SUPPLY CHAIN CONFIGURATION: A TYPOLOGICAL APPROACH

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by

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ABSTRACT

Though supply chain integration has emerged during the past several decades as a major source of competitive advantage, there is scant academic research on the antecedents of the configuration of supply chains. Built on two dimensions of supply chain integration, number of stages and form of control, this paper proposes a typology of supply chain integration, which defines four configurations: the independent integrator, the collaborative integrator, the controlling integrator, and the full integrator. A model in which the environmental, strategic, and operational variables directly impact supply chain configuration is proposed. Contributions, limitations, and implications are offered.

Keywords:

Supply chain configuration
Product life cycle
Strategic environment
Competitive priorities
ANTECEDENTS OF SUPPLY CHAIN CONFIGURATION: TOWARD A CONTINGENCY THEORY

INTRODUCTION

The development of the integrated supply chain is arguably one of the most significant sources of competitive advantage for manufacturing and distribution firms in the last few decades. By minimizing the economic costs of manufacturing and delivery and maximizing customer service across multiple stages of acquisition, production, and distribution, supply chain management activities have redefined their competitive edge in many industries, both nationally and globally. More directly, supply chain efficiency is increasingly becoming the basis for competitive survival.

Much of the academic research of supply chains to date has centered on uni-dimensional constructs involving the definitions, benefits, and general risks and costs of supply chain integration. Alternatively, this paper argues that the supply chain is a multi-dimensional construct and that there are multiple configurations of supply chain integration, which would match with environmental, strategic, and operational factors. Therefore, the appropriateness of these configurations is not linear; it depends on the fit with a firm’s unique situation. Thus, we specifically address the research question: how do selected environmental, strategic, and operational variables affect the choice of supply chain configuration? We propose a contingency model in which certain supply chain configurations are more appropriate with specific antecedents (external environments, strategic emphases, and operations strategies) than with others. Such a model, when tested and operationalized, would assist operations practitioners and corporate strategists and planners, as well as academicians, assess the conditions under which supply chain integration would warrant the effort and how such integration should be pursued.

This paper is structured as follows. We first present a typology of supply chain integration based on number of stages of integration and form of control. Building on the work of Williamson (1975), Hayes and Wheelwright (1979a, b, 1984), and Harrigan (1985), we propose a theoretical model in which selected environmental, strategic, and operational variables impact the choice among alternative
configurations. A series of propositions that delineate the contingencies leading to the choice of a specific configuration follows. This paper concludes with implications for researchers and practitioners.

**A TYPOLOGY OF SUPPLY CHAIN INTEGRATION**

**A Multi-Dimensional Construct**

Heskett (1977) was among the first to anticipate and identify the contribution of logistics integration to improve corporate performance. Previously, integration usually meant vertical integration, including such mechanisms as: financial leverage, management of diverse corporate assets, and control of resources. However, by the early 1980s, firms turned their focus inward toward efficient flows of products and information (LaLonde, 1994). Supply chain integration initially implied local optimization of separate activities (Reyes, Raisinghani & Singh, 2002). But, optimization of one stage may negatively impact other stages, thus the “bullwhip effect” (Lee, Padmanabhan & Whang, 1997), reduction of which emphasizes overall balance of the supply chain. Lummus, Vokurka, and Alber (1998) add other reasons to balance supply chains: 1) global competition forces extraction of supply chain efficiencies and 2) specialization generates a disintegrating effect, which must be counterbalanced. Other recent studies underscore the multi-faceted, complex nature of the supply chain (Akkermans, Bogerd, & Vos, 1999; Cooper, Lambert, & Pagh, 1997; Mejza & Wisner, 2001).

Harrigan (1985), in her classic study, also argues that a supply chain is not a unidimensional construct; rather, it is characterized by different patterns that display varying stages, breadth, degrees, and forms of integration. Stages refers to “the number of steps in the chain of processing which a firm engages in – from ultra-raw materials to the final consumer” (p. 399). Breadth is defined as “the number of activities that firms perform in-house at any particular level of the vertical chain” (p. 401). Degree is the percentage of total production outputs exchanged with sister units. The final dimension, form, means ownership or other arrangements of control, such as shared ownership, long-term contracts, information exchanges, or resource and risk sharing agreements. This paper chooses number of stages and form of integration as the dimensions. We consider these two dimensions to be most responsive to changes in the
environmental, strategic, and operational variables. The non-selected dimensions, breadth and degree, as shown by Harrigan (1985) are closely intertwined with number of stages.

**Number of Stages.** The number of sequential stages of an integrated supply chain may vary from one or several (limited) to many or all (extensive) of the links, from basic raw materials to the end customer. Research, which is subsequently documented, shows that a firm is likely to engage in few stages when technology, volume, or quality requirements differ notably from stage to stage, when product life cycles are short or new obsolescing technologies are anticipated, or when the product or industry structure is embryonic. Alternatively, a firm is likely to engage in extensive stages when it seeks technology, volume, or quality leadership; when product life cycles are expected to be several years or longer; or, more generally, when the firm seeks to stabilize production of a standardized commodity good.

**Form of Integration.** The form of integration – Harrigan (1985, p. 402) also uses the terms leverage and control – can range from tight control or total ownership of the vertical supply chain activities to looser control through partial ownership or a variety of quasi-ownership and control mechanisms. Examples include long-term supplier contracts and sharing of proprietary product, process, or information technology and risks, as well as shared ownership, capital underwriting, and mutual agreements or contracts. These various forms of integration can be generally categorized as more flexible (looser forms of control) or less flexible (tighter forms of control). Research, which is subsequently documented, shows that greater flexibility (or looseness) of the form of control would likely be associated with fewer stages of integration, less continuity of process, and earlier stages of the life cycle; alternatively, less flexibility (more tightness) of the form of control would be associated with more stages, greater continuity of process, and later stages of the life cycle.

**Types of Configuration**

As demonstrated in Figure 1, these two dimensions of supply chain integration result in four classifications of configuration: the independent integrator, the collaborative integrator, the controlling integrator, and the full integrator. These configurations are subsequently described and exemplified.
The Independent Integrator. The independent integrator is a firm that only integrates activities that are closely related to their core processes, and minimally relies on non-ownership forms of integration to control these externalities. For example, Company D, a subsidiary of a Fortune 500 firm, manufactures parts primarily for the automotive aftermarket. Though they build many variations of several parts families, the product differences are generally not notable; a cable length or the dimensions of a spring, for example, may vary. The company competes primarily on cost and manages by process control. Lot sizes are large with high volumes of low-cost inventories on hand; products are engineered based on designs from the original manufacturer and produced in volumes to meet general market demand. Employees perform rather narrow, mechanistic activities such as repetitive machining operations or filling plastic bags with specified parts. Company D has few long-term relationships with either suppliers or customers and limited supply chain integrative technology beyond personal communication and expediting in response to market demand. Company D generally represents the characteristics of a manufacturing firm that aggressively competes in open markets of suppliers and customers and makes limited efforts either to increase the number of stages or to increase the tightness of control.

The Collaborative Integrator. The collaborative integrator is extensively vertically integrated with suppliers and customers through generally loose mechanisms of control. For example, Company R is a large privately-held producer of food toppings, dough, and several other niche or intermediary food products. They buy processed raw materials and sell to wholesalers, distributors, and large institutional buyers, as well as in a few retail markets. Company R competes primarily on quality; in fact, they acknowledge that to achieve their levels of quality, costs are somewhat higher than those of competitors. Production processes are internally highly integrated; external integration is through long-term contracts with most suppliers and some customers. They use inventory to enhance responsiveness to customer demands; however, lots are small and demand for many products is seasonal, requiring extensive
coordination. As such, Company R generally represents a processing firm that is highly integrated internally and with most suppliers and customers, but uses looser forms of control externally.

**The Controlling Integrator.** The controlling integrator is a firm that uses tight control mechanisms with those few activities with which they choose to integrate. For example, Company F, a subsidiary of a *Fortune* 1000 firm, builds engine components primarily for OEM automobile assembly plants in North America, though there is also a limited aftermarket business. Given the wide range of engine models, the multiple units of product in each engine, and the notable variations in size, shape, and material, the company manages small lots of more than 75,000 stockkeeping units. Company F competes primarily on cost, but also must meet rigid quality specifications, associated with end product warranties. Additionally, changes in the roughly month-ahead visible automobile assembly schedule require some amount of flexibility. Kanbans are used internally and electronic data interface is used externally. A tight three-tier interaction has developed among suppliers, Company F, and customers – which, though their processes are highly differentiated – is integrated through standardization and broadly defined, in some cases, partial-ownership-based, partnerships. Company F generally represents characteristics of a manufacturing firm that integrates both internally and externally with a small number of highly differentiated suppliers and customers through tight control mechanisms.

**The Full Integrator.** The full integrator is tightly linked from raw materials to distribution outlets and owns or actively manages each stage of production and distribution. For example, Company K is a *Fortune* 50 producer of a wide variety of high-volume food and snack items; in many lines they operate all processes from raw material acquisition to retail outlets. Additionally, partnership activities are aggressively pursued to smooth integration with non-owned components of the supply chain. Products range in storage complexity from refrigerateds to liquids and dries and from high-volume meat, coffee, and grain processing lines to specialized bakery and final product assembly operations. Lot sizes are generally small, and the distribution pipeline is highly complex, in part due to short product shelf-lives and the need for product safety. Company K competes on low costs and standardized quality, and achieves high delivery performance of generally short shelf-life goods through ownership and tight
management control, including a proprietary information system and hundreds of supply chain management personnel. Company K generally represents the characteristics of a tightly controlled and extensively integrated firm.

These four configurations, from the independent integrator, to the collaborative integrator, the controlling integrator and the full integrator, represent four different business strategies and the associated operations management decisions. In a more general sense, these firms show an evolution of strategies in the following five ways:

1) **The business focus** has evolved from emphasis on process control to customer satisfaction.

2) **The competitive priority** has evolved from cost, to cost/quality, to cost/quality/flexibility and finally to cost/quality/flexibility/time.

3) **Methods of improvement** have evolved from the initial large-scale, large lot size, process-focused and product engineering and analytic emphases to the subsequent small-scale, optimized lot size, and systematic, incremental, and continuous process improvement.

4) **Supply chain relations** have evolved from initial characteristics of short-term, rigid and adversarial processes with many suppliers/customers to more long-term, flexible and relational efforts, with fewer suppliers / customers and with recent increases in extent and type of technology sharing.

5) **Human interaction** has shifted from centrally controlled, untrusting, and mechanistic involvement to distributed, organic and systemic trust.

A summary of the key characteristics of these four configurations is provided in Table 1.

| Insert Table 1 about Here |

**THEORETICAL MODEL AND DEVELOPMENT OF PROPOSITIONS**

Various methods to smooth the inefficiencies of multi-dimensional supply chains have been put forward. Brewer and Hensher (2001); McAfee, Glassman, and Honeycutt (2002); Stuart (1997); and Birou, Fawcett, and Magnan (1998) all have identified the importance of fit, alignment, or consistency to
the integration of supply chain of activities. This approach emphasizes that variation from strategic alignment results in inefficiencies of cross-functional interaction, or the structural or behavioral equivalent of the “bullwhip effect” (Lee et al, 1997). Still others have posited that notable explanatory variables include competitive priority (Stonebraker & Liao, 2003), process components (Marsh, Meredith, McCutcheon, 1997; Ryan & Riggs, 1996), and product life cycle (Birou, Fawcett & Magnan, 1997, 1998).

Effective supply chain integration will likely ultimately be tied to a wide range of environmental, strategic, organizational, human, and operations variables. Bagchi and Virum (1998) conclude that successful logistics alliances involve an atmosphere of openness and trust supported by clear communication lines. Additionally, Brewer and Hensher (2001) find, in a canonical evaluation of twenty logistics organizations, a strong complementarity between a logistics strategy and various key business processes, including operations, inventory, customers, and information technology. This finding suggests a strategic convergence toward the organization’s customer. Other contributors, including Akkermans et al (1999), Cooper and Ellram (1993), Ellram (1991a,b), and Sanders and Premus (2002), emphasize the importance of cultural, human, and organization variables to supply chain effectiveness.

This study posits that an important component of the choice among the four specific configurations of supply chain integration depends on the antecedents of the external environment that the firm faces and the strategic orientation that a firm adopts. In another words, each configuration can be equally effective if there is a fit between the configuration and the antecedents. The better the fit, the greater the efficiency or smoothness of the operation, and the better the consequential performance outcomes.

**Environmental Turbulence**

Environmental turbulence involves uncertainty or unpredictability and has a major impact on the central decisions of supply chain integration, particularly on risk assessment and the need for greater flexibility. Turbulence is traditionally associated with transaction costs, including the costs of finding, selling, negotiating, monitoring, and resolving disputes with other firms in open market transactions
Supply chain integration is one mechanism by which these transaction costs may be reduced. From the perspective of transaction cost theory, integration permits a variety of make-or-buy arrangements that a firm may use to provide greater assurance of desired quantities and qualities of raw material and service inputs and ready market for outputs. In theory, integration occurs where markets cannot allocate resources in a manner that alleviates uncertainty (Williamson, 1975). In imperfect markets, suppliers or buyers can manipulate prices through supply shortages and output gluts. But, to reduce uncertainty and achieve price stability, firms must write and closely monitor risky contracts with suppliers or buyers or actively pursue integration. Theoretically, integrated firms internalize input and output activities to reduce the risks and costs associated with self-interested behavior by suppliers or buyers and the uncertainty of market exchanges (Carlton, 1979; Coase, 1937).

Transaction theory thus suggests that greater environmental turbulence would be associated with greater supply chain integration efforts to capture the benefits of coordinated activities derived from organizational hierarchies (Williamson, 1975). Under turbulent environmental conditions, costs associated with production decoupling, inventory scheduling, and R&D coordination across multiple parties would be substantially increased. However, greater integration would likely result in less flexibility, which would not be wanted in the face of turbulence, particularly with extreme shifts of customer demand, production volumes, or technology. Consequently, in a turbulent environment, when number of stages is examined, we would expect more collaborative integrators and full integrators than independent integrators and controlling integrators. Based on this rationale, we propose:

Proposition 1a: On the stages of integration dimension, as environmental turbulence increases, collaborative integrators and full integrators would be more effective than independent integrators and controlling integrators.

Integration has consistently been shown (Williamson, 1971, 1975; Carlton, 1979; Coase, 1937) as a risk-reducing response to uncertainty. Several stages of production activities are integrated to smooth supply chain inefficiencies, particularly those with costly technologies, standardized quality, or high volumes, all of which would reduce costs and enhance customer service. However, having a low degree of ownership control of the integrated activities could further reduce the risk and enhance organizational
flexibility. Consequently, in a highly turbulent environment, when the form of integration is examined, we would expect more collaborative integrators and independent integrators than full integrators and controlling integrators. Based on this rationale, we propose:

**Proposition 1b:** On the form of integration dimension, as environmental turbulence increases, collaborative integrators and independent integrators would be more effective than full integrators and controlling integrators.

Combining Proposition 1a and Proposition 1b, we propose the following corollary of the impact of environmental turbulence on supply chain configuration:

**Corollary 1:** In a highly turbulent environment, collaborative integrators would be more effective than full integrators, independent integrators, or controlling integrators.

**Environmental Complexity**

Environmental complexity involves many and varied external factors, such as technology, government, competition, and weather. Duncan (1972) contends that managers facing a more complex (i.e., heterogeneous) environment will perceive greater uncertainty and have greater information processing requirements than managers facing a more simple environment. Further, Dess and Beard (1984) suggest that organizations that compete in industries requiring many different inputs or producing many different outputs should find that resource acquisition and output disposal is more complex than organizations competing in industries with fewer and less different inputs and outputs. For these reasons, we expect that firms operating in highly complex environments would focus on fewer activities in the supply chain in order to compete more effectively. Consequently, in a highly complex environment, when number of stages is examined, we expect more independent integrators and controlling integrators than collaborative integrators and full integrators. Based on this rationale, we propose:

**Proposition 2a:** On the stages of integration dimension, as environmental complexity increases, independent integrators and controlling integrators would be more effective than collaborative integrators or full integrators.

Moreover, environmental complexity describes both the number of units that require interaction and the amount of knowledge about products and customers that the manager must secure. Aldrich (1979) contends that an increase in the environment’s structural complexity would increase the need for a
firm’s strategic activities. Additionally, organization theorists (Thompson, 1967; Dess & Beard, 1984) emphasize the need for organizations to adapt flexibly or to buffer themselves from increasingly turbulent and complex environmental conditions. On the one hand, when facing a highly complex environment, companies would tend to have a more flexible and simple structural arrangement by focusing on a few key activities in a value chain and outsourcing other less core activities. On the other hand, firms are more likely to attempt to minimize the uncertainties of dealing with external suppliers by closely controlling these activities in the various stages of the supply chain. Consequently, in a highly complex environment, when the form of integration is examined, we would expect more controlling integrators and full integrators than collaborative integrators and independent integrators. Based on this rationale, we propose:

Proposition 2b: On the form of integration dimension, as environmental complexity increases, full integrators and controlling integrators would be more effective than independent integrators and collaborative integrators.

Combining Proposition 2a and Proposition 2b, we propose the following corollary of the impact of environmental complexity on supply chain integration:

Corollary 2: In a highly complex environment, controlling integrators would be more effective than full integrators, independent integrators, or collaborative integrators.

Environmental Munificence.

Environmental munificence is characterized by bountifulness or supportiveness of the environment for the firm’s activities and includes such considerations as supportiveness of government regulations, supplier and customer relations, financial, legal, and other factors. The opposite of environmental munificence is environmental scarcity. High environmental munificence, for example a monopoly or near-monopoly situation, might offer little incentive for an organization to improve their supply chain through extensive integration efforts. Munificent environments permit organizational growth and stability, which in turn, may generate slack resources (Cyert & March, 1963). These slack resources can provide a buffer for the organization during periods of relative scarcity. Therefore, we expect that
firms operating in munificent environments would be less compelled to make extensive supply chain integration efforts.

Relative scarcity of resources in existing markets increases the risk of remaining in those markets and increases the need to expand operations into new markets, thereby reducing dependence on existing domains (Hannan & Freeman, 1977). Thus, firms tend to expand into markets with more munificent environments as a way to balance overall risk (Bettis, 1981). Expansion into related markets is easier to achieve than expansion into unrelated markets, especially considering that related diversification efforts would outperform unrelated diversification efforts. Thus, firms in highly munificent environments would be expected to be less prone to engage in integrative efforts, while firms in high scarcity environments would be more prone to engage in integrative efforts. Consequently, in high scarcity (less munificent) environments, when the number of stages is considered, collaborative integrators and full integrators would be more prevalent than independent integrators and controlling integrators. Based on this rationale, we propose:

*Proposition 3a: On the stages of integration dimension, as environmental munificence decreases (scarcity increases), full integrators and collaborative integrators would be more effective than independent integrators and controlling integrators.*

In a munificent environment, there is also less incentive for firms to control for activities of the upstream or downstream businesses. Further, there will be less opportunistic behavior by others in such an environment. Additionally, partial ownership and long-term agreements are usually less costly than fully-owned operations. Therefore, regarding the form of integration, we would expect tighter forms of supply chain control in high scarcity environments than in munificent environments. Consequently, in high scarcity environments, when the form of integration is examined, we would expect more full integrators and controlling integrators than independent integrators and collaborative integrators. Based on this rationale, we propose:

*Proposition 3b: On the form of integration dimension, as environmental munificence decreases (scarcity increases), full integrators and controlling integrators would be more effective than independent integrators and collaborative integrators.*
Combining Proposition 3a and Proposition 3b, we propose the following corollary of the impact of environmental munificence on supply chain configuration:

**Corollary 3:** In a less munificent (high scarcity) environment, full integrators would be more effective than independent integrators, controlling integrators, or collaborative integrators.

**Strategic Orientation.**

Several typologies of strategic orientation have been set forth in the strategic management literature (i.e., Porter, 1981; Miles & Snow, 1978; Parnell, 1997). The Miles and Snow (1978) typology is selected for this analysis because it is widely regarded as the most central of strategic orientation typologies. Miles and Snow postulate that competing firms within an industry exhibit patterns of behavior representative of several ideal competitive strategy types: prospectors, analyzers, defenders, and reactors. Prospectors are characterized by their constant search for new products, processes, and markets. They continually experiment with product redesign, adopt new process technologies, and venture into new markets. Consequently, prospectors tend to be characterized by a proactive disposition toward the competitive environment and endeavors to exploit new opportunities along product, process, and market development growth vectors. In contrast, defenders have a narrow and stable product, process, and market domain and seldom make major adjustments in their technology or structure. The emphasis is on more efficient ways of producing a given product or service and supplying a market. Analyzers are a hybrid of prospectors and defenders, adjusting over time between more proactive and more defensive postures. Finally, reactors lack any clear strategy and only respond in a characteristically inconsistent and unstable manner to competitive circumstances when forced to do so. The common dimension underlying this typology is a firm’s proactiveness in pioneering products, processes, and markets.

Quinn, Doorley, and Paquette (1990) and Miles and Snow (1986) question the value of highly integrated firms in dynamic, highly-competitive environments, such as those with numerous cost-conscious competitors or in which technology changes quickly or drastically. For example, Quinn *et al* (1990) note that firms operating in competitive, turbulent environments tend to avoid vertical integration to minimize the risks of an elaborate and less flexible structure. When a firm adopts a more proactive
prospector strategy, it reflects the firm’s need to exploit emerging opportunities, experimenting with change and mobilizing first-mover actions. Therefore, firms with proactive strategies will likely be less integrated and opt for a more flexible environmental response through such techniques as outsourcing. The advantages associated with outsourcing include: hiring suppliers with the best value, quickly substituting inferior components or services, switching supply sources when new technology appears, and avoiding idle capacity and inventory swings in the entire supply chain during a cyclical or temporary downturn (D’Aveni & Ilinitch, 1992). Thus, under a more proactive strategy, the firm’s need to innovate products and adapt to markets may out-weigh efforts to reduce risks by smoothing inputs. Consequently, supply chain disintegration is a mechanism to improve organizational flexibility. Consequently, among strategically more proactive firms, when the number of stages is examined, we would expect more independent integrators and controlling integrators than collaborative integrators and full integrators.

Based on this rationale, we propose:

Proposition 4a: On the stages of integration dimension, as a firm’s strategic proactiveness increases, independent integrators and controlling integrators would be more effective than full integrators and collaborative integrators.

Proactive strategies, such as that of the prospector, call for more simple and flexible organizational form. In the choice between ownership and alliances, prospectors would choose the latter. Such a structural arrangement would enable these firms to minimize bureaucratic costs, maintain innovativeness, and be responsive to the external environment. Consequently, among strategically proactive firms, when the form of integration is considered, we would expect to find more independent integrators and collaborative integrators than controlling integrators and full integrators. Based on this rationale, we hypothesize:

Proposition 4b: On the form of integration dimension, as a firm’s strategic proactiveness increases, independent integrators and collaborative integrators would be more effective than full integrators and controlling integrators.

Combining Proposition 4a and Proposition 4b, we propose the following corollary of the impact of strategic orientation on supply chain configuration.
Corollary 4. For a firm that adopts a more proactive strategic orientation, independent integrators would be more effective than full integrators, controlling integrators, or collaborative integrators. These relationships are shown at Figure 2.

As shown at Figure 2, this research has postulated the relationship between environmental conditions and the strategic posture of the organization and the key dimensions of the supply chain, number of stages and forms of control. This research suggests that the collaborative integrator is best suited for the highly turbulent environment and the controlling integrator is best suited for the highly complex environment. Similarly, the full integrator is best suited for the less munificent (high scarcity) environment and the independent integrator is best suited for a proactive strategic orientation.

Because of the highly multi-dimensional nature of supply chains, we would expect most situations to be impacted by combinations of these factors; thus, the diagonal arrows note the directions of effect. For example, increased munificence and greater proactiveness would be associated with the limited stages of integration and the looser forms of control associated with the independent integrator, while less munificence (greater scarcity) and a less proactive posture would be associated with more extensive stages of integration and the tighter controls of the full integrator. Correspondingly, greater turbulence and less complexity would be associated with the more extensive states of integration and the looser controls associated with the collaborative integrator, and lesser turbulence and greater complexity would be associated with the limited stages of integration and the tighter controls of the controlling integrator.

CONCLUSIONS AND IMPLICATIONS

This study is among the first to define and posit the relationships between the strategic and environmental contingencies and the dimensions of integration of the supply chain. As such, this paper represents an interdisciplinary approach to supply chain integration by identifying and focusing
operational decisions pertaining to the environmental and strategic contingencies of the supply chain. In that pursuit, this study makes a number of contributions, yet simultaneously has some limitations.

Early studies define the supply chain and vertical integration variables as unidimensional and static; this study, following more recent analyses, addresses supply chain integration as a continuous and multidimensional variable and proposes a typology of supply chain integration. For efficiency and effectiveness, a fit must exist between a specific supply chain configuration and the strategic and environmental conditions. That fit would attenuate “bullwhip” inefficiencies, either of inventories and other mechanical decisions or of the less tangible structural and human interactive sort.

This study does, however, have several limitations; notably, it has focused on the model building, dimensionalization, and proposition-positing activities only. Given that the recent research focuses primarily toward description and characterization, with only limited emphasis on the measurement of integrative variables, this study is an initial attempt to provide a contingency theory foundation and model of the integrated supply chain. It has not developed or operationalized a high-confidence test of the model. That work is yet to be done.

Certainly the lack of direct consideration of several variables, such as the depth and breadth dimensions of the integrated supply chain, detracts from the overall scope of the model. These variables, as noted, are likely extensively entwined with those of the present study and should be pursued, both separately and in concert, in future efforts. Of course, there is a tradeoff between the preciseness and elaboration of the definitions of a study and the manageability of that study. The more variables that are described, the more complex the model and the greater the number of potential hypotheses. As the study moves forward toward empirical testing, larger and more complex survey instruments, sampling processes, and statistical methodologies would likely be encountered.

Overall, this study is an example of the sort of cross-disciplinary and cross-functional analyses that are increasingly relevant to the more dynamic and integrated environments of global business. It establishes the foundations for numerous future theoretical, conceptual, and empirical research efforts. Further, this study begins the process of evaluating and diagnosing situational variables focused toward
answering the questions: under what environmental and operational circumstances should management pursue supply chain or vertical integration, at what costs, and with what expectancies for success? Clearly, knowledge of the contingencies under which integration should be pursued and the extent and type of effort would be helpful to practicing managers and strategic planners, as well as to academicians. Of course, testing of the postulates proposed here is necessary, but based on those results, practicing supply chain managers could reduce the both costs and risks of ill-advised integration efforts and focus on the most effective approach to integrate an activity in a particular situation. Such a contingency-theory-based typology of the supply chain thus advances operations knowledge in both theory and application.

REFERENCES


Figure 1

A Typology of Supply Chain Integration

Looser forms of integration, including supplier contracts, technology and risk sharing and partial ownership and collaboration.

Tighter forms of integration, including tighter control and total ownership.
## Table 1

**Supply Chain Integration: A Comparison of Four Configurations**

<table>
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<th>Independent Integrator</th>
<th>Collaborative Integrator</th>
<th>Controlling Integrator</th>
<th>Full Integrator</th>
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<td>Integration</td>
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<td>Full internal</td>
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<td></td>
<td>Systemic trust</td>
</tr>
<tr>
<td>Workforce Mngt</td>
<td>Centralized</td>
<td></td>
<td></td>
<td>Distributed</td>
</tr>
<tr>
<td>Tasks &amp; Structure</td>
<td>Mechanistic, tall</td>
<td></td>
<td></td>
<td>Participation</td>
</tr>
<tr>
<td>Interaction</td>
<td>Unit transactions</td>
<td></td>
<td></td>
<td>Relationship</td>
</tr>
<tr>
<td>Worker Education</td>
<td>Untrained</td>
<td></td>
<td></td>
<td>Continuous Training</td>
</tr>
</tbody>
</table>
Figure 2

Environmental and Strategic Posture Effects on Supply Chain Dimensions

- - - - Looser forms of integration, including supplier contracts, technology and risk sharing and partial ownership and collaboration.
--- Tighter forms of integration, including tighter control and total ownership.
C1, C2, C3, C4 – Corollary 1, 2, 3, 4
↑T – Increased turbulence; ↑C – Increased complexity; ↑S – Increased scarcity;
↑P – Increased proactivity