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The Role of Operations Executives in the Process of Strategy: A Contingency Theory

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THE ROLE OF OPERATIONS EXECUTIVES IN THE PROCESS OF STRATEGY: A CONTINGENCY THEORY

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ABSTRACT

Notions of information processing and firm resources are used to create a contingency theory for the role of operations executives in the process of strategy. This role is defined by a balance between 'functional deliberation' within the operations function and 'top-level communication' with the chief executive officer and other functional heads. Conjectures about the value of both processes lead to propositions regarding the effect of environment and resources on the proper balance between the two.

Operations executives play an important role in the selection and implementation of business strategies, or what we refer to as the *process of strategy*. In this process, some of what the operations executive (OE) does can be described as having a functional focus. This type of activity involves spending time and communicating with subordinates to learn about the state of operations and to explain courses of action to be taken, personally analyzing operations strategy decisions using the information at hand, and overseeing the implementation of the previously made decisions. The other type of activity can be described as having a top management or cross-functional focus. This type of activity involves spending time and communicating with the chief executive officer (CEO), other functional heads, or the entire top management team. The purpose is typically to inform others about relevant aspects of operations, such as cost, quality, and product variety issues, or to learn from them about other functions, firm strategy, or various other aspects of the competitive environment.

We label the activities of the first type 'functional deliberation' and those of the second type 'top-level communication.' We argue that, given the limited time and bounded rationality considerations (Simon, 1947), one crucial aspect of the OE's job is to find a good balance between the two, because both are needed and one has to come at the expense of the other. The question that arises then is what the optimum balance is and whether and how it needs to be readjusted as various internal and external circumstances change.

Of course, the optimal mix of functional deliberation and top-level communication by the OE is the one that best serves the overall process of strategy or, in other words, the firm as a whole. Hence the question of the optimal mix of activities is naturally part of the larger question of the optimal or near-optimal design of the overall process of strategy. In this

paper, we draw from several streams of literature in order to address this larger question, as well as the more specific role of the OE.

Our point of departure is the notion that the process of strategy is cognitively challenging in that it needs to take in and process a great deal of information that is incomplete, constantly updated and outdated, and diffused over the top management team and possibly other organizational members and outside parties. Moreover, the process often operates under severe time pressures. Hence the question of the optimal design of the process of strategy goes to the heart of the organization theory's interest in bounded rationality and decentralized information processing inside organizational structures (Galbraith, 1973; Simon, 1947). In other words, the optimal role of the OE in the process of strategy is an integral part of the larger question of how much centralization and communication is needed in a functional hierarchy and under which circumstances is less communication among the top management team better. Various aspects of this problem that can inform our analysis have also been addressed in the closely related literatures in economics, computer science, and mathematical optimization.

Several other streams of literature help us narrow down the focus and place the general information processing view of an organization in the specific context of the process of strategy. A number of contingency theories give us a rich taxonomy of environments in which organizations tend to operate and ways in which they respond to these environments. Hence these theories provide at least a partial template of typical environments in which the process of strategy unfolds, as well as internal arrangements and levers that are available to it.

In addition, the field of competitive strategy informs us about the content and goals of the process of strategy, as well as some of the ways in which these goals can be accomplished. Operations strategy supplements this view in ways that are more specific to the operations function and the role of the OE. In essence, these two literatures study

decisions about resource commitments that are hard to reverse, at the firm level and within the operations function, respectively. The stakes are very high on both sides, and the way the OE balances his or her attention to functional deliberation *versus* top-level communication is likely to have profound implications for the competitive success of the firm.

Our analysis ascribes two roles to organizational functions, and the operations function in particular. First, functions create the information processing architecture for the strategy process. This architecture puts the CEO atop the hierarchy in which each functional head can be seen as an information-processing node. Second, functions provide a structure and home for much of the firm's resources. We posit that the OE trades off 'top-level communication', that is, the time to connect with the CEO or other functional heads to convey or interpret new information, with 'functional deliberation', the time to make decisions, possibly involving his or her staff, with information already available to the operations function. We argue that functional deliberation is useful primarily for building resources within the operations function, while top-level communication improves the cross-functional coherence of firm resources.

We hypothesize that the usefulness of the two types of contributions by the OE will depend on the external environment and the resources that the firm already has. Taking the view that OEs should devote their efforts and attention to where they bring the most value, we posit that environmental dynamism and environmental munificence will tilt the appropriate balance toward more functional deliberation, while environmental complexity will call for more top-level communication. We also propose that, when the operations function's development potential is high or when its resources have become more critical, a larger emphasis on functional deliberation will be appropriate.

These propositions form the first testable contingency theory for the role of the OE in the strategy process that we are aware of. The underlying logic draws from and integrates

several traditions of thought, allowing us to incorporate differences between various environmental types, as well as differences between firms in one integrated view. Hence, in the spirit of the currently very influential resource-based view in strategy, this approach adds a whole new, firm-specific, dimension to the traditional contingency approach. Such integration of theoretical perspectives may ultimately result in innovative empirical tests, as well as provide useful feedback for further advancement of the aforementioned perspectives.

To allow for a succinct elaboration of the propositions, the scope of this paper is limited to the following. We consider a functionally organized firm and assume that it contains an operations function with an OE reporting directly to the CEO. Although one can also think of this firm as a business unit of a diversified conglomerate, we do not consider issues of corporate strategy. We also focus on how the strategy process plays out at the *top* level of the organization's structure, i.e., the CEO, OE, and heads of other functional areas such as marketing or R&D. The decision processes that take place within the operations function are only considered in the aggregate, as functional deliberation, and not in further detail. Finally, we limit ourselves to the information processing challenges for this type of decision-making and assume that the incentives for all the involved parties have been aligned *a priori*.

LITERATURE REVIEW

Several distinct literatures are concerned with various aspects of processing and communication of information in networks. They identify and illuminate important tradeoffs that are naturally present in the process of strategy and have direct consequences for the role of the OE in it.

An important stream of literature in economics attempts to explain the existence of hierarchical networks and decentralized decision-making based on the notion of bounded rationality, typically operationalized as costly communication and processing of information

in mathematical models of organizations (e.g., Bolton & Dewatripont, 1994). In a review of this literature, Van Zandt (1999) writes: "The bounded rationality of economic agents means that there are limits on their ability to communicate, that is, to formulate and send messages and to read and interpret messages, and to calculate with information in the brain. Both communication and computation constraints appear implicitly or explicitly in [the reviewed literature]." In other words, if ***A*** is busy communicating with ***B***, ***A*** cannot have a separate simultaneous communication with ***C***, or engage in independent problem solving with the information that is already on hand.

A similar articulation of this trade-off is present at the intersection of computer science and mathematical optimization. Researchers in these fields have studied how to exploit parallel computing architectures to solve optimization problems. Parallelization strategies in this literature are often classified according to their 'granularity,' i.e., the ratio between computation time and communication time, and bottlenecks in these parallel algorithms are usually identified as either computation or communication-related (Cung, Martins, Ribeiro & Roucairol, 2001; Grama & Kumar, 1995).

Interestingly, the same trade-off also appears in descriptions of new product development, which is known to involve highly complex decision making. When a product is composed of a large number of components, it is often advised to use a 'modular' design, which minimizes the communication between design teams for the various product modules and allows them to deliberate virtually independently and to deliver high quality designs within short development times (Sanchez & Mahoney, 1996; Ulrich & Eppinger, 2000). An alternative way of dealing with the complexity of product designs is suggested by Mihm, Loch, & Huchzermeier (2003: 744) and calls for frequent communication between designer groups, with immediate organization-wide broadcasts of changes to component designs. This ambivalence suggests that a nuanced, contingency-based approach that takes additional

variables into account might make it possible to untangle when one recipe, i.e., recommended granularity, is better than the other and why.

In our analysis below, we attempt to build a contingency-based view of the process of strategy and the OE's role in it that explicitly recognizes the above tradeoffs. We will take the view that the communication with the CEO and other functional heads has to come at the expense of other information processing activities, and of those that take place within the operations function in particular. Because firms are clearly and critically embedded in the environment, and because we are interested in how various environmental factors should affect the role of the OE in the process of strategy, below we review some of the findings of the rich body of contingency theories in the literature. We do not attempt a comprehensive review but try to create a context for our propositions by distilling the arguments that are related to the information processing view of organizations or, more directly, to the process of strategy itself.

Contingency Theories

From the early days, the information-processing view of organizations linked dynamic and complex environments to the increase in the information processing load on the organization (Simon, 1945; Galbraith, 1973, 1977). Lawrence & Lorsch (1967), who coined the term contingency theory, observed that such dynamic and uncertain environments require more 'organic' organizational structures with less formalized communication and more decentralized decision-making. Additional organizational responses to complexity and dynamism proposed in the early literature include the increasing decision support from information systems and decentralization of information processing through lateral information flows (e.g. Tushman & Nadler, 1978).

The subsequent research has developed a large number of contingency theories, reviewed recently by Donaldson (2001). In considering environments that organizations tend to face, researchers have typically focused on the dimensions of dynamism, complexity, and munificence proposed by Dess & Beard (1984). Dynamism is a measure of the uncertainty or rate of change in the environment and is often proxied by the variability of sales growth. Complexity is a measure of the number of factors and the interactions between them that play a role in the environment. Munificence is a measure of the environment's capacity for growth and is commonly operationalized as industry-wide sales growth.

The studies that are most closely related to our topic are part of the strategy process literature that is categorized under 'rational decision making' by Chakravarty & White (2002), or 'teleological theories' by Van de Ven & Garud (2002) in their respective reviews. This literature contains several contingency theories regarding the information-processing characteristics of the strategy process. One set of studies found that comprehensive planning contributed to success in a stable environment (Fredrickson, 1984) but not in an unstable one (Fredrickson & Mitchell, 1984). Seemingly contradicting these results, others have found that rationality and analysis correlate well with performance in dynamic environments (Goll & Rasheed, 1997; Miller & Friesen, 1983; Priem, Rasheed, & Kotulic, 1995). The results regarding the information processing needs created by munificence are similarly inconclusive. Some studies find that benign or munificent environments, characterized by high growth rates, call for more rational analysis and planning (Goll & Rasheed, 1997), whereas others ascribe this effect to hostile environments (Miller & Friesen, 1983).

Other studies not only consider the overall intensity of information processing but focus specifically on how the strategy process is distributed within the organization. Miller & Friesen (1978) find considerable heterogeneity in levels of decentralization and effort to integrate or coordinate the decisions by different organizational members. Several

contingency propositions have emerged in the subsequent literature. For turbulent environments Hart (1992) proposes a 'generative' mode of strategy making that relies heavily on member initiative, while for complex environments he proposes a 'transactive' mode that is still very participative but more guided. An alternative approach to deal with dynamic environments is proposed in Hart's (1992) 'symbolic' mode, which foresees strong, vision-driven leadership to drive lower-level decisions. Others have proposed processes that combine elements of decentralization and leadership, such as in 'umbrella strategies' that are partly 'emergent' and partly 'deliberate' (Mintzberg & Waters, 1985), or in 'entrepreneurial strategies' that combine strong leadership and participative processes (Dess, Lumpkin, & Covin, 1997). A recent simulation-based study by Siggelkow & Rivkin (2004) evaluates the performance of these different information-processing strategies in environments of varying complexity and dynamism. The results point to the limits of decentralization when the complexity, here interpreted as interactions between departments, is high, but suggest that intensified processing of information at all levels helps when the environment is both complex and dynamic.

Table 1 summarizes the arguments and empirical findings of the above studies. In the left part of the table, we capture the proposed impact of the three environmental variables on the information-processing load of the organization. Obviously, there is a wide consensus that environmental complexity raises the information processing requirements. On the other hand, few authors have studied the effects of munificence, and the results are inconclusive (Goll & Rasheed, 1997; Miller & Friesen, 1983). One possible way to reconcile these results that we will explore is that munificence may change the organizational level at which the information processing should occur, thus allowing two observers at different levels to observe seemingly opposite effects.

We also propose that environmental dynamism is generally seen as increasing the information-processing load despite the inconsistent results regarding the usefulness of analysis and planning in this context. In essence, the disagreement appears to be about the best organizational response to the increased information-processing load caused by dynamism rather than the presence of such load. If the need to react fast is emphasized, it may indeed be desirable to simplify the problem by eliminating the consideration of relatively less likely and/or important factors and scenarios, thus limiting the comprehensiveness of the process (Fredrickson & Mitchell, 1984). We label this organizational response "limiting the search space." On the other hand, dynamic environments also tend to increase the range of options that managers are presented with, and increasing the information-processing intensity, whenever possible, can be an appropriate response (Goll & Rasheed, 1997). In either case, the notion that dynamism increases the information-processing load on organizations seems consistent with this prior research.

Insert Table 1 about here

The right hand side of Table 1 summarizes the results and arguments regarding what we distill as the three most commonly proposed organizational responses to the increasing information-processing load. The three responses are intensifying the process, decentralizing the process, and limiting the search space. We use bold face whenever an organizational response is shown empirically to be useful in a particular environmental context.

The number of empirical results is surprisingly small, and the strongest consensus, as well as empirical support, emerges for the idea that intensifying the process of strategy is a useful response to dynamism. There is a similar wide consensus but no empirical support for the usefulness of this organizational response to complexity, and no consensus, as well as conflicting results, regarding munificence. It is important to note that these results are not

surprising from the information-processing standpoint. When the information-processing load is higher due to complexity and/or dynamism, one would indeed expect the need for information processors to work harder. On the other hand, it is not clear why munificence should have the same or similarly strong effect, and hence somewhat ambiguous results could be expected.

Given the natural limits on the capacity of any individual information processor, another way to deal with high information loads is decentralization, or the involvement of additional information processors. With the take on complexity by Siggelkow & Rivkin (2004) as an exception, there seems to be a general consensus that the increased information-processing load due to dynamism and complexity can be handled partially by increasing the level of decentralization, often advanced under different labels, such as member initiative (Hart, 1992), participative processes (Dess et al., 1997; Hart, 1992), or emergent strategies (Mintzberg & Waters, 1985). The relationship between dynamism and decentralization has also been supported empirically (Fredrickson & Mitchell, 1984; Lawrence & Lorsch, 1967). To the best of our knowledge, the relationship between munificence and decentralization has not yet been addressed directly in the literature.

A third way to cope with information processing overloads is to limit the scope of the analysis to the most important factors that play a role and a reduced menu of actions that could be taken. We detect this idea in the incremental (Fredrickson & Mitchell, 1984) and vision-driven (Hart, 1992) strategies that are proposed for dynamic environments. Limiting the search space seems particularly useful in the context of decentralization, when multiple organizational actors assume information-processing roles in response to the combination of complexity and dynamism. We detect such limits of each individual's search space in partly-deliberate (Mintzberg & Waters, 1985) and leadership-based (Dess et al, 1997) strategies.

In summary, the existing logic in contingency theories sees an increased information-processing load in dynamic and complex environments and observes and prescribes a mix of three responses to handle the increased load: intensifying the processing, decentralizing, or limiting the search space. While each of the responses influences the role of the OE, none of them explicitly acknowledges the OE's trade-off between top-level communication and functional deliberation. It is this gap we hope to address. In order to focus more specifically on the process of strategy, we review the relevant ideas and concepts from the fields of strategy and operations strategy that describe in more detail the goals and content of this process.

Strategy and Operations Strategy - Discerning the OE's Role

The concept of internal fit or coherence between functional activities and the business strategy has been a major theme in the field of strategy for over two decades (e.g., Hofer & Schendel, 1978). Porter's influential works (1980, 1985) on industry attractiveness, firm positioning in an industry, and the value chain have solidified this concept. In this view, firm strategy is about choosing a structurally attractive industry and a defensible cost-quality position in it, and then staking a claim on this position through a disciplined fit among all the choices that are made across functions and supporting activities.

The idea of internal fit or coherence is echoed (or may even have antecedents) in the early works in operations strategy. Skinner (1969) argued that the strategy process does not stop at decisions about markets, products, and competitive positions. Instead, the process needs to filter down to the manufacturing function, because manufacturing systems face trade-offs and have to be designed with a specific mission or task in mind. The field of operations strategy has subsequently studied how operational choices, ranging from the 'hard' ones about capacities, facilities, process technology, and sourcing to the 'soft' ones about quality policies, workflow scheduling, performance measurement, and organization,

can be made coherent with the firm's strategic position (Hayes & Wheelwright, 1979, 1984; Skinner, 1969, 1974, 1985).

This need for coherence has engendered a rather straightforward, top-down design of the strategy process in which all functional heads focus on executing the strategy that was selected by the CEO or top management team. For the specific case of the OE, the literature in operations strategy formulation (e.g., Fine & Hax, 1985; Hill, 1989; Skinner, 1969) relies on an interface or a link between the business unit strategy and the operations strategy. In this interface, the business unit strategy defines and specifies a set of competitive priorities (Hayes & Wheelwright, 1984), 'order qualifying' and 'order winning' criteria (Hill, 1989), or 'competitive manufacturing capabilities' (Ward, Bickford, & Leong, 1996), which are typically related to aspects of cost, quality, speed, dependability, and flexibility of operations. Once these operational priorities have been set, it becomes easier to make decisions about major investments in the operations function. For example, cost leadership strategies are often pursued at the operations level through investments in large plants, automation, elimination of waste, and savings in factor costs.

This top-down approach to the process of strategy may leave the impression that the role of the OE mainly consists of focused and disciplined functional deliberation, based on a set of operational priorities received from the top. However, the OE is also an important and unique source of knowledge, old and new, and is thus involved in other ways as well. De Groote (1994), for example, showed the need for the operations function to communicate upwards and sideways about potential investment options. He showed that, if the marketing function is unaware of potential investments in flexible manufacturing technology, the marketing function holds on to low product variety because it believes that the production costs would otherwise be prohibitive. Similarly, the operations function does not invest in flexible manufacturing, because the benefits, in light of the existing level of product variety,

do not appear sufficiently enticing. Hence, achieving optimal coherence in an evolving organization can require that operations executives engage in substantial top-level communication, a role that is observed in practice as well (e.g. Menda & Dilts, 1997).

In other situations, it is not so much coordination with other functions that occupies the OE but a need to develop and adopt best practices. For example, the diffusion of best practices such, as just-in-time inventory management, total quality management, and lean manufacturing (e.g. Schonberger, 1986; Womack, Jones, & Roos, 1990) or the deployment of new information technology and reengineered processes (Hammer & Champy, 1993) have strongly impacted competitive positions. The development and adoption of such innovations can be an important aspect of the OE's strategic role, as the success of Japanese manufacturing firms over the last three decades has proven. This proactive development of capabilities requires careful decision-making as well. Ferdows & De Meyer (1990) show, for example, that some development sequences are better than others. They find that the prior development of basic capabilities, such as total quality management (TQM), makes it easier to acquire other kinds of competences, such as those related to short production runs, fast turnaround and delivery times, and manufacturing flexibility in general. This dynamic element of strategy calls for a more collaborative and decentralized process of strategy, as well as a more active and externally oriented role of the OE. Porter (1996) has argued that firms should indeed combine such dynamic strategies with purposeful positioning and dynamic fit. One of the arguments that we will make in this paper is that the balance in such a combination could be usefully made contingent upon the characteristics of the firm's environment.

In our propositions, we will also take into account the fact that strategy, whether based on innovation or industry positioning and fit, faces another, more conceptual problem. As emphasized in the currently very influential resource-based view of the firm (Barney,

1986, 1989, 1991; Rumelt, 1984; Teece, 1984; Wernerfelt, 1984), the competition for resources necessary to implement a strategy may cancel out the profits that ultimately stem from this strategy. In the context of competitive bidding for resources, a firm can realize extraordinary returns only through luck or superior information (Barney, 1986). Luck in essence means pre-existing heterogeneity among firms, which makes some better candidates than others to take advantage of new market opportunities (Peteraf, 1993). It is important to note that merely having something that others can purchase in the open market does not give a firm any real advantage in pursuing these opportunities (Dierickx & Cool, 1989). Hence resources, or competences (Prahalad & Hamel, 1990), that are accumulated over time and are not easily imitated by competitors tend be especially important from the standpoint of firm strategy.

Whether it is the pursuit of superior information about resources and opportunities (Barney, 1986; Makadok & Barney, 2001), taking advantage of one's uniqueness in pursuing these opportunities (Barney, 1989; Teece, 1980, 1982), accumulation of resources or competences that may ultimately create such opportunities (Dierickx & Cool, 1989), or a combination of these three approaches (Porter, 1996; Teece, Pisano, & Shuen, 1997), the challenge for the process of strategy is substantial. We will propose that, in this process, the relative emphasis on resource selection, accumulation, and leveraging depends on the environment and the existing resource bundles, which will allow us to develop a contingency view for the role of OE.

Toward a Contingency-Based View of the OE's role in the Strategy Process

So far, few studies have attempted to follow up on the conceptual paper by Mills, Platts, & Gregory (1995) who propose a contingency-based approach to the making of operations strategy and stress the need to link it with the contingency theories for the process of strategy. Empirical studies, by Swamidass & Newell (1987) and Ho (1996), have

examined how external contingencies affected the role of the OE in the strategy process. Both studies found that environmental uncertainty diminished the OE's role, but this smaller role was also associated with deteriorating performance. Importantly, these two studies are not completely in the spirit of the contingency approach because they did not attempt to link environmental conditions to the role of manufacturing managers to explain performance (Venkatraman, 1989).

As the resource-based view alerts us, different firms face different opportunity sets (Barney, 1986). In other words, internal contingencies, and the existing firm resources in particular, should be important variables in any contingency-based approach to the process of strategy. The framework proposed by Wheelwright & Hayes (1985) can be seen as an example of this approach, as it describes an evolving role for the OE as a function of the state of resource development. Wheelwright and Hayes provide case study evidence for how a four-stage development path of the operations function affects the process of strategy. In the first stage, a firm's operations resources are not on par with those of the firm's competitors, a condition which is remedied when a firm reaches stage 2. Stage 3 is reached when the operations function begins to support and strengthen the company's competitive position. It is only at this stage that firms start to carefully screen manufacturing investments for consistency with the overall business strategy. The fourth stage arises when operations resources reach world-class status and when business unit strategy rests to a significant degree on a company's production capability. Importantly, the OE engages in increasing levels of top-level communication along this path. In stage 1, production managers are barely involved in communication with top management. In stage 2, there are some interactions between operations and other functions but most important decisions are based on simple formalized processes and quantitative financial data. In stage 3, OEs assume a broader role; they need to deeply understand the business strategy, translate it into a manufacturing

strategy, and continually screen manufacturing decisions for consistency with the business strategy. In stage 4, OEs participate directly in the formulation of the business strategy and coordinate its implementation with other functional heads, both formally and informally.

In the remainder of this paper, we attempt to build on these initial works to construct a theory of how internal and external contingencies influence the role of OEs in the process of strategy, with a focus on the balance between the OE's top-level communication and functional deliberation.

THE PROCESS OF STRATEGY AND THE OPERATIONS EXECUTIVE

We define the process of strategy broadly as the process a firm uses to decide about the costly-to-reverse investments of money, time, energy, and/or other resources that are made in order to maximize the value of the firm. We consider all the information processing that leads up to such decisions; hence we do not force a separation between strategy formulation and implementation. In other words, we only consider realized strategies (Mintzberg & Waters, 1985) and thus consider both planned and emergent aspects of the information processing leading up to the actual investment decisions. To create a context for our analysis, we briefly discuss the role of the operations function inside the firm and, more specifically, how the OE contributes to the overall value of the firm through his or her information processing and decisions about operations.

As mentioned earlier, we limit our analysis of the process of strategy and the OE's role in it to a business unit with a functional organizational structure. In a functionally organized business unit, the operations function typically houses all the activities that are directly related to the transformation of inputs into final goods or services, and other functions house their own clusters of highly interrelated activities, such as marketing, research and development, human resources, and others that are typically found in any modern business (e.g., Hofer & Schendel, 1978).

The operations function is often one of the critically important areas in which a firm's resources are accumulated (Hayes, Pisano, & Upton, 1996). Several general characteristics of operations contribute to this phenomenon. First, operations typically account for a large percentage of costs and investments and can strongly impact product or service quality. The firm's profitability can therefore be very sensitive to investments in operations. Second, the typical high-volume and repetitive nature of operations often results in strong learning-by-doing effects, which indicate the accumulation of resources that cannot be purchased in open markets (Dierickx & Cool, 1989). Third, because operations are generally complex and difficult to observe from the outside, these learned capabilities are of the type of accumulated resources that are not easily imitated by competitors (Hayes & Upton, 1998; Schroeder, Bates, & Junttila 2002).

Like operations, other functions are engaged in accumulating valuable resources as well. For example, the marketing function typically controls the investments in brands, sales capabilities, and customer or channel relationships. The research and development function is often in charge of scientific know-how, patents, and the development of new technologies and products.

The fact that functions provide a structure for the firm's resources has important direct consequences for the role of functional heads in the process of strategy. Because of their proximity and direct involvement in functional investments, each function has exclusive direct access to information and knowledge about the respective acquired resources and capabilities. This unique body of knowledge can only be accumulated over time and is very difficult to transfer. This knowledge makes functional heads uniquely positioned to contribute to the process of strategy, especially when it concerns further investments in such resources. In order to further characterize this contribution, we first dissect how resources add value to the firm.

In the spirit of the strategy (e.g., Porter, 1980) and the operations strategy (e.g., Skinner, 1969, 1974) literature that emphasizes the notion of internal fit or *coherence*, we distinguish, as others have (e.g. Conner & Prahalad, 1996), between two different ways in which a resource, or the investment needed to acquire it, can add to the value of the firm: through its base value and through its functional and cross-functional coherence. The base-value component is only affected by the environment and not by the firm's other resources. The coherence component of value can be seen as firm-specific and stemming from the interaction with all other related resources residing in the same or other functions.

To illustrate the notion of coherence, consider the net present value of the reduced inventory costs due to the acquisition of a large centralized warehouse ***A***, and that due to the acquisition of a computerized inventory tracking system ***B***. We can easily imagine how the value of acquiring both resources is strictly greater than ***A***+***B***, and we can attribute this additional value to the *coherence* between the two investments or, in the formal language of Milgrom & Roberts (1990), supermodularity between these two investments. On the cost side, as suggested by Ferdows & De Meyer (1990), acquiring resource ***B*** may be cheaper if the firm already has resource ***A***. In other words, firms may be able to exploit synergies in the acquisition of resources by focusing on those that are more basic first. The idea is that some resource acquisition paths may be more coherent, i.e., less costly, than others even though they may lead to the same or very similar resource bundles in the end. For example, expertise in TQM logically precedes and facilitates the acquisition of the reputation for quality.

Insert Figure 1 about here

Figure 1 summarizes this view of the firm as a collection of resources that determine the firm's value through their joint interaction with the environment. It also shows that we

associate the notion of *functional* coherence with synergies among the strongly interdependent resources that reside within a function, and we associate *cross-functional* coherence with synergies across functional boundaries. Importantly for the role of the OE, we will also assume that the additional value from the functional and cross-functional coherence of resources is proportional to the base value of the individual resources. In other words, coherence is a meaningful construct if and only if some level of resources, i.e., investments, is present within the firm.

The claim that a firm's value is structured in a way that parallels the firm's organizational structure seems consistent with explanations of why functions emerge in the first place. Firms are under pressure to lower production costs, and they respond to this situation by dividing labor and making task-specific investments. This process, in turn, creates the need for coordination between tasks, which is most efficiently achieved by clustering interdependent and/or similar tasks and their shared resources into functional departments (Galbraith, 1977; Simon, 1947; Thomson, 1967). Hence we find the basis of firm value in functional resources, whether they assume the form of physical capital or intangible coordination and other skills, and we attribute the additional firm value beyond the simple sum of these individual functional values to their mutual coherence.

In order to characterize the OE's contribution to the process of strategy we also need to understand his or her unique position and role in the firm's information processing network, which is summarized in figure 2. As head of the operations function, the OE has direct access to other functional heads and to the CEO, who is the person that oversees and aggregates, within the limits of bounded rationality, the diverse body of the business unit's knowledge. To simplify the analysis, we let these links represent the totality of the OE's communication with the central office and other functions, and we label this combined activity 'top-level communication.' Similarly, we combine all of the OE's operations-centric

information processing, including his or her own decision making and communication with subordinates and external contacts in what we label 'functional deliberation.' Figure 2 summarizes this characterization of the OE's information processing role.

Insert Figure 2 about here

The OE's functional deliberation includes the OE's analysis and making of strategic decisions, communication with subordinates to learn about the state of operations or to convey courses of action that they need to take, and communication with direct external contacts, such as suppliers, customers, or consultants, in order to improve the firm's production or service delivery system. We chose this label because of the clear functional focus of this type of activity, as well as its largely analytical and problem-solving content. This type of activity is heavy on the 'computation' side of information processing in that it updates, increases, and ultimately uses the OE's knowledge of operations management and operations strategy, as well as that of the firm's particular production system, in order to make specific decisions that alter this production system.

On the other hand, the typical purpose of top-level communication is to inform other functional heads or the CEO about aspects of operations, such as cost, quality, and product variety issues that may be of relevance in their respective decision making, or to learn from them about (changes in) firm strategy, or concerns in other functions that should be taken into account in making future decisions about operations. Obviously, while there may be some joint analysis and decision making that takes place, the focus here is shifted away from the OE's computation to transfers of information. Moreover, these transfers occur at the highest level of the organization, which is why we choose the label top-level communication.

We propose that the balance between the time and energy spent on the two types of activity is an important lever that can be adjusted to maximize the OE's contribution to the process of strategy. Moreover, the proper balance is contingent upon the firm's environment and resources that the firm already has. To analyze this balance, we turn to the actual content and ways in which the two types of activities contribute to the firm's value.

Moreover, we propose that the OE's functional deliberation is a crucial activity that increases the base value and functional coherence of the operations resources. In other words, the OE's functional deliberation is a key input to choosing plant locations, technology, facility layouts, training programs, and other operations resources that have a good base value in the current environment and that are functionally coherent.

In contrast, top-level communication allows the OE to learn about resources that are present in other functions, which he or she can then use to increase the cross-functional coherence of the operations resources, thus increasing their contribution to firm performance. Similarly, top-level communication allows other functional heads to capitalize on and build synergies with resources that are already accumulated within the operations function, thus further contributing to the value of the firm through cross-functional coherence. Obviously, the more resource-rich the operations function, the more opportunities for these synergies exist. Finally, top-level communication informs the CEO about the resources that can be capitalized on so that he or she can guide resource decisions towards additional coherence across functions.

This model of the OE's contribution to the strategy process is captured in Figure 3. The OE's functional deliberation mainly increases the strength of the operations resources and his or her top-level communication mainly increases their cross-functional coherence. As indicated in the figure, we also assume that both of these contributions face diminishing returns. This assumption is consistent with the intuition that, in most situations, some level of

both will be needed to achieve good firm performance. Figure 3 also captures our earlier comments about the contribution of operations resources to firm value, with their base-value and functional coherence as one element, and their cross-functional coherence as a second element whose contribution is proportional to the contribution of the first element.

Insert Figure 3 about here

In the following section, we place this model of resource accumulation in the contingency context in which a firm may face different types of environment and, at the same time, may have various states of accumulated resources.

PROPOSITIONS

The first three propositions that follow from the above discussion consider the impact of dynamism, complexity, and munificence of the firm's environment on the strategy process and the OE's role in it. The three variables have been widely used in the literature, following the work by Dess & Beard (1984). As we have argued above, several authors have hypothesized and provided evidence that dynamism and complexity increase the information processing requirements on the firm (e.g., Goll & Rasheed, 1997; Miller & Friesen, 1983; Tushman & Nadler, 1978). However, given that the OE cannot simply engage in more functional deliberation *and* top-level communication, especially over extended periods of time, the problem boils down to whether such increased requirements are better served if the OE communicates more with the CEO and other functional heads, thus helping process information at the firm level, or by focusing on information processing within the operations function.

We interpret dynamism as the rate of change or the amount of turbulence in the environment. Logically, environmental dynamism has several important effects on firm resources (Figure 3). First, it tends to make resources dissipate faster, which, in turn, requires increasing levels of effort, time, and money in order to maintain them. For example, it is harder to maintain quality control procedures or other knowledge-related assets if the employee turnover is high, or technological know-how if the rate of technological change accelerates. Second, because it makes the future uncertain, dynamism reduces the expected value of resources, particularly those that are non-basic. For example, the value of plant space and location, market reputation, and knowledge of TQM are less vulnerable to changes in technology than the particular machinery and equipment that is used in the production process. Finally, dynamism tends to reduce the expected value generated through coherence. For example, the expected value of tightly integrated and coherent marketing and operational resources is reduced if there is uncertainty about the delivery methods or product attributes that will be preferred in the future or the possibility of a completely revolutionary technology emerging on the production side.

In summary, because of the increased dissipation of the basic resources that are also the least vulnerable to the uncertainty associated with dynamism, the OE will likely need to devote more attention to their maintenance through functional deliberation. At the same time, because of the decreased expected value of coherence, as well as the likely increased difficulty in even discerning coherence in a fast-changing world, top-level communication can become a luxury that is hard to afford in dynamic environments. In contrast, the search to enhance operations through functional deliberation can result in diminishing returns relatively fast in stable environments, and additional value can then be created primarily through optimizing the interaction with resources residing in other functions. As a result,

stable environments tend to call for increasing levels of top-level communication. All these arguments support the following proposition:

PROPOSITION 1: If the environment becomes more *dynamic*, the role of operations executives in the process of strategy will need to involve more *functional deliberation*.

This proposition may seem counterintuitive, especially if interpreted as prescribing that the CEO relinquish control of the strategy process in dynamic environments. However, the proposition is consistent with the insight that a loss of central control may be a price that a complex system has to pay in order to become more adaptive, usually by having looser connections between elements and by simplifying the rules for interaction (Eisenhardt & Bhatia, 2002). In other words, dynamic environments may call for a simpler form of central control rather than a complete absence of such control.

We interpret complexity as a measure of the number of elements and the number of their interactions that play a role in decision-making. Naturally, the OE has to be careful about the impact of operations resources on other functions, as well as aware of how they may affect operations because complex environments are characterized by strong interactions. In addition, the work by Dess & Beard (1984) suggests that environmental complexity is associated with industry concentration (concentrated industries are considered less complex) and the amount of heterogeneity in the environment. Hence complex environments tend to be those in which customers need to be segmented, minor interactions can make a big difference, and competition is intense. We conjecture that pure enhancement of basic functional resources has reached its limits in this type of environment, and firms compete by trying to build cross-functionally coherent bundles of resources. Hence OEs need to spend more time on top-level communication as they search, together with the CEO

and other functional heads, for synergies and distinctive and coherent resource combinations. Each of the two aspects of complexity points to the following proposition:

PROPOSITION 2: If the environment becomes more *complex*, the role of operations executives in the process of strategy will need to involve more *top-level communication*.

To illustrate why environmental complexity has the opposite effect to that of dynamism, it is useful to briefly explore a different argument that would suggest otherwise. One could argue that increased environmental complexity may lead to an overall stress on the information-processing capacity and cause a retrenchment to functional deliberation because, in a complex environment, it would take much longer to reach diminishing returns of doing so. The reason we cannot subscribe to this view is that we believe that the complexity of an environment and the information processing performed in that environment are deeply interdependent. In other words, environments may *become* more complex when the simple problems have been solved, and there remain opportunities for further advancement by addressing the difficult problem of interdependence. The solution then calls for harnessing the diverse body of knowledge and expertise through communication and joint processing of information by the functional heads and the CEO.

Munificent environments are those that are conducive to growth and pose few risks to the firms in an industry. We conjecture that such environments create easier pickings when it comes to resource selection and accumulation decisions. Hence we would expect that there are significant benefits to be gained by simply building the functional resources. Holding all other dimensions equal, a firm in a fast-growing industry can realize more benefits from expanding its operations resources than a firm in a slow-growing or declining industry. Expanding operations resources is achieved by allowing OEs to spend more time on

functional deliberation, which results in our final proposition regarding the firm's environment.

PROPOSITION 3: If the environment becomes more *munificent*, the role of operations executives in the process of strategy will need to involve more *functional deliberation*.

Propositions 1 and 3 imply that munificence and dynamism impact the role of the OE in similar ways. In essence, they both keep the OE further away from reaching the point of diminishing returns to functional deliberation. A dynamic environment keeps knocking down resources, which then have to be rebuilt, while a munificent one keeps raising the ceiling on the level to which these resources can profitably be accumulated.

Proposition 3 is consistent with the findings of Slevin & Covin (1997) that 'planned' strategies, which we expect to involve considerable levels of top-level communication, work well in hostile environments, and the idea that 'emergent' strategies (Mintzberg & Waters, 1985), which we expect to involve more functional deliberation, work well in munificent environments. The proposition also provides a potential reconciliation between the findings of Miller & Friesen (1983), who observe a useful increase in the amount of strategy-making analysis in more hostile environments, and those of Goll & Rasheed (1997), who observe a useful increase in rationality in munificent environments. The proposition implies that it may be that the locus of the intense analysis shifts from the functional level in munificent environments to the top management team in hostile environments, which would be consistent with both studies if they were based on observations collected at different organizational levels.

In the next two propositions, we focus on how the OE's role in the process of strategy is influenced by the resources that are already present in the operations function and elsewhere in the firm. Here, we identify several forces that drive the balance between

functional deliberation and top-level communication in the same direction. As a firm's operations function accumulates more valuable resources, starting from those basic ones that can support the acquisition of other resources that are more specific to a particular strategy, the returns stemming from pure further resource accumulation through functional deliberation are diminished. At the same time, this process puts on the agenda the acquisition of less basic resources whose contribution to firm value is more sensitive to cross-functional coherence. Hence the OE needs to increase his or her top-level communication in order to learn about resources that are already present in other functions or whose acquisition is contemplated by those functions. Finally, as they are accumulated, operations resources create opportunities and limitations for the choice of resources in other functions. Hence it becomes increasingly desirable for the CEO and other functional heads to learn about these resources, and the result is, again, more top-level communication. All three arguments support the following proposition, which is consistent with the increasing visibility of the operations function in strategic planning as it progresses through the four-stage development described by Wheelwright & Hayes (1985).

PROPOSITION 4: If operations resources become *more developed*, the role of operations executives in the process of strategy will need to involve more *top-level communication*.

We now turn to what we label the criticality of operations resources for the firm. We use the notion of criticality as a measure of how important operations resources are relative to those residing in other functions. It is important to note that changes in the criticality of operations resources can be induced internally, as other functions accumulate or disperse resources, or externally, because the environment changes the way in which it values firm resources.

As an example of the first type of change, resources in other functions can become more or less important as a result of the rate of their development and accumulation. For example, an R&D department may discover a radically improved new technology, or a marketing function may develop a particularly successful brand. As a result, the criticality of the operations function is reduced, and the balance of the OE's activities is shifted toward more top-level communication in order to better leverage these new and valuable resources in other functions. Obviously, the criticality of operations resources can also change independently from internal development, as a result of the emergence of new technologies in the firm's environment, changes in customer trends, government regulation, etc. When such an exogenous event increases the importance of a particular resource, an opportunity to further accumulate or hone that resource to extract additional benefits in terms of its contribution to the firm value is created. For example, if the market starts to place a higher premium on fast deliveries and turnaround times, the operations function is likely to be able to increase its contribution to the firm by building competencies in this area. The acquisition of such competencies requires functional deliberation. Both these conclusions lead to our final proposition.

PROPOSITION 5: When the criticality of operations resources *increases,* the role of operations executives in the process of strategy will need to involve more *functional deliberation*.

The above analysis provides a useful template to describe possible paths of the development of the operations function over time. We can map these paths on a chart with the level of accumulated operations resources (base-value plus additional value from functional coherence) plotted on the x-axis, and their cross-functional coherence on the y-axis. Based on our arguments, functional deliberation can be seen as resulting in horizontal

moves to the right, whereas top-level communication facilitates moves upward on this graph. Figure 4 illustrates two possible development paths of the operations function that follow from Propositions 4 and 5.

Path 1 is consistent with a scenario in which the operations function becomes very critical after an important external event (Proposition 5). The focus then becomes to quickly develop the operations resources through functional deliberation. In a sense, the function is allowed to 'run with the ball,' progressing almost horizontally to the right. Only at a later stage will a focus on increased coherence with other functions bring further payoffs. This path is also consistent with a scenario in which the operations function is particularly lucky or successful in building resources faster than other functions, in which case the horizontal shift occurs automatically (Proposition 5). Further payoffs are, again, achieved through the buildup of coherent resources elsewhere, and the result is an almost vertical upward move toward the end of the path.

Insert Figure 4 about here

Path 2 illustrates a very different scenario in which some other function becomes critical through an external event or internal discovery (Proposition 5). In this case, the OE needs to engage in top-level communication earlier on, in order to accumulate the missing operations resources that are cross-functionally coherent with the resources already residing in the more successful/important function(s). As a consequence, the development path 2 is much closer to the diagonal of the chart.

In addition, Proposition 1 implies that dynamic environments limit the extent to which firms can progress on these paths because the environment keeps pushing them back a few notches every time; the 'end' position will be more to the left and further down. Proposition 3 implies the same for munificent environments, this time because the environment keeps

raising the maximum attainable value of basic resources. Proposition 2, on the other hand, implies that complex environments are those in which firms follow higher paths, competing more intensely on cross-functional coherence than on the development of basic resources. Finally, it is important to note that the three environmental variables affect the development paths of all functions in the same way, whereas different levels of accumulated resources or their uneven importance across functions results in the divergence of these paths between the resource rich and/or critical functions *vis-à-vis* all others.

DISCUSSION

The above analysis has suggested the need to monitor and control the balance between the time operations executives (OE) spend on functional deliberation *vis-à-vis* top-level communication as the environment and internal firm resources change. We have proposed that OEs should devote relatively more time and energy to functional deliberation when the environment in which they operate becomes (1) more dynamic, (2) simpler, and/or (3) more munificent. We have also proposed that low development levels of operations resources or an increase in their competitive importance relative to that of other resources have the same effect. On the other hand, environmental stability, complexity, and hostility, richness of operations resources, and the relative importance of other functions all tilt the balance in favor of top-level communication.

These propositions form a concrete, testable contingency theory regarding the role OEs play in the process of strategy. Hence this analysis makes a theoretical contribution to the field of operations strategy where calls have been made for progress in this direction (e.g., Mills, Platts, & Gregory, 1995). In addition to building upon the literature in operations strategy, the propositions are rooted in insights from competitive strategy, organization theory, and information economics, thus further integrating the still young and fast growing field of operation strategy with other related disciplines.

Drawing from and integrating several streams of literature to analyze a specific problem often highlights potential areas for cross-fertilization. With respect to the theory of organizations, the analysis raises interesting questions about the often-used notion of centralization. A strategy process can be described as centralized if the CEO is heavily involved in all decision-making, supported by extensive top-level communication with functional heads who then have little time for functional deliberation. However, in another form of centralization, the CEO could set policy centrally, by strictly limiting the search space for the functional heads (i.e., by giving them very specific tasks), and then allowing them to independently deliberate within these narrow constraints. Clearly, while there is no one-to-one mapping between centralization and the information-processing constructs of communication and deliberation, they seem intimately related, and the separation between deliberation, communication, and ultimate decision-making could be used to explore a potentially very useful taxonomy of various forms of centralization.

Similarly, the information-processing view of organizations can potentially be used to clarify the constructs of 'rationality,' 'analysis' and 'comprehensiveness' that are commonly tested in contingency theories of the strategy process (e.g., Fredrickson & Mitchell, 1984; Goll & Rasheed, 1997; Miller & Friesen, 1983). These theories have focused mainly on the level or intensity of overall information processing in the strategy process. Our analysis is different in that it assumes a fixed level or intensity of information processing, and focuses on the importance of tradeoffs in the sense that more information processing of one type results in less of another. We specifically address how functional heads should balance communication and deliberation in a range of situations. In other words, we have added another lever that an information-processing organization can use, and adopted the contingency approach to identify how this lever could be used.

Finally, the contingency approach and the close look at the nature of the decisions that OEs have to make can potentially inform the field of strategy as well. The analysis suggests that perhaps a contingency approach could be used to integrate the views in strategy that emphasize resource-picking (Barney, 1986; Makadok & Barney, 2001), accumulation of non-purchasable resources (Dierickx & Cool, 1989), and industry positioning and fit (Porter, 1980, 1985).

Obviously, the proposed contingency theory has important limitations. The analysis assumed the limited scope of a functionally organized business unit and did not consider alternative organizational arrangements and potentially important issues related to corporate structure and strategy. We also adopted an information-processing logic that ignores possible misalignment of incentives in the organization. Clearly, additional work could explore these limitations and how they may alter the presented view of the strategy process and the OE's role in it.

From a practical standpoint, the question that naturally arises is how firms may go about adjusting the balance between functional deliberation and top-level communication in their actual strategy processes. It seems that firms can accomplish this objective in two ways: they can try to dynamically redesign their strategic decision-making process as the external and internal conditions change or, if they already have multiple processes in place, they can simply adjust the extent to which they rely on each of these processes. As suggested by Hart & Banbury (1994), the latter may be better because it tends to maintain the firm's capability in different types of processes, while making it possible to adjust the balance. It is important to note, however, that regardless of the employed mode, organizational inertia may present significant problems, which are potentially a fruitful area for further inquiry, along with other practical issues that may arise in the rebalancing between functional deliberation and top-level communication.

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TABLE 1

Contingency Theories

	Effect on Information Processing Load			Strategy Process Response		
	Dynamism	Complexity	Munificence	Intensify	Decentralize	Limit search space
Lawrence & Lorsch (1967)	**+**				**✖** organic	
Galbraith (1973;1977) Tushman & Nadler (1978)	+	+		× information systems	× lateral relations	
Fredrickson (1984) Fredrickson & Mitchell (1984)	**(+)**				**✖** loose coupling	**✖** incremental
Miller & Friesen (1983)	**+**	+	**–**	**✖** analysis		
Priem, Rasheed & Kotulic (1995)	**+**			**✖** rationality		
Goll & Rasheed (1997)	**+**		**+**	**✖** rationality		
Hart (1992) – Generative mode	(+)	(+)			× member initiative	
Hart (1992) – Transactive mode		+			× participative	
Hart (1992) – Symbolic mode	+					× vision-driven
Mintzberg & Waters (1985) – Umbrella strategy	+	+			× partly emergent	× partly deliberate
Dess et al (1997)	+	+			× participative	× strong leader
Siggelkow & Rivkin (2004)	+	+		×	× in simple environments	×
Legend	+ or - : direction of impact ( ) : presumed **bold** : empirical support that the marked response on the right enhances performance			× : proposed response to the increased information processing load caused by what is marked on the left **bold** : empirically supported performance effect in environments marked on the left		

FIGURE 1

Structure of Firm Resources

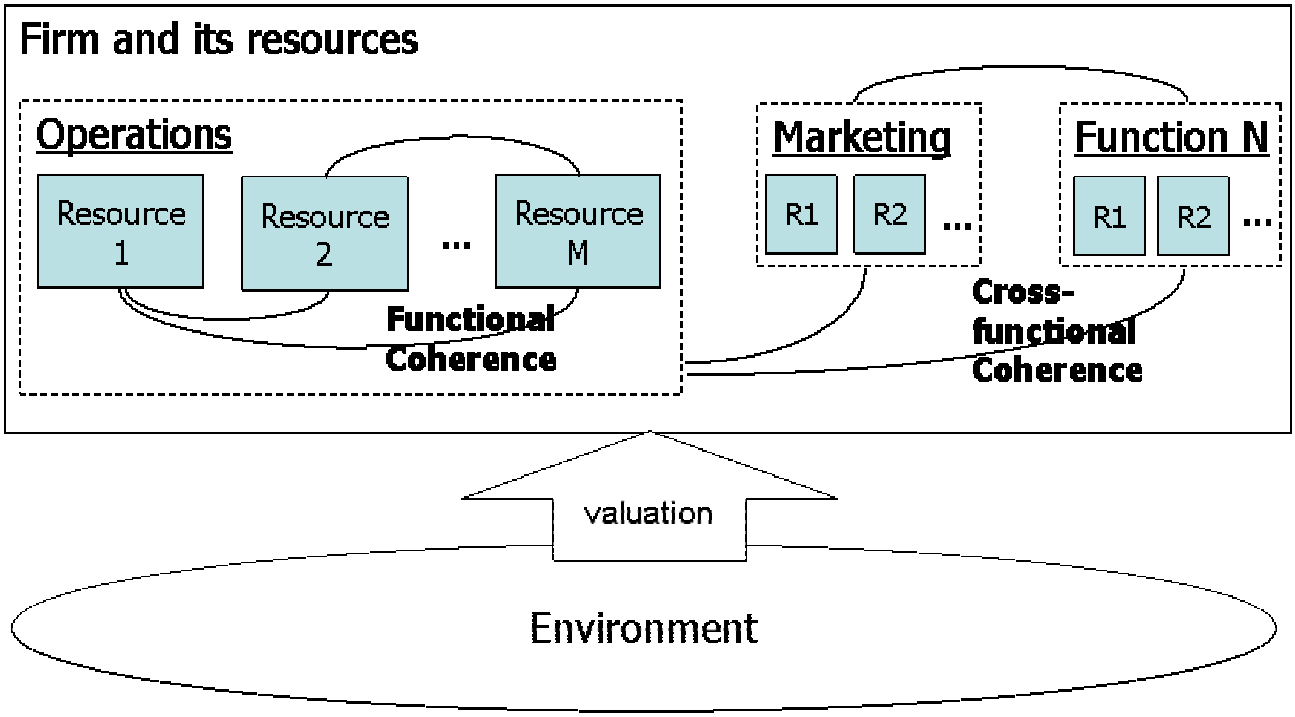


FIGURE 2

The Information Processing Role of Operations Executives (OE) in the Strategy Process

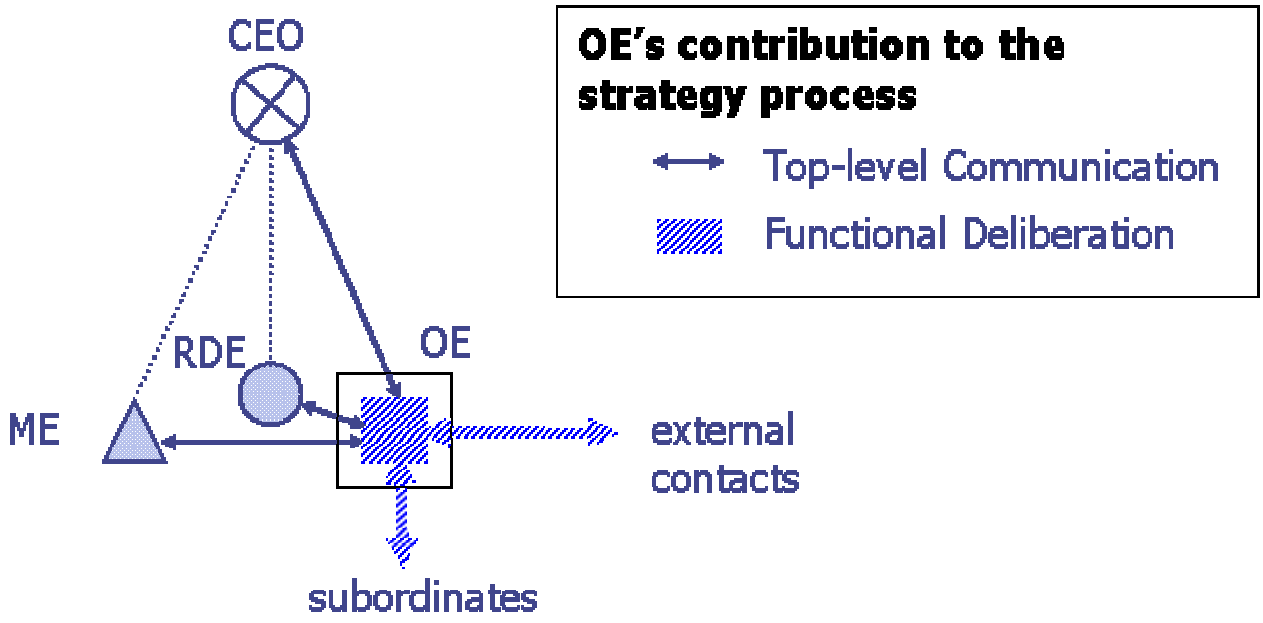
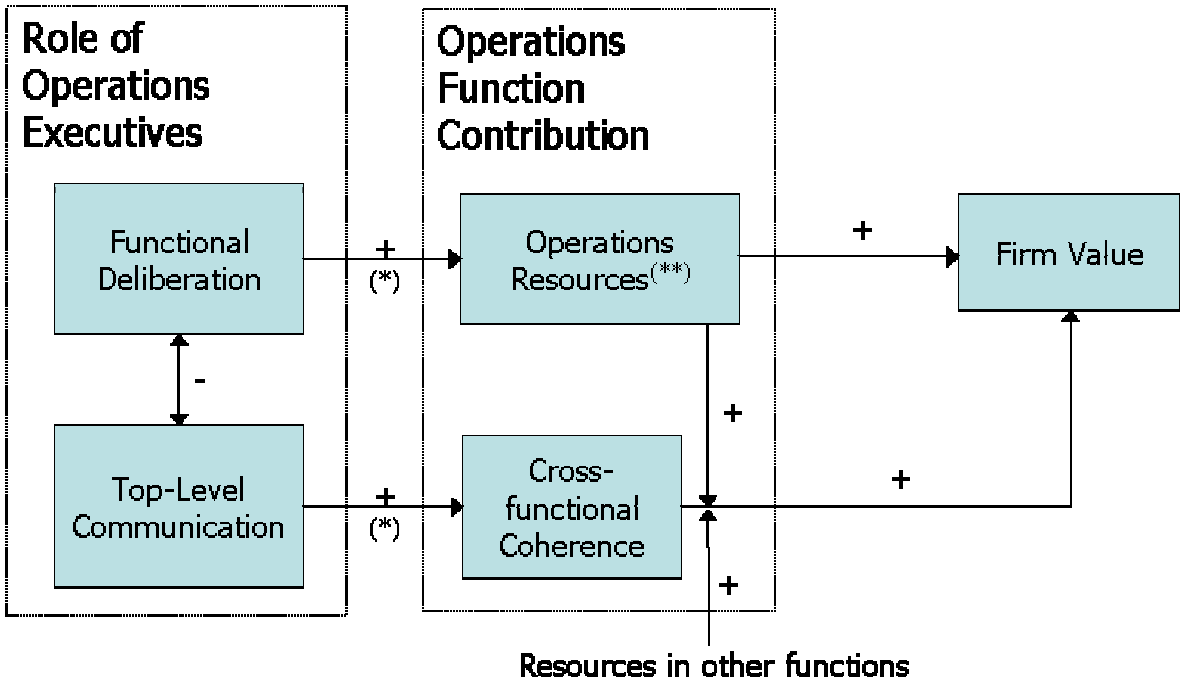


FIGURE 3

Role of Operations Executives, Operations Resources and Firm Value



(*) with diminishing returns
(**) base-value plus additional value from functional coherence

FIGURE 4

Various Development Paths for the Operations Function