely in several journals and books.

In reviewing the manufacturing strategy (MS) content literature, the works of Hill (1985), Miller and Roth (1988), Schroeder, Anderson, and Cleveland (1986), Skinner (1969), Swamidass (1986), and Wheelwright (1984) were chosen as a representative sample of the current body of manufacturing strategy literature. Table 2 summarizes “content” variables identified in these writings. (The reader is referred to the original sources for definitions of each content variable in Table 2.) Although we have carefully examined the studies, our interpretation of an author’s intended content variable could be a potential source of error in our synthesis.

Although more than a dozen content variables have been identified in manufacturing strategy literature, Table 2 reveals that some variables are more frequently stressed in empirical as well as conceptual writings. The variables most frequently identified are quality, cost, flexibility, and technology. We are interpreting the terms *manufacturing process* and *manufacturing technology* to be mutually interchangeable. Thus, in Table 2 and Figure 1, we use the term *technology-process*.

Using concentric circles, Figure 1 places the most frequently mentioned variables at the core, and the less frequently mentioned variables are placed in concentric rings farther away from the core.

In Figure 1, immediately surrounding the core is the ring showing delivery, service, and focus variables, which are second only to the core strategy content variables in the frequency of their mention in literature. We are somewhat surprised that dependability (schedule) was not more frequently mentioned as it often is stressed as an operating objective. A number of variables that appear inconsistently in the literature are shown in the outermost circle.

Table 2
Manufacturing Strategy Content Variables in the Literature

Content Variables	Authors						# of times mentioned
	Hill 1985	Miller Roth 1988 ^a	Schroeder et al 1986 ^a	Skinner 1978	Swamidass 1986 ^a	Wheelwright 1984	
Capacity			yes			yes	2
Cost/price/productivity	yes	yes	yes	yes	yes		5
Delivery	yes	yes		yes	yes		4
Product design and engineering	yes				yes		2
Distribution		yes					1
Employee relations			yes				1
Facilities						yes	1
Flexibility	yes	yes	yes	yes	yes		5
Focus	yes			yes			2
Infrastructure	yes						1
Quality		yes	yes	yes	yes	yes	5
Return on investment				yes			1
Service		yes	yes	yes			3
Standardization	yes						1
Technology-process	yes		yes	yes	yes	yes	5
Vertical integration						yes	1

^aEmpirical studies.

Advanced technologies and their justification is fast developing into an important manufacturing strategy issue. The most common themes in advanced technology acquisition literature are (a) the costing and justification methods for new technologies, and (b) incorporating strategic benefits of new technology in cost/benefit analyses (Bennet & Hendricks, 1987; Blank, 1987; Engwall, 1988; Kaplan, 1986; Meredith & Suresh, 1986; Primrose & Leonard, 1987; Skinner, 1984; and Suresh & Meredith, 1985).

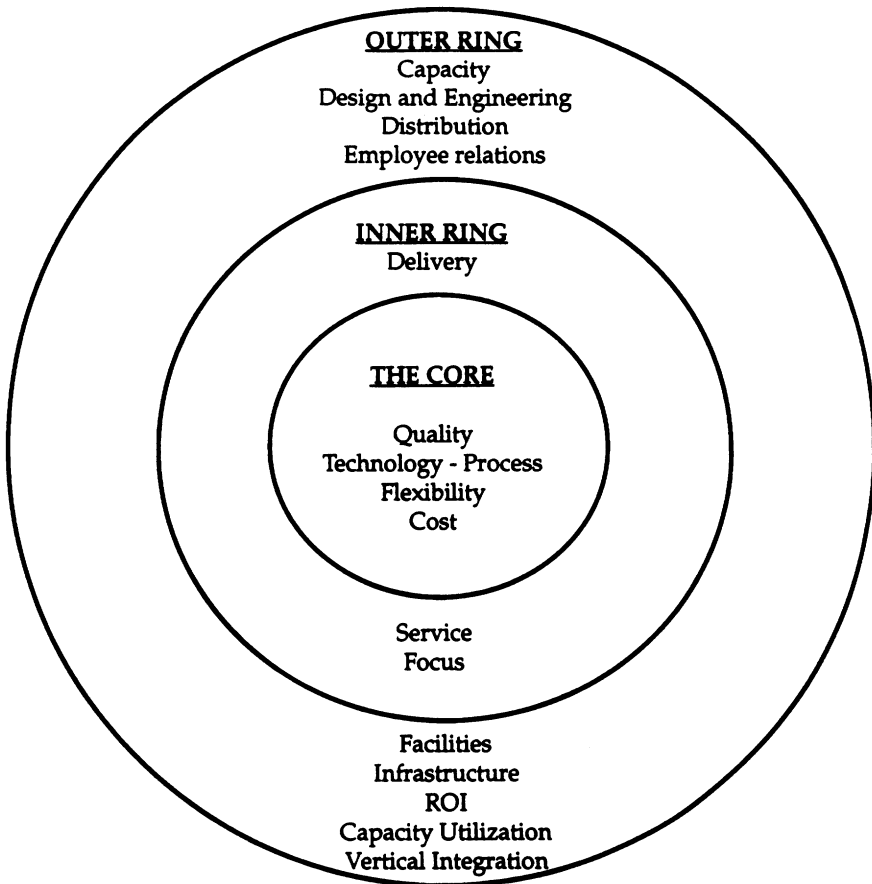
The shortcoming of manufacturing strategy (MS) content research is that it lacks empirical investigations of relationship among its variables. Particularly needed is research that investigates the effect of cost, flexibility, technology/process, quality, and dependability on business performance individually and the effect of their mutual interaction on performance. Swamidass and Newell (1987) provide a rare example of the much needed investigation of relationships between MS variables and performance.

Service Operations

The formal study of service operations as a subset of operations management is a relatively new phenomenon. The discussions in this section starts with a definition of service operations, followed by a discussion on the key issues of service operations that have a bearing on strategy.

Services, as contrasted with manufacturing, involve the conversion of re-

Figure 1
Manufacturing Strategy Content Variables Making the Core and Surrounding Rings



sources into an *intangible* output. The distinguishing characteristics of service operations are manifested in many typological or classificatory studies of service operations (Adam, 1983; Albrecht & Zemke, 1985, pp. 3-12; Heskett, 1986, pp. 5-25; Lovelock, 1983; Mills & Margulies, 1980; Mills & Moberg, 1982; and Snyder, Cox, & Jesse, 1982). Service operations are distinguished by the following major characteristics: the intangible nature of output, immediate consumption of output, conversion processes that require a great deal of labor and little equipment, direct customer contact, frequent customer participation in the conversion process, and rather simple (or elementary) measures for the conversion activities and outputs. Based on these characteristics, the following are typical service sector industries: transportation, communications, utilities, wholesale and retail trade, finance, insurance, real estate, business services, personal services, and nonprofit services.

There exists a wide range of labor-capital-technology blends that are found in service sector organizations. This diversity in the range of service operations is reflected in the diversity of operations strategy appropriate for the service sector.

For example, there is a tremendous difference between a utility delivering nuclear power and a small business providing a haircut. This diversity in labor-capital-technology blend lends itself to a broad variety of strategies in service sector firms, a variety yet to be developed in the formal literature.

The service operations management literature is not abundant, a situation scholars have noted (Chase, 1978, 1985; Collier, 1985, 1987; Heskett, 1986; Hostage, 1975; Lovelock, 1988; Mills, 1986). Even though service operations management problems or issues are repeatedly addressed, in most instances a great deal is yet to be known about them. Some of the established issues in the service operations literature will be addressed as strategy content variables below.

Strategy and Service Operations

Manufacturing literature has for most of the last century focused on rationalization at the production core—increasing direct labor productivity, process design, inventory control, and computerized scheduling and control. Only recently has our attention in manufacturing been directed at the broader strategic business issues such as quality and automation, which extend beyond cost reduction. In general, the literature on service sector operations lags behind the literature in manufacturing. Currently, in the process of its evolution, we see an emphasis in the rationalization of service operations, rather than an emphasis on broader strategic issues.

In the following sections, we review service operations strategy literature under the heading of strategy content, strategy process, and technology in service operations. It should be noted that the development of the service operations strategy literature has not followed along these well defined headings, which are used to make the review of service strategy literature consistent with the rest of this paper and to offer a guideline for future research in services.

Strategy content. An analysis of service operations strategy content literature reveals these variables: capacity, automation, quality, queuing, staffing, customer awareness, and multi-site operations. Table 3 provides the context of each content variable in service operations. Were we to select core content variables from frequency of presentation, the variables would be customer awareness, capacity, quality, and staffing decisions (Chase, 1978; Chase & Prentice, 1987; Collier, 1985, 1987; Heskett, 1986; Lovelock, 1988; Mills & Marguiles, 1980; Mills & Moberg, 1982; and Snyder, Cox, & Jesse, 1982).

Albrecht and Zemke (1985) explain that an effective service *strategy content* is arrived at by positioning one's service in the marketplace. Many analogies are made in their writings to "product positioning," which is reminiscent of the pioneering thinking of Alfred P. Sloan as he developed automobiles for market segments in General Motors' formative years. Their description of service operations strategy parallels a typical forced choice model (Adam & Ebert, 1989), where markets and the environment are balanced against financial and operating capabilities of the firm, forcing the development of strategic choices.

Strategy process. Writers on the subject of service operations strategy process have considered variables such as the service concept, markets, and the service delivery system, (Albrecht & Zemke, 1985; Heskett, 1986). Consider Albrecht and Zemke (1985, pp. 39-41, 63-76), who visualized a service triangle that

Table 3
Service Operations Content Variables in the Literature

Content Variable	Service Operations Usage
Capacity	Because no inventories are available to buffer demand, capacity defines the capacity to meet demand. Capacity has temporal (time of week, day, etc.) dimensions. Incorrectly established capacity can strangle a service business. On one hand, too high a capacity defines a high fixed cost structure or, on the other hand, too low a capacity can end the business because of inadequate service delivery, resulting in customers who never return.
Automation	Establish the level of technology, mechanization, and automation—often computer-based—that is economically and technically feasible.
Quality	Consistency in service delivery.
Queuing	Managing waiting lines. Use of flexible labor staffing, signs making apparent all stages of the process, and fair queues (first come-first serve). Customer participation in the service process.
Staffing	People-oriented staff given "customer contact," task oriented staff "in back office," cross-training, part-time employees, and so forth. Service worker skills are the focus.
Customer Awareness	Commitment to the customer as reason for existence. Understanding customer interactions. Proximity to customer.
Multisites	Capability to repeat a winning service business. Standardization of processes and services.

places the customer at the center. Corners of the triangle are formed by the service strategy, the service system, and the employees. Their theme is that a service concept and strategy set the stage for service systems (processes) and people (employees) to interact with and serve the customer.

A representative work in the area is that of Heskett (1986, pp. 5-25), who developed an integrative *strategy process* for managing services that moves successively from the specification of target market segments, to the development of a service concept, to the development of an operating strategy, and then to the service delivery system. His concept of operations strategy includes specification of the firm's overall strategy and its relation to marketing, finance, operations, and other functional areas. Heskett suggests a position be taken on where management effort is to be focused; either investments, quality and cost control, or on specifying the results to be expected against competition (in terms of quality, cost, productivity, and morale/loyalty of service staff). Because service operations strategy literature seldom distinguishes between content and process, it is sometimes difficult to sort out the variables and often there are overlaps between the works of authors stressing process on the one hand and those stressing content on the other.

Adapting from manufacturing strategy. Much promise for research lies in the transfer of ideas from manufacturing strategy literature to service operations strategy. In the opinion of the authors, an example of a promising approach to service strategy may be adapted from the work of Chris Voss (1986). Based on his experiences and study in Great Britain and Europe, Voss presents a view of manufacturing strategy that links the policy decisions associated with operations to the marketplace, the environment, and the company's overall goals. This view

is readily adaptable to services, requiring but minimal understanding of the differences between service and manufacturing operations (Adam & Ebert, 1989, pp. 36-39).

One feature of Voss's approach that is crucial to competitiveness is his market-based view of strategy development. In every area the company chooses to compete, there is a set of specific *market-based criteria for success*. His approach allows the organization to choose the strategic dimensions such as *efficiency, price, effectiveness, quality, and flexibility* as demanded by the market. An appealing feature of Voss's suggestion is the choice managers must make, given a specific operations mission established from market-based criteria for success. These choices involve facilities, aggregate capacity, choice of process, vertical integration, operations integration, and operations interface with other functions.

In service strategy formulation, because of the closeness of the service business to customers, service operations must be extremely sensitive to customers and markets. The real key to Voss's approach is expressed in the following quote concerning the firm's choice of strategy:

[Operations] strategy must be changed and adapted to maximize the market criteria for success, or the chosen markets should be changed to match more closely operations capability in terms of market criteria for success. (p. 68)

Voss's statement on setting operations strategy is built on the simple idea of a customer (or market) orientation for operations: match operations to markets or select markets to match existing operations capability.

Common Theme 3: Technology offers strategic advantages to service operations.

Technology is frequently discussed as a major strategic content variable in service operations (Collier, 1985). The literature on the subject stresses automation to replace labor and automation as a means to provide flexible capacity, but has not paid enough attention to the strategic benefits of technology. The message of this stream of research is that great opportunities exist for technology, not only to replace labor in services, but also to gain strategic advantages in the form of improved delivery speed, increased quality and reliability, and increased new services that the customer could not envision.

Collier (1985) addresses well the revolution taking place in the automation of services and the management of new technology with good documentation. Mills and Moberg (1982) suggest that technology can buffer service operations from customers, yet not seal operations off as in manufacturing. Operationally, this allows for improved efficiency, yet strategically it does not totally isolate customers and operations, an interaction often demanded by customers (especially for personalized services).

It is well recognized that, lacking the benefits of inventories, service operations have major problems with capacity planning, scheduling, and managing demand (Lovelock, 1988). Therefore, new technologies—especially computer processes and light equipment—are proven, flexible approaches for adding capacity inexpensively and for scheduling. It has been shown that with technology

capacity and *demand* can be managed much better (Collier, 1985; Lovelock, 1988). Through automation and mechanization we can adjust capacity quickly by turning on and off equipment. With computer evaluation of demand patterns we can more effectively manage demand through pricing.

Mills and Moberg (1982) suggest that a stream of research that focuses on technology choices at the client-worker interface is needed. Finally, we agree with many service sector scholars who suggest services be studied separate from manufacturing (Chase, 1978; Chase & Prentice, 1987; Heskett, 1986). The technologies *are* often so different that this seemingly simple suggestion is worth repeating.

Missing Themes in Operations Strategy

Business strategy and manufacturing strategy (MS) literatures had almost contemporary beginnings. Business strategy literature, which can trace its origin to Andrews (1971) and Lawrence and Lorsch (1967), has since made rapid progress in research. Growth in the research of business strategy may be attributed to several factors including the contribution of PIMS database to strategy research in the early 70s, the growth of a strategy movement among management scholars and executives, and the creation of the Strategic Management Society and its journal, the *Strategic Management Journal*. The growth of MS strategy research during the same period has been extremely spotty and severely lags behind business strategy research. The advantage of using themes found in business strategy literature as yardsticks to evaluate MS strategy research is that the themes permit us to see how far the research in MS has yet to go in reaching important milestones already reached in a related discipline.

The missing themes considered in this paper are the need for distinct research streams for strategy content and strategy process, strategic planning, effect of operations strategy (OS) on performance, empirical theory building, taxonomic research, international strategies, and operations management (OM) themes missing in OS literature. The missing theme called "OM themes missing in strategy literature," which is the last theme discussed here, is a catchall for several themes that are well developed in the operations management area but have not been successfully absorbed into the operations strategy literature.

Compared to the research on traditional operations management topics such as inventory management, scheduling, and methods analysis, operations strategy research is going at a crawling pace. One of the purposes of the missing themes approach is to expose the diversity of research needs in the area in the hope of attracting increased interest and research activity. The missing themes and accompanying suggestions for research apply equally to manufacturing and service operations strategy literature.

Missing Theme 1: Operations strategy research needs distinct research streams investigating strategy content and strategy processes.

The discussions on the formal distinction between strategy process and content can be traced to Andrews (1971), Ansoff (1965), Chandler (1962), and Schendel and Hofer (1979). Researchers in the business strategy area have established a di-

chotomy: "researchers study content, or they study process" (Huff & Reger, 1987).

Although business strategy research proceeds along two distinct paths, one pursuing strategy content and the other strategy process, such is not the case with manufacturing and service strategy literatures. In operations strategy literature, it is common to study the two together (Schroeder et al., 1986; Miller & Roth, 1988). One of the few explicit discussions of the distinction between manufacturing strategy content and process variables in the operations strategy literature is in the work of Swamidass and Newell (1987). Often operations management authors address process variables along with content variables without acknowledging them as such.

Establishing two distinct streams for the content and the process of manufacturing strategy will likely aid the development of the discipline. For example, in the business strategy literature several major research streams on the subject of strategy process have emerged, including strategic planning, strategy formulation, and strategy implementation. The many-pronged research effort in the area of business strategy processes has resulted in rapid growth and maturity of the discipline.

Missing Theme 2: Strategic planning is an important strategy process tool for operations management.

Strategic planning deals with the structured as well as the unstructured process of strategy formulation. Steiner (1969) and Ackoff (1970) are credited with early work on strategic planning. The literature on strategic planning, which is based on rationality and logic and founded on case illustrations, has been criticized for being an overly heroic approach to strategic management (Huff & Reger, 1987). Yet, regardless of its limitation, strategic planning is vital to the process of strategy formulation.

Hill (1985) and Skinner (1969, 1985) are two advocates of formal planning for manufacturing strategy. Their work, grounded in case studies, stands alone in the area of strategic planning for manufacturing strategy. One of the serious weaknesses in the operations strategy literature is the lack of progress and research interest in the area of structured, formal planning. In contrast, one can point to hundreds of research and scholarly writings in the area of business strategy planning (Huff & Reger, 1987).

The benefits of strategic planning are well summarized in Greene, Adam, and Ebert (1985). The benefits of strategic planning are that it offers systematic procedures for identifying upcoming strategic issues and problems (Ansoff, 1980; King, 1981), it formalizes the leadership role of top executives in strategic planning (Hunsicker, 1980), and it provides specific analytic tools and techniques for formulating strategy (Dutta & King, 1980; Hoffman, 1985; Mokwa, 1986).

Swamidass (1986) reported that executives and manufacturing managers show a systematic lack of understanding for manufacturing strategy, resulting in poor implementation. The role of systematic planning for operations may be one important solution to this problem. The need for more vigorous research in the area of strategic planning for manufacturing and service strategy cannot be overstated.

Missing Theme 3: The real test of operations strategy is its effect on operating and overall performance.

In our judgement, the greatest weakness of operations strategy research becomes evident when one searches for research that studies interrelationships among variables, particularly the effect of strategy content and process variables on performance.

Twenty years after Skinner's pioneering work, manufacturing strategy research is still predominantly one of either identifying strategy process variables and their importance to practitioners (Miller & Roth, 1988; Schroeder, 1986; Swamidass, 1986), conceptualization of the variables (Wheelwright, 1984), or axiomatic prescriptions based on case studies (Hill, 1985; Skinner, 1969, 1974). What is glaringly absent is a body of studies that would investigate the interrelationship among variables or the effect of a subset of variables on performance.

In contrast, business strategy research has matured. "The major thrust of this research has been to identify linkages among environmental conditions, corporate- or business-unit strategic decisions, and economic performance" (Fahey & Christiansen, 1986, p. 167). The basic paradigm for business strategy, according to Fahey and Christiansen, is shown in Figure 2. This model enables the investigation of questions of the genre, "What performance results arise from following specific strategies under different conditions?" To reach maturity in research, this paradigm must become a part of operations strategy research. Swamidass and Newell (1987) provide one empirical investigation of relationships among manufacturing strategy variables that conforms to this research paradigm. In particular, their study investigated the effect of environmental uncertainty on selected manufacturing strategy content and process variables and the latter's effect on plant performance.

The study by Schoeffler, Buzzell and Heany (1974) was a forerunner to numerous business strategy studies that have adhered to the above paradigm. In their study, Schoeffler et al., investigated the impact of market share, investment intensity, and company factors on performance. Such studies reveal the effect of strategic choices on performance. They provide evidence for the numerous claims by strategy writers and material for theory building. Clearly, the effect of strategic choices on performance must be a part of all strategy-related research.

A prerequisite for studies that investigate the effect of manufacturing strategy variables on performance is an agreement in the discipline on suitable measures of performance. One study that investigated the effect of manufacturing strategy variables on performance used performance measures commonly found in the business strategy literature—growth in sales, growth in return on assets, and

Figure 2
Typical Research Paradigm in Business Strategy Literature



growth in return on sales (Swamidass & Newell, 1987). If the volume of work in the business strategy literature is any indication, developing appropriate measures for performance is extremely important to the study of strategy (Bowman, 1980; Kudla, 1980; Montgomery & Singh, 1984; Montgomery, Thomas, & Kamath, 1984; Schendel & Patton, 1978). Taking this argument further, one stream of manufacturing strategy research should concentrate on performance measures that are appropriate for investigating manufacturing strategy, but are not explored by business strategy researchers.

The consequence of the failure to research the impact of manufacturing and service operations on performance is that we are not any wiser about the axiomatic claims and prescriptions about operations strategy that proliferates in the literature.

Missing Theme 4: Operations strategy theory development should use empirical research as building blocks.

In the 1980s, empirical studies based on surveys have appeared (Miller & Roth, 1988; Schroeder et al. 1986; Swamidass, 1986; and Swamidass & Newell, 1987). The continuing survey of manufacturers concerning their strategies by the Manufacturing Futures Project, Boston University is a welcome contribution to the development of manufacturing strategy literature.

There is much to be understood about operations strategy from scientifically designed field studies that are generalizable. The lack of field data is a deterrent for empirical studies because prescriptive writings on operations strategy remain untested. Thus, theory building and validation of prescriptive ideas have been arrested by insufficient empirical research.

Empirical studies of operations strategy based on objective data is very rare. Operations strategy research based on PIMS-type (Schoeffler et al., 1974) data bases are needed to move forward and approach maturity. The lack of debate and discussion on research methods and research strategies within the discipline accentuates the limitations of operations strategy research.

Missing Theme 5: The development of taxonomies and classificatory schemes would improve operations management and strategy.

Taxonomies provide a mechanism through which both operations management content and strategies (or patterns of strategies) could be classified for better and more detailed investigation. Business strategy researchers have devoted considerable effort in identifying and empirically validating strategy taxonomies (Dess & Davis, 1984; Galbraith & Schendel, 1983; Hambrick, 1983; Porter, 1980).

Although there has been some effort within the broader context of operations management to develop taxonomies (Adam, 1983), operations strategy literature is weak on taxonomical research, both at the conceptual and empirical level. Conceptual development of strategy taxonomies usually precedes empirical research. For example, Porter's generic strategy types were confirmed by the investigation of Dess and Davis (1984). Sometimes taxonomies are revealed by sound empirical research. When using PIMS data, Galbraith and Schendel (1983) found four "distinct, internally consistent patterns of strategic behavior,"

which they labelled *efficiency*, *service*, *product innovation*, and *brand identification*.

In the logical progression of manufacturing and service operations strategy research, the development of well rounded and well respected manufacturing strategy taxonomies is needed. The most commonly stated manufacturing strategy taxonomy identifies cost, quality, dependability, and flexibility (Buffa, 1984; Skinner, 1978; Swamidass & Newell, 1987; and Wheelwright, 1978) as the strategic manufacturing options. However, as Figure 1 shows, there are many more strategic options cited in the literature. Taxonomic studies could reconcile empirical findings. The typology of manufacturing flexibility, which is a manufacturing strategy core variable, proposed by Swamidass (1988) is an example of a typology related to operations strategy that may stimulate more research.

Kotha and Orne (1989) provide just the typology we are suggesting. They offer a conceptual framework that links manufacturing to business unit strategy and focuses on developing the notion of generic manufacturing strategies. Kotha and Orne relate Porter (1980, 1985) to Hayes and Wheelwright's (1984) traditional manufacturing classification. Their eight generic manufacturing strategies reflect process structure complexity, product line complexity, and organization scope.

Missing Theme 6: Operations management needs to reflect the international context of business.

Manufacturing and service firms seemingly share the desire for internationalization or globalization in distribution and consumption of products and services. Sometimes, the globalization of operation is a strategic necessity for competitive survival (Buffa, 1984; Hayes & Wheelwright, 1984; Jolly, 1987, and Starr, 1988).

The work on international operations dating back to Stobaugh (1969), Vernon (1971, 1974), Vernon and Wells (1976), and Wells (1972) must be integrated into contemporary operations management literature. Established themes in international operations management that have been around for over two decades are vertical integration (both forward and backward), prolonging product life cycles by manufacturing in developing nations, rationalization through international operations, defensive and offensive strategies in international plant locations, hollowing-out the U.S. manufacturing core, operating cost trade-offs, and technology transfer.

Global competitiveness. Within the production and operations management literature, "global competitiveness" or "manufacturing and global competitiveness" is an important emerging theme. Examples are studies on product profiling (T. Hill, 1987), the role of the operations manager in internationalizing manufacturing (M. Hill, 1987), speed of change in product-market posture (Hirano, 1987), and factory level practice comparisons between nations or cultures. Among the broader works on this theme on global competition are Buffa, 1984; Hayes and Wheelwright, 1984; Jolly 1987; and Starr, 1988. Key issues in these writings seem to center on (a) gaining access to markets, (b) designing products (or services) by tailoring for a specific market versus standardization, (c) providing low cost/high quality manufacturing locations and (d) meeting national re-

quirements for manufacturing, such as value-added in the purchasing (consuming) country.

The strategic issues concerning technology, political environment, currency, geographical distances, culture, and so forth have been addressed in the international business area literature since Vernon (1971). Yet, because the manufacturing and service strategy literatures have hardly benefited from it, international business literature must be selectively integrated into international operations management literature.

Given the current state of development of the literature, it would be helpful to have a typology for international production and operations management to map the area, identifying key variables and their interactions. Such a typology would be helpful for the presentation of what we already know and would serve as a driver for future investigations. The typology of Adam (1983) might be extended to include an international dimension.

Emerging research interest. Most recent research in international production/operations management tends to fall into one of two categories: (a) an across-the-board comparison of industries, countries, or regions on productivity, performance, and managerial behavior, or (b) an evaluation of an operations problem/issue in the international context.

The studies by Miller and others emanating from Boston University's Manufacturing Roundtable provide a good example of the first category, where manufacturing managers are annually surveyed in Japan, North America, and Europe on a variety of issues (DeMeyer, Nakane, Miller, and Ferdows, 1987). Similarly, Rho and Whybark (1988) compare the People's Republic of China and South Korea, focusing on the non-fashion textile and small machine tool industries. This stream of research typically investigates production and inventory practices in various countries, which may include sales forecasting, production planning and scheduling, shop floor control, purchasing and materials management (Rho and Whybark, 1988). Further, Australia's manufacturing practices are reported by Harrison (1987) as are the United Kingdom's by New and Meyers (1987).

Typical of the second category is the in-depth comparison of product development processes within North American and Japanese manufacturing firms (Clark & Fujimoto, 1987).

Missing Theme 7: Major themes in the operations management literature such as JIT, productivity, and quality are not integrated into manufacturing and operations strategy.

The literature that is identified with manufacturing strategy *per se* has generally limited its focus to issues flowing from Skinner's work. However, there are a number of strategic decision issues in operations management that have been excluded from OS discussions. For example, though the literature on plant location, technology, design, Just-in-time (JIT) and Total Quality Control (TQC) production have strategic implications, they have not received direct attention in the strategy literature. In the context of this review, we present JIT, plant location, productivity, and quality as some of the OM themes that should receive more direct attention in operations strategy literature.

JIT production. Just-in-time (JIT) production poses an opportunity and challenge to the manufacturing strategy literature. Its benefits to manufacturers are reported to be very high, ranging from 500%-2000% improvement over pre-JIT levels of performance (Schonberger, 1987). Although the benefits of JIT are yet to be documented systematically in large sample studies, the benefits of JIT so frequently reported by practitioners qualifies JIT for consideration as a strategic variable. By any measure, the impact of JIT on manufacturers has been strategic; for individual manufacturers, the impact has been long-term gains in competitiveness that is anything but marginal (Schonberger, 1987). The competitive advantage gained through JIT and TQC appear in cost, quality, flexibility, and dependability—all recognized strategic goals. Yet, manufacturing strategy literature has not formally embraced JIT for its strategic value to manufacturers.

Location. A distinctive feature of the operations management literature is the use of management science to model problems. Although location decisions are legitimate strategy issues, and management science models on location and capacity expansion abound, the respective literatures stand apart from each other. For example, field studies (such as the one by Schmenner, 1982) and location models must be brought together in the operations strategy literature.

Productivity. Operations management strategies are reflected in objectives that stress schedule (delivery), quality, cost, and flexibility. Cost is a key strategic variable (Porter, 1980; Skinner 1978). A common surrogate for “cost” is “productivity” because it more accurately measures inputs to and outputs from the conversion (transformation) process.

Productivity can be measured broadly (at the national level), measured narrowly (at the level of employees), or measured at many levels in between. At the level of the firm or division, measurement of productivity is not practiced widely. Experts estimate that less than 2% of firms do so, even though several measurement techniques do exist (Kendrick, 1986; American Productivity Center, 1986).

Can the strategic value of productivity be unleashed by the appropriate use of productivity measurement? This is an area for fruitful investigation. There is little progress in using well known productivity measurement procedures as a method of performance measurement. One exception is the progress made in the modification of total factor economic productivity measurement to be consistent with accounting records (American Productivity Center, 1986).

Another area of strategic importance is the measurement of the productivity of indirect and professional employees. The performance of shop floor employees is the most closely measured, the performance of service employees is measured less and the performance of indirect, professional, and management employees is measured even less.

Productivity measurement leads to competitive advantages. Consider, for example, banking deregulation. Increased competition and increased cost of money to banks has brought about the pricing of services previously free to bank customers. This forces banks to identify costs and get involved in costing labor and technology on a service-by-service basis. The gains made by individual banks in measuring productivity translates into a strategic advantage for banks that now understand their costs and can price accordingly in a competitive environment.

One group of employees whose output has not been measured effectively consists of professionals: computer systems analysts, engineers, managers, physicians, professors, and so forth. Managers, in particular, need to have their productivity measured as a basis for improvement. Estimates suggest there are 10 million managers and supervisors at work in the United States alone. The strategic value of developing measures for these employees is worthy of investigation. Productivity measurement is a meaningful and fruitful research topic for operations strategy scholars because it is data rich, offering a great deal of opportunity for intensive analysis.

Quality. Quality is frequently mentioned in the operations strategy literature, yet it fails to receive the attention given in the traditional operations management literature. In this discussion, selected issues surrounding competitive quality that have a bearing on operations strategy are addressed.

Profitability, to a larger extent, is driven by quality (Adam, Hershauer, & Ruch, 1986; Heyl, 1987). Many U.S. manufacturers view quality in the context of the rather obsolete classical cost-quality trade-off. It is common knowledge that quality related costs are prevention costs, appraisal costs, internal failure costs, and external failure costs. The key to attaining competitive quality (i.e., quality with profitability) lies with prevention. A proven assumption of total quality assurance is that an increase in prevention expenditures will generate a proportionately greater savings in the other, downstream cost categories. Clearly, prevention will result in the reduction of internal and external failure costs because fewer defective items will be produced. Plus, less appraisal will be required because the products will be made correctly the first time (Evans & Lindsay, 1989). Strategically, improved quality results in increased market share. With increased demand *and* lower costs due to quality improvements, price can be reduced to increase market share and profits. The strategic use of quality derives from the understanding of the above cause-and-effect sequence, which we refer to as the value of competitive quality.

Among those most influential in the quality improvement literature are Deming (1975, 1982, 1985), Juran (1982), Crosby (1979) and Feigenbaum (1983). Each has a unique, yet outstanding managerial approach to quality. Manufacturers adopting their work have demonstrated the strategic value of quality not only to individual firms, but also to entire industries and the nation. Japan is a case in point. Their prescriptive work covers issues pertaining to operations strategy formulation and implementation. The empirical research on this prescriptive literature is yet to develop in earnest. The potential of a large body of studies on the formulation and implementation of a strategy for attaining competitive quality based on the various paradigms recommended by these writers is yet to be exploited.

Deming's method has had a great international impact. In the early 1950s, Deming began spreading statistical thinking and continual improvement to Japanese top management. He outlines his framework in terms of 14 points, the final one stressing a never-ending process of improvement (Gitlow & Gitlow, 1987).

Juran (1982), founder of the Juran Institute, provides another paradigm for the effective use of quality. Juran, like Deming, has a program of quality improve-

ment that is broken down into a series of 16 steps. He notes that statistical quality control is a useful and necessary tool in quality improvement programs. However, he says, many zealous managers regard the tool as a panacea to their quality problems. Juran blends statistical analysis with rather classical managerial action; planning, organizing, and control. His theme is that quality improvement is a long-term process (Juran, 1982).

Crosby (1979) expresses a 14-step process for quality improvement in four absolutes of quality. The first is that quality means conformance to requirements. Next, defect prevention, not inspection, is the only way to achieve true quality. The third absolute proclaims that the only acceptable performance standard is zero defects. Finally, Crosby states that the cost of quality is the cost of non-conformance—the cost of doing things wrong. He claims that nonconformance costs can add up to 25% of selling price for manufacturing firms and 40% of operating costs for service companies (Crosby, 1979). However, critics say that it is a good program for changing attitudes, but it is not a good basis for specific actions (Fierman, 1985).

Total quality control (TQC), a term that was coined by Feigenbaum (1983) in the late 1950s, is another major theme found in quality improvement literature. This concept denotes that in any given organization effective quality management must be a total, company-wide effort aimed at the avoidance of problems that will inevitably arise. Continuous correction of these problems leads to continuous improvement of quality (Evans & Lindsay, 1989; Ishikawa, 1985).

Several recurring themes in the quality improvement literature are continuous improvement, quality treated as everyone's job, the relationship between quality and productivity, and the role of management. These themes primarily stress the process of attaining quality. Although operations strategy literature is weak on strategy process research in general, the literature is rather extensive and diverse in the area that prescribes the process leading to world-class quality levels in products (Adam & Barker, 1987; Heyl, 1987). However, most of the literature on the topic is rather prescriptive, leaving much room for empirical theory-building work that is yet to develop. Further, there is a need for longitudinal field studies that more clearly identify relationships between quality, productivity, and profitability. Any investigation in this area will be incomplete without a fair share of the research focusing on the processes associated with the Japanese experience in attaining strategically effective quality levels in products.

The root of Japan's success with quality points to human factors. The Japanese process for attaining competitive quality has somehow found the secret of harnessing the energy of its people more effectively than others (Ishikawa, 1976, 1985). There are many reports depicting the Japanese production worker as a robot who is completely dedicated to the well-being of his or her company. A study by Weiss (1984) dispels three myths associated with Japanese manufacturing: compared with American workers in an electronics manufacturing firm, Japanese workers are not significantly less absent, are not less likely to quit, and do not work harder.

An exploratory study by David Garvin produced some evidence explaining the differential between Japanese and U.S. manufacturers in the process used to gain

competitive quality. In Japan, quality problems are attributed to external factors such as poor materials or purchased parts. In the U.S., the problems stem from internal sources—workforce, maintenance or adjustment of equipment or processes. In addition, the Japanese strategic objective is to produce high quality products. American manufacturing managers tend to subordinate quality objectives to the drive to meet production schedules (Garvin, 1986).

Conclusion

Three common themes and seven missing themes were used as a framework to review operations management literature from a strategic perspective. The missing themes in operations strategy literature identified here form logical indictments against the literature while automatically pointing to important directions for future research themes. In reading this review, the reader may rightly come away with the feeling that the strategy research in the area is spotty and lacks dedicated research effort.

The prescriptive work on manufacturing strategy that has gone on for nearly two decades and the growth of more prescriptive work on the process of attaining world-class quality levels are encouraging occurrences because many variables and constructs are being generated for eventual empirical theory-building, which unfortunately is not happening with any regularity.

Two concluding remarks are offered about the state of operations strategy literature. First, theory building seems to be endlessly stalled for want of high quality empirical research. The reasons for this problem are many, including a lack of interest among operations management researchers for empirical research and a lack of training in empirical research methods among operations management scholars. Operations strategy is not readily subject to a management science model which is the preferred research tool for operations management researchers. Empirical methods are more appropriate for the investigation of strategic issues in operations.

Secondly, the missing themes illustrate another important problem hindering the advancement of research in the area: the failure of operations management scholars to integrate and build upon themes developed in the business strategy area. Even though many would contend that business strategy research is soft or weak, by comparison, operations strategy research is anemic. This is a condition that is made worse by its isolation from relevant research occurring in related disciplines.

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