INTERNATIONAL SUPPLY CHAIN MANAGEMENT: GAINING ADVANTAGE TO BUSINESS PROCESS ORIENTATION

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Abstract: Multinational corporations are redesigning their organizational structure from a hierarchic multi-domestic structure into a global network. Using the contingency theory framework, the researcher's proposed to identify the reasons for the change, optimal structures and the potential cost/benefits to be expected. In addition, the study also indicates about how supply chain learns and adapts to the dynamic global environment. These findings can help practitioners gain a better understanding of international supply chains and provide a theoretical model for academicians to conduct future studies. In the last two decades, competition has changed dramatically with the opening up of trade barriers regionally and globally. Local companies in both developing and developed countries are being now exposed to increased competition from a new set of competitors that may be exploited to the comparative advantage of several countries simultaneously. Adding to the local companies' problems it is observed that the growing volatility of the business environment due to the larger number of international players, rapid changes in technology and shorter product life cycles. This research study have adapted the Business Process Orientation (BPO) advantage measurement instrument to the Supply Chain Council's (a global organization formed to define and benchmark supply chains) model for describing and measuring supply chains. BPO related questions were developed, pre-tested and used to evaluate the impact of BPO on supply chain decision process performance, or supply chain management, in a cross industry study. Conclusions from the study were quite clear, as the BPO is a major contributor in improving supply chain management performance.

Keywords: contingency theory, international operations, material and information flows, software agents, coordination, interaction, supply chain.

Introduction

The era was on focusing and managing the supply chain of a single company is over. Today, these processes can and often do transcend company boundaries and involve cross-company planning and implementation. The companies application of supply chain management has evolved from designing and managing the supply chain to obtain the functionally best supplies to design, manage and integrate their own supply chain with that of their suppliers and customers. Following this evolution, we attempted to more clearly define supply

chain management, as it is practiced today

Firms have begun to implement two strategies in order to remain competitive: (i) by seeking supplies and productions on a global scale, and (ii) reducing value-added operations in-house via outsourcing and strategic alliances. By sourcing internationally multinationals can take advantage of the unique conditions existing in the countries, such as low wages, raw material availability, and proximity to markets (Grunwald and Flamm, 1985). In addition, this distributed system now gives firms the flexibility to react to the increased volatility in technology and marketplace. It requires transformation of the organization and proper management of supply chains to be successful (Hobbs et al, 1998).

Initially, American firms took their ideas from the US and transplanted them to overseas locations, whereas Japanese firms invested in operations overseas to tap the local cost, material availability and quality advantages. The European firms set-up multi-domestic operations and let them develop their own products, services and supply system. Today, most large American, Japanese and European Multinational Corporations (MNCs) are now moving toward the twin strategy of global disaggregation and supply chain management. In this research, we develop a model to identify why such strategies are necessary today and the expected benefits to accrue by making such a transition.

In the following sections, we will (i) examine the literature relevant to our research, (ii) define our model, and (iii) highlight the implications of this model for managers and nations.

Literature Review

In this study, the researchers has examined the literature on (i) locating plants globally, (ii) supply chain management, (iii) flexibility, and (iv) contingency theory in order to ground our proposed model.

Managers have had extensive literature to rely upon in locating facilities internationally. For example, Bass, et al (1977) outline the economic, social and political considerations for locating plant sites. A number of quantitative models are also available (Haug 1985, Hodder and Jucker 1986) to help managers in putting up plants globally. Next, the applicable literature on international supply chains is examined. The literature on international supply chain management is extensive and includes defining the concept, providing descriptive/survey studies of its practices, modelling flows via quantitative/simulation models and providing theoretical models for the control of supply chains.

Logistics is defined by Davies (1987) and Gary and Davies (1991) as composed of materials management, physical distribution management, credit rating, insurance and delivery promises. According to Houlihan (1987), the concept of international logistics can be expanded into international supply chain management by including purchasing, product distribution and sales. A topology by Wood (1990) provides a classification of the various types of distribution channels and the use of intermediaries.

Descriptive/survey studies have also examined the approaches MNC's have taken in redesigning their supply chains (Berry and Naim 1996, Ernst and Guerrieri 1998), impact of JIT systems

on supply chains (Cook and Rogowski 1996, Humphreys, et al 1998, Simpson et al. 1998) and the role of logistics partnerships (Kopeczak, 1997). Quantitative models of international supply chain have been suggested (Maloni and Benton, 1997), such as using Theory of Constraints (Ferez, 1997) and strategic production-distribution models (Vidai and Goetschalckx, 1997). Levy (1995) finds a significant impact of demand variability and production disruptions which result in substantial unexpected costs related to expedited shipping, high inventories, and lower demand fulfillment using a simulation study.

Theoretical models have also been proposed (Cohen and Malik, 1997). For example, Thorelli (1986) applies organizational network theories to determine the optimum level of control in supply chain management. In addition, Delk (2000) proposes a financial model for international supply chain.

Configured plants form a network or chain that needs to be effectively coordinated (Pope and Prasad 1998, Motwani et al 2000, Popp 2000) to achieve needed flexibility (De Meyer et al. 1989, Fernie 1994, Kogut 1985a, Kogut and Kulatilaka 1994). Multinationals view these flexible networks as a means to derive a strategic advantage (Schary and SkjottLarsen, 1998). A number of researchers have attempted to define the benefits of such systems (Allen and Pantzalis 1996, Gupta and Somers 1996, Upton 1997). However, none of these researchers examine the organizational dimension to support such flexible structures.

Contingency theory has been extensively used to describe organizational structures under varying environmental conditions. This theory assumes that there is not one "best" structure for all conditions, but rather the optimum form varies according to the underlying condition (Burns and Stalker 1961, Lawrence and Lorsch 1969). The organizational structures are viewed to exist on a continuum from a mechanistic (hierarch) structure on one end to an organic/flat form at the other extreme. In between the two forms, is a range of structures adopting a variety of characteristics of the two extremes. The mechanistic form is prescribed where the environment is stable. A hierarchic structure is quite efficient when the processes can be standardized and mechanized. However, such a structure becomes inefficient when the environment changes and the standards and mechanisms become no longer relevant. In such situations, less formal, organic structure would be more effective.

Much of the literature in international operations is fragmented and is not able to provide an integrative approach to a manager who is trying to apply the dual strategies of global disaggreation and supply chain management. In this paper, a model is developed that specifies the type of international operation and the corresponding logistics structure based on the dynamic international conditions using the contingency theory.

Traditional Vs. Integrated Supply Chain Management

The Supply Chain Council, an organization of companies working together to provide a cross-industry supply-chain management framework, offers the following definition for

integrated supply chain management (see figure 1.1).

Supply Chain: "The flow and transformation of raw materials into products from suppliers through production and distribution facilities to the ultimate consumer".

Adapted from Srivastava, Shervani, Fahey, *Journal of Marketing*, 1999
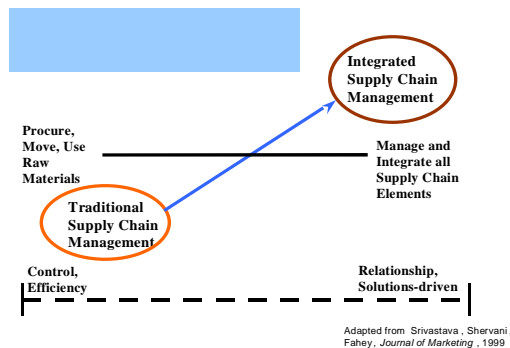
Figure 1.1. Traditional vs. Integrated Supply Chain Management

The Supply Chain Council has further defined the supply chain by building the Supply Chain Operations Reference (SCOR model, shown in Figure 1.2). This is only a process model and does not clearly show company boundaries or company-to-company structures but focuses on the basic processes involved in any supply chain. This model breaks the supply chain into the core processes of *Source, Make, Deliver* and *Plan* components and is further defined by more detailed process models within each component area. This "common language" for supply chains offers the opportunity for cross-functional and cross-company communication and collaboration and is proposed as the preferred supply chain language for the examination of BPO impacts on the supply chain. For this reason the SCOR model was selected as the framework to be used in examining

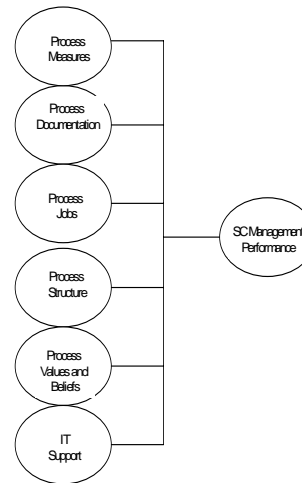the impact of BPO on supply chain management performance.

Figure 1.2. SCOR - Supply Chain Operations Reference Model Overview

Purpose of the Study

During the past several years, the concept of supply chain management has been maturing both in terms of theory and practice. Terms such as integrated supply chain management, supply chain optimization and supply chain collaboration have become the focus and goal of many organizations in the U.S. and around the world. Global supply chain management has also emerged as a key competitive strategy. The initial challenge the researchers were faced in the study was in developing a clear, simple definition of the main concept of supply chain management. A review of the popular business press literature revealed that supply chain management was becoming another "buzz-word" that seemed to lack a clear simple definition. It well acknowledged that if you can't define something in simple terms, you don't really know what it is. With that in

mind, the definition we used in this project was first the result of decomposing supply chain management into its constituent parts.

Supply chain: The flow and transformation of raw materials into products from suppliers through production and distribution facilities to the ultimate consumer.

Management: The process of developing decisions and taking actions to direct the activities of people within an organization; planning, organizing, staffing, leading and controlling.

The final definition used in this study combined these two statements to read as follows:
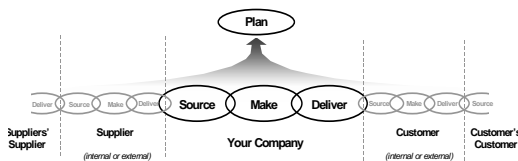

Figure 1.3. BPO Related Relationships to Supply Chain Management Performance

Supply Chain Management:

"The process of developing decisions and taking actions to direct the activities of people within the supply chain toward common objectives."

Therefore, we posed this question, which guided our research efforts: To what extent is supply chain management influenced by a business process orientation advantage? The model presented above in Figure 1.3 guided the entire research process.

The researchers have developed detailed definitions and operational measures for the practice of supply chain management. To accomplish this, we conducted interviews and focus groups with supply chain experts and practitioners. Questions were organized generally around the components of BPO but slightly expanded. The questions asked were supply chain management specific but generally about process view, process jobs, process structures, process values and beliefs, process management and measures, information technology support and supply chain specific best practices. The definitions for each of these categories are listed below and are a slightly expanded definition from the original BPO measures discussed in other chapter.

Process View:

A "Process View" can be described as the process steps, activities and tasks documented in a visual and written format that creates a cross-functional process vocabulary.

Process Structure:

These are cross-functional process team organizational strategies with a "flat" hierarchy, and process owners with leadership, not control oriented management.

Process Jobs:

These are job strategies that consist of empowered, multi-dimensional, process team oriented jobs.

Customer Focused Process Values and Beliefs:

These are organizational values and beliefs displayed through behaviors that are customer-focused empowerment and continuous improvement oriented.

Process Measurement and Management Systems:

The components of this area are process measurement systems, rewards for process improvement, outcome measurements, customer driven measures, and team and customer based measures and rewards.

IT Support

This area captures the level of current "IT support" for the decision processes.

Best Practices

These are activities that are generally presented in the literature, interviews and focus groups as contributing to supply chain effectiveness or efficiency.

The results of these focus groups and interviews were used to build and initial list of survey questions to be used in this research study.

The initial questionnaire, which was organized according to the four SCOR model (see Figure 1.2) processes as well as a section on overall supply chain common themes, was sent to several experts for evaluation and feedback. Modifications were made to wording and some redundancies were eliminated. A revised questionnaire measuring the

frequency of the supply chain management activities was then developed using the following 5-point Likert scale: Note: the common theme questions used a slightly modified scale)

1 - never or does not exist
2 - sometimes
3 - frequently
4 - mostly
5 - always or definitely exists

The respondents gave their opinions concerning "what, how often, who, and how activities are conducted their supply chain. Participants were also asked to rate the overall performance of their supply chain management processes and the performance of each management process by SCOR model category. This initial questionnaire was then tested within a major electronic equipment manufacturer and with several supply chain experts. Improvements in wording and format were made, some items were eliminated and several were removed based on this pilot test of the questionnaire. A final version of the questionnaire was developed based on feedback from the pilot study and was used to gather our study.

Data Gathering and Analysis

The sampling frame used in our study was constructed from a membership list of the Supply Chain Council. The "user" or practitioner portion of the list was used as the final selection since this represented members who's firms were in the business of supplying a product, rather than a service, and were thought to be generally representative of supply chain practitioners rather than consultants. This list consisted of 523 key informants representing 90 firms. The questionnaire

was distributed by mail to the supply chain council members with a cover letter explaining the purpose of the study and the sponsorship of the Supply Chain Council. Recipients were also encouraged to distribute the survey to other practitioners within their firm. Forty-three usable surveys were returned. Figure 1.4 shows the industry representation in these responses. Figure 1.5 shows the functional representation and 1.6 the respondents' position within the company.

As can be seen from the pie-chart, the data represent a broad cross section of industries, functions and positions. As expected, supply chain management is usually staffed with mangers or above, the individual contributor portion of the respondents is very low. The function "other" accounts for 37% of the respondents, which represented process- oriented titles for jobs that were cross-functional in nature. This indicates that process-oriented job rating should be fairly high.
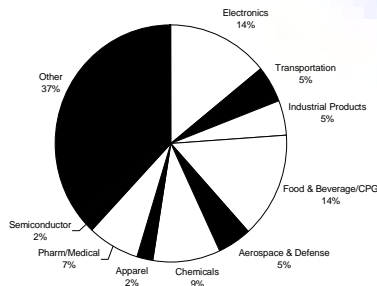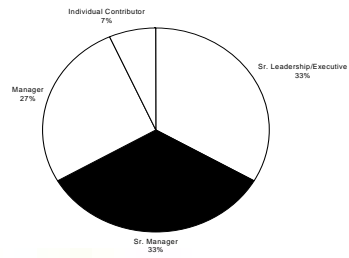

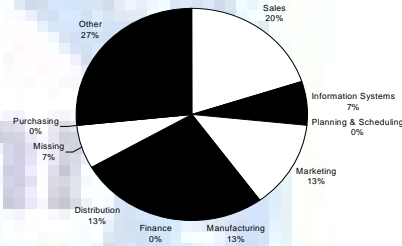**Figure 1.5** Functions Responding to the Questionnaire

Figure 1.6 Positions Responding to the Questionnaire

The data from the returned questionnaires were tabulated and analyzed. Descriptive statistics (frequencies, means, and standard deviations) were computed as well as correlation coefficients measuring the relationship of each BPO category (eg., process structure, process documentation, etc.) to each core process (e.g., plan, source, make, deliver).

Results of BPO Impact on Supply Chain Management

First, general or common theme questions were asked in order to determine the general overall BPO levels within supply chain management.

Figure 1.4 Industries Responding to the Questionnaire

The results of the five common theme questions indicates that, in general, the organizations surveyed were fairly evenly distributed across the scale of process orientation, where their mean responses averaged approximately 3 (somewhat). Nine percent of the respondents indicated that their jobs are broad process based, whereas five percent said that their organizational structure is entirely process based while no one said that their measures could be described as entirely process based. The level of process documentation or process view also clusters in the middle with no one answering that the processes are completely documented.

The numbers shown are the correlation coefficients of each BPO level to overall performance. Process measures had the most impact on performance (0.2910) followed by process oriented organizational structure n (0.2408), then process jobs (0.1780) and finally process documentation or process view (0.1145). Information systems support does not appear to be a factor. This corresponds generally to our original research but with a few surprises. Process structure appears to be more important than in our original research while the order of the other factors remain consistent. The conclusion from just looking at these common theme questions is that the components of BPO appear to have an influence on supply chain management performance. A more detailed examination will be discussed below.

Next, in order to determine the specific impact of BPO on supply chain management, correlations were performed on the data. Responses to the specific survey questions summed by BPO component category, were then correlated with overall supply chain management core processes. The correlation coefficients indicating the strength of the relationship between core process performance and each BPO component.

Examining the detailed relationships reveals a "mixed picture". For classification purposes we drew a line between strong and weak relationships. Above 0.5 are considered strong relationships and below 0.5 are considered weak. Most of the correlations are 0.5 or above while the common theme question correlations were only 0.2. Apparently, when asked in the context of a specific SCOR area, the answers improved in granularity. Asking a question in a more specific context is known to improve the quality of the answer and in this case it apparently did. Correlations for all components other than IT support were 0.5 or above in most areas.

Process structure appears to be slightly stronger than the others. When we asked respondents about this, we discovered that this was indeed true. The structure represents the span of involvement, influence and authority in an organization. It is the base operating system for an organization. Like a computer, if the structure does not allow for multi-dimensional, cross-functional authority, then it is difficult to operate. This is particularly true in a management function that demands cross-functional action such as supply chain management. The basic process structure measures represented cross-functional teaming, process integration and cross-functional authority of the teams. This makes sense, if supply chain

management is to be successful, the individuals involved must work as a tightly integrated group with shared authority to both, "make decisions and take actions".

Process documentation, according to our research, is also very strongly related to supply chain management performance (0.5-0.7). This is slightly stronger that our original BPO research. One possible explanation is that, in a cross-functional and possibly cross company activity such as supply chain management, the documentation of the process to be used is much more important that in other activities. A clear understanding and agreement of what is to be done seems to be very important in supply chain management. This is usually achieved through process design and mapping sessions or review and validation sessions with the team. This is a clear message to those implementing supply chain management strategies. The time and money invested in designing and documenting the processes to be used are critical to success. Omitting this step or allowing it to be done in an ad hoc way will negatively impact supply chain performance.

Process values and beliefs that were measured are actions representing customer trust, firm credibility and inter-firm collaboration. These appear to also be strongly related to supply chain management performance (0.5-0.6). The *deliver* area, although slightly below 0.5, is still important. Trusting customers enough to team with them and supply critical information is a very important factor in cross company collaboration. Trust applies in a similar fashion when dealing with suppliers. For example, it is important that functional employees in

an organization jointly participate on operations teams with their counterparts from the supplier firms. Our research also states that believing what we told and acting upon, it is also a critical factor in supply chain management. Getting forecasts from the customers if we don't believe them or don't act upon them is also necessary to consider.

Process jobs reflect the assignment of broad process ownership. In this research we measured whether process owners were identified for each SCOR area of Plan, Source, Make and Deliver as well as an owner for the overall supply chain. The correlation results of 0.5-0.6 means that there is a strong relationship between process jobs and supply chain management performance. Clearly, creating broad, cross-functional jobs with real overall supply chain authority is a key component of supply chain management performance.

Process measures are also strongly correlated to supply chain management performance (0.5-0.7). This study identified key measures in each SCOR area and asked respondents about the frequency of use. Measures such as supplier performance to agreements, inventory measures, and customer and product profitability were included in this study. The results clearly show that measures are very important in supply chain management just as in the original BPO research.

Since many software firms and consultants are emphasizing the importance of information technology in supply chain management, we considered the role it plays in supply chain management performance. Our research shows that *IT support*, although

strongly related to delivery process performance, is only marginally related to overall supply chain management performance (<0.5). The strong relationship of "IT support" to the deliver SCM process is perhaps because customer orders processing and inventory management are usually part of the *deliver* processes. These are very information intensive processes and, by definition, very dependent on IT support. From our research we have concluded that IT investments, by themselves, will not improve supply chain management performance, except in the *deliver* process area. Therefore, in order to realize a significant return, these investments must be in support of actions to improve the business process orientation of a supply chain management organization.

In summary, the next generation supply chain management system will be as like as the following:

1. *Distribution*. The functions of supply chain management are divided among a set of separate, asynchronous software agents.

2. *Performance*. Each agent performs its functions asynchronously as required, as opposed to in a batch or periodic mode.

3. *Knowledge*. Each agent is an "expert" in its function. It uses artificial intelligence and operations research problem-solving methods.

4. *Interrelation*. Each agent is aware of and can access the functional capabilities of other agents.

5. *Response. Each agent is able to ask* for information or a decision from another agent-each agent is both a client and a server.

6. *Action*. Each agent is able to respond to events as they occur, modifying its behavior as required, as opposed to responding in a preplanned, rigid, batch approach.

7. *Cooperative*. Each agent can cooperate with other agents in finding a solution to a problem; that is, they do not act independently.

8. *Interactive*. Each agent may work with people to solve a problem.

9. *All time*. No matter how much time is available, an agent can respond to a request, but the quality of the response is proportional to the time given to respond.

10. *Full*. The total functionality of the agents must span the range of functions required to manage the supply chain.

11. *Reengineering*. The supply-chain management system itself must be adaptable and support the "relevant subset" of software agents. For example, a user who wants to schedule only a plant should not be required to use or have a logistics component.

12. *Common*. Each agent must be adaptable to as broad a set of domains as possible.

13. *Adapt*. Agents need to quickly adapt to the changing needs of the human organization. For example, adding a

resource or changing inventory policy should be quick and easy for the user to do.

14. *Backup*. Agents need to have a seamless upgrade path so that the release of new or changed features does not compromise existing integration or functionality.

The supply chain is a worldwide network of suppliers, factories, warehouses, distribution centers, and retailers through which raw materials are acquired, transformed, and delivered to customers. In recent years, new software architecture for managing the supply chain at the tactical and operational levels has emerged. It views the supply chain as composed of a set of intelligent software agents, each responsible for one or more activities in the supply chain and each interacting with other agents in the planning and execution of their responsibilities. This study also investigates various issues and relative present solutions for the construction of gaining advantage to business process orientation.

In this study, the fundamental concepts of BPO have been investigated in the context of supply chain management, one of the most critical processes within a firm. The question we posed earlier; "To what extent is supply chain management influenced by a business process orientation?" has been answered. We also investigated the general level of BPO in supply chain management. Our conclusion is that, in general, supply chain management is somewhat process oriented with pockets of excellence. Overall, using the common themes results, process oriented measures and structure appear to be

strongly related to documentation, values and beliefs, and IT support. However, when we examined the results by the SCOR processes of Plan, Source, Make and Deliver, these relationships become more important.

Building the process view and the understanding that results from the construction process is a critical foundation to successful supply chain management. With the new networked e-corporation it becomes even more important. Establishing the process view across a networked e-supply chain becomes even more important to performance. Putting the process oriented structures and jobs in place has also been shown to be a key contributor to e-supply chain management performance. Coordinating the flow of materials, cash and information across a networked group of firms in the e-supply chain is the new competitive battleground. Supply chain management performance is the key to wining this battle.

The results of the research also clearly show that process measures and process oriented values and beliefs are critical ingredients of supply chain management. Cascading measures used to link people's actions to supply chain performance goals is definitely related to performance but seems to be very difficult to implement. A great number of the participants in our research indicated very little progress in this area. As supply chain management crosses company boundaries, this becomes even more difficult but will yield a potentially greater return. Process oriented values and beliefs are also difficult to implement. Trust and credibility are built over time and should not be treated

as a "project". Trust is also between individuals, not companies and is established as a result of hundreds of successful interactions between individuals. Creating an environment that enables this to occur is the task of the leaders of companies in the supply chain and a critical success factor in implementing successful supply chain management.

Overall, our research has shown that BPO is a critical factor in supply chain management. When an organization's supply chain management becomes more business process oriented, the better it will perform. This is true for the old economy linear supply chain or the new economy networked e-supply chain.

During the past few years a significant number of companies from many different industries have practicing this BPO and do gain lot of advantages to their business process orientation. **The researchers would like to invite all interested parties to contact, for the use of this survey and database.**

Conclusion

The researchers believes that the contribution in several ways lead to the goal of constructing models and tools enabling multi-agent systems to carry out coordinated work in real-world applications. We have contributed a model of the new type of coordination knowledge as complex, coordination enhanced plans involving interactions by communicative action. The execution by agents of these plans results in multiple structured conversations taking place among agents. These ideas have been substantiated into a practical, application-independent coordination

language that provides constructs for specifying the coordination-enhanced plans as well as the interpreter supporting their execution. Our interpreter supports multiple conversation management, a diverse rule typology that, among others, provides for handling exceptional or unexpected situations, conversation synchronization, and optimization of plan execution by decision-theoretic mechanisms. In cooperation with industry partners, we applied these models and tools to industrially relevant problems to keep our work in touch with reality and "falsify" our solutions as early as possible based on feedback from reality.

The approach relies on the use of an agent building shell, providing generic, reusable, and guaranteed components and services for act-based communication, conversational coordination, role-based organization modeling and others. Using these components, we show two nontrivial agent-based supply-chain architectures able to support complex cooperative work and the management of perturbation caused by stochastic events in the supply chain.

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