



## Identifying the Factors for Successfully Managing Supply Chain Risks

by

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## INTRODUCTION

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On behalf of Western Michigan University (WMU) and MBtech, our group conducted a research project about the potential for managing risks in Supply Chain Management (SCM). Managing supply chain risks is emerging as a viable, proactive, and strategic SCM application. This project's focus is on the structure, implementation, and maintenance of a formal system for managing risks in the supply chain. A common theme is that the decision to manage supply chain risks constitutes a major undertaking for most firms. Such an undertaking, it is argued, does not take place in a vacuum. Rather, it is a response to a number of factors or influences. However, no research to date has empirically identified these factors and explained how they can be leveraged into a competitive advantage. In this study, we use data from 46 firms and SCM managers to identify which factors affect the decision to develop a system for managing supply chain risks and we also explain how these factors can influence the level of success.

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Certain factors were identified as having a critical impact on predisposition and progress toward managing risks in SCM. These factors included: Corporate Strategy, Supply Chain Organization, Process Management, Performance Metrics, and Information & Technology. These factors describe a situation where the respondents saw managing risks as an extension of their SCM movement. There seems to be recognition that succeeding requires more than simply creating a new program or department. It is argued that these various factors act to pre-condition the firm and its systems to the introduction, acceptance, and progress on managing SCM risks. The report begins with a profile of the respondents and how they manage supply chain risks. The report then concludes with an evaluation of the factors underlying the decision to develop a system for managing supply chain risks and how these factors can be leveraged into a competitive advantage.

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## RESPONDENT PROFILE

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### Sample job titles:

Supply Chain Leader, Strategic Buyer, Senior Buyer, Director of Supply Chain, Vice President of Purchasing, Purchasing Manager, Senior Supply Chain Manager, Global Sourcing Business Unit Manager, Director of Global Procurement, Strategic Procurement Manager, Commodity Manager, Plant Manager

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### Main activities of companies:

**Manufacturing (39/46):** 11 automotive first tier suppliers, 4 automotive OEMs, 3 electronics manufacturers, and 21 other (e.g., office furniture, home appliance, pumps, seals, gauges, valves, hydraulics, aerospace, medical equipment, plumbing fixtures, seats, recreational vehicles, safety equipment, industrial doors, automation equipment, pharmaceuticals, cosmetics, home building material, child care goods, food)

\*28/46 of the manufacturers can be classified as capital intensive high volume producers that make use of assembly lines in operations and 11/46 of the above can be classified as low volume producers of highly customized products

**Non-manufacturing (7/46):** 3 distributors, 1 logistics, 1 telecommunications, 1 clinical testing, and 1 retailer

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### Annual sales revenue:

**\$1B-\$9B:** 32%      **\$10B-\$49B:** 34%      **\$50M-\$99M:** 4%      **\$50B-\$99B:** 7%  
**\$100M-\$499M:** 14%      **Over \$100B:** 2%      **\$500M-\$999M:** 7%

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### Number of employees:

**Under 50:** 2%      **50-99:** 2%      **100-499:** 9%      **500-999:** 5%  
**1,000-4,999:** 24%      **5,000-9,999:** 9%      **Over 10,000:** 49%

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### Ownership structure:

**Privately Owned:** 33%      **Publicly Owned:** 60%      **Public/Private Owned:** 7%

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### Geographical regions accounting for sales revenue:

**Africa:** 16/46 firms      **Europe:** 31/46 firms      **North America:** 46/46 firms  
**South America:** 30/46 firms      **Asia:** 34/46 firms

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## How Respondents Manage Supply Chain Risk

### Q1. Usage of supply chain risk evaluation tools, techniques, and methodologies:

Plan to implement an application within 1-2 years: 6%      \*Currently using an application: 61%  
Plan to evaluate an application within 1-2 years: 13%      No plans to use anything: 20%

\* All firms agreed there is no obvious single application for managing supply chain risks on the market today.  
These 61% are actually only using existing SCM applications for managing risk.

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### Q2. Spending plans next year for managing risks in the supply chain (e.g., IT, support services, process changes, etc.):

Less than \$500,000: 52%      \$500,000-\$1,000,000: 2%      \$1,000,000 - \$5,000,000: 9%  
More than \$5,000,000: 7%      Unanswered: 30%

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### Q3. Budget for managing supply chain risks increase, decrease, or stay the same next year:

Increase: 45%      Decrease: 14%      No change: 41%

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### Q4. Area within company that usually takes ownership of investments for managing supply chain risks:

Risk Management: 3%      Supply Chain/Purchasing: 60%      Legal: 6%      Logistics: 3%  
Accounting/Finance: 7%      Manufacturing/Operations: 12%      IT: 3%      Quality: 6%

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### Q5. Funding for managing supply chain risks comes from:

General operations budget: 26%      Specific departmental budget: 42%      General finance budget: 11%  
General IT budget: 4%      Specific budget to address supply chain issues: 17%

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### Q6. Techniques used to identify and analyze risk in supply chain:

Sample of responses: Initial supplier evaluations, financial risk assessment, supplier quality audits, capacity planning for operations and suppliers, lead time analysis for project management, supplier scorecard, management review, supplier risk analysis based on accounts payable performance, contingency plans, on-site capability review, forecasting techniques, safety stock, capacity and network planning, multi-sourcing, price hedging for commodities, back up carriers, historical data, cross-functional teams, risk mgmt group, project service levels, information sharing w/ suppliers, total spend mgmt, open communication, supplier competency reviews, benchmarking, life cycle management, failure mode & effects analysis, develop local supply base, contract mgmt & leverage, demand planning, inventory management, & vendor management inventory.

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## FACTOR 1. CORPORATE STRATEGY

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### **Data and Observations:**

Firms overwhelmingly agreed there is no obvious single application for managing supply chain risks on the market. Most firms (61%) are only using existing SCM applications for managing risk (see Q1). In the absence of risk management applications, these firms are building risk considerations into traditional SCM applications (e.g., spend, contract, & inventory management, demand planning, benchmarking, building long-term partnerships, etc). An additional 6% said they would like to implement a SCM risk application in 1-2 years, and another 13% said they are considering it. This indicates that while specific supply chain risk applications do not exist, interest levels are very high (80%). The 80/20 rule resurfaces as 80% of the firms have placed a priority on managing supply chain risks. The following questions were also asked on 1 to 7 scale (strongly disagree to strongly agree): 1) Managing supply chain risk is an increasingly important initiative for our operations; and 2) Without a systematic analysis technique to assess risk, much can go wrong in a supply chain. The means for both questions were well above 5.00 and had very small amounts of variance. Again, interest and need levels for supply chain risk applications remains high.

18% of the firms said they will spend over \$1M in services, technology, and personnel to support managing supply chain risks, while 7% actually plan on spending over \$5M. Another 52% said they plan on spending more modest amounts of less than \$500,000. 30% would not answer the question because of its proprietary nature, but indicated a moderately large amount of spend was planned. Not surprisingly, larger companies will invest more than smaller ones. The manufacturing firms look very similar in their higher spending efforts with a focus on supplier failure, whereas the non-manufacturing firms indicate lower spending levels with a focus on logistics failures.

These questions were also asked on 1 to 7 scale (strongly disagree to strongly agree): 1) Our spending intentions for managing supply chain risks are very high (mean=3.37, var.=2.47); and 2) We do plan on investing nontrivial amounts in managing supply chain risks (mean=4.30, var.=3.77). In this study, there was dedicated funding for managing supply chain risks and 86% indicated that such budgets will increase or stay the same (see Q3). However, only 42% will come from specific SCM departmental budgets and 60% indicated that SCM takes ownership of such investments (see Q4 and Q5). While spending intentions for managing supply chain risks are moderate, funding is poorly targeted and ownership is not centered within the SCM discipline. Managing risks is just now reaching the core of traditional and mature SCM applications.

### **Conclusions and Recommendations:**

A common theme identified from the cases was that while there were few examples of best practice, there were valuable lessons to be learned from the way individual companies managed risks. It was agreed that the management of risk should be a core issue in the planning of any organization. Firms have increased their exposure to risk through their SCM initiatives which focus on cost reduction. Few firms in this study made

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a formal assessment of supply chain risks or had a strategy in place. These findings indicate the importance of dedicated resources and aligning risk management with corporate strategy.

Formulating an appropriately aligned organizational strategy can to a certain extent mitigate risks in the supply chain. While the actions of competitors, customers, and suppliers external to the company cannot be strictly controlled, formulation of an appropriate strategy can help a company prepare for many events. The companies in this study have a strategy committed to investing heavily in the development of their supply chains to increase cost efficiency in alignment with corporate strategy. However, they also need to limit their exposure to risk by investing in the implementation of systems to increase monitoring and control of their suppliers, while also aligning their strategies with corporate risk management groups. With significant opportunities for improvement, there was no indication that such systems and alignment were in place.

Most professional bodies which deal with risk take the view that risk management should be a continuous process which runs throughout the organization's strategy. It should address methodically all risks surrounding the organization's activities past, present, and in particular, future. It must be integrated into the culture of the organization with an effective policy and process led by senior management. It must also translate the strategy into tactical and operational objectives, assigning ownership throughout the organization with each manager and employee responsible for the management of risk as part of their job description. It must support accountability, performance metrics and rewards, thus promoting operational efficiency at all levels, including SCM.

Most of the risk management strategies in this study appear to be fragmented – one group buys insurance, another administers claims, another handles everything related to safety or security, etc. The perspective of a holistic and enterprise wide approach is a new approach concerned with managing risks to provide reasonable assurance to all stakeholders (including SCM) regarding the achievement of company objectives. In reality, SCM covers the supply chain from suppliers to your company and not from your company to customers. Only the corporate risk management group can address risks for the entire supply chain and life cycle of a program. An effective strategy for managing risks in the supply chain requires a closely aligned strategy and relationship between risk managers and others in the organization. Risk management can provide its traditional expertise and information. Other functions such as purchasing, sales, marketing, finance, operations, and logistics can bring additional expertise. As a cross-functional collaborative team, these holistic and enterprise wide functions can create and implement a supply chain risk strategy that is strategically aligned with corporate objectives. This will require obtaining senior management understanding and approval, and setting up organizational responsibilities.

Gaining management support is often the most challenging part of implementing a proactive system for managing risks in the supply chain. It is necessary to emphasize the importance of supply chain risk management to senior management in order to get the properly targeted resources necessary to implement such a system (rather than the poorly targeted budgets seen in this study). Depending on the management culture, this should be the first step but could be the last. The firms in this study strongly disagreed supply chain risk initiatives are driven from the bottom up. This indicates the strong potential for a proactive approach since supply chain risk initiatives appear to be driven from the top down.

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This study recommends having an organizational strategy fully committed to undertaking risk assessments in the supply chain and at the very least the need for business continuity planning when the company is exposed to the supply chain. As a part of organizational strategy, it would behoove these firms to build a valued and respected risk management function. Progressive organizations will implement a risk management strategy to enable them to react to potential issues in a streamlined fashion. By having a plan, organizations are able to minimize a large ripple effect in other operations within their organization and across their supply chain.

## **FACTOR 2. SUPPLY CHAIN ORGANIZATION**

### **Data and Observations:**

Risk management in this study was mostly handled by a corporate function, usually dealing with insurance companies and some security issues. However, risk management in the supply chain has emerged rather recently and it appears many managers and functional areas are not involved. The following questions were asked on 1 to 7 scale (strongly disagree to strongly agree): 1) My workplace uses supply chain risk managers who work closely with corporate risk mgmt (mean=2.53, var.=3.03); and 2) I fully understand the activities being performed by our risk management group (mean=4.00, var.=2.66). On a higher level, the corporate function is involved with risk management and has contact with insurance companies, but does not necessarily coordinate risk management activities in the whole group, not does it appear to develop directives.

Most of the firms in this study have outsourced one or more of its non-core business functions. For financial reasons, resource constraints, and/or the need to tap into expertise they do not have, outsourcing has become a key aspect of many strategic initiatives. The following question was asked on 1 to 7 scale (strongly disagree to strongly agree): 1) We are planning to outsource all or some of our risk management functions. The mean was only 2.25 with little variance. The organizations in this study have no intentions to outsource risk management and are strongly inclined to develop these skills internally by purchasing a risk management application for internal use, and specifically in the SCM area. However, the following questions were asked on 1 to 7 scale (strongly disagree to strongly agree): 1) There is no single set of tools or technologies on the market for managing supply chain risks; and 2) Managing supply chain risk is an increasingly important initiative for our operations. The means were well above 5.00 and had small amounts of variance. Again, interest and need levels for supply chain risk applications remains high.

Respondents in our study see a broad set of risk factors that pose a disruption to their supply chains. These risks did not vary much by industry, and most were shared (see Table 1.1). Supplier failure/reliability was the top risk factor and common across all respondents. Bankruptcies of suppliers, logistics failure, commodity cost volatility, natural disasters, and strikes/labor disputes were distant seconds. The non-manufacturing respondents were more inclined to place a higher priority on logistics failure which is not surprising since they were mostly made up of distributors and a retailer.

**Respondents were asked to rank order five of the following risks which would have the greatest severity or impact on the supply chain if it occurred (e.g., 1=most severe, 2=second most severe, etc.). The numbers below indicate the frequency of responses.**

Supplier failure/reliability	↑	41
Bankruptcy, ruin, or default of suppliers, shippers, etc	→	22
Logistic failure	→	20
Commodity cost volatility	→	18
Natural Disasters or accidents	→	15
Strikes- labor, buyers, and shippers	→	15
Diminishing Capacity	↓	10
Government Regulations	↓	9
Attracting and retaining skilled labor	↓	8
Customer- related ( demand change, system failure)	↓	8
Lack of trust with partners	↓	7
Currency exchange, interes, and/or inflation rate fluctuations	↓	7
Intellectual property infringement	↓	7
Energy/raw material shortages and power outages	↓	6
Geopolitical event	↓	6
Ethical issues	↓	5
Legal liabilities and litigation	↓	5
Information delays, scarcity, sharing, and infrastructure breakdown	↓	5
Customs Acts/Trade restrictions and protectionism	↓	4
Contract failure	↓	4
Degree of control over operations	↓	3
Contamination exposure- food, germs, infections	↓	3
Measuring tools- metrics translate differently	↓	2
Weakness in the local infrastructure	↓	2
Internal and external theft	↓	2
Return policy and product recall requirements	↓	2
Banking regulations and tighter financing conditions	↓	2
Port/cargo security	↓	1
Tax issues	↓	1

Table 1.1

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While the majority of the manufacturing respondents identified supplier failure as their top risk factor, they also attributed the majority of their downtime in operations to supplier failure. In general, these firms have reacted to manage this risk factor, along with others such as natural disasters, strikes, etc., by building risk considerations into current SCM applications. Commodity cost volatility was also a growing concern, but with limited amounts of systems to manage its risk. For example, the majority of the firms strongly disagreed that they were using hedging strategies (to protect against commodity price swings) and speculation (forward placement of inventory, forward buying of raw material, etc.) for managing supply chain risks (and yet it was identified as one the top risk factors). Not surprisingly, firms were very disappointed with their supply chain's performance on lower commodity prices and reduced material price volatility. Only one firm in the entire sample had a system in place to proactively manage commodity prices. This firm had a dedicated staff that used a price sliding system on key commodities which were tied to market indices (e.g., plastics, metals, rubbers, etc.).

Notice that some of the top risk factors are to a large extent beyond the control of buying organizations (e.g., natural disasters, default or ruin of supplier, geopolitical events, or perhaps even supplier failure). Managers insisted that while preventing these will not be possible, reacting to them quickly is an option through contingency planning. The firms in this study are recognized as leaders in SCM and several have received formal recognition by industry associations for their ability to use SCM applications in a customer-driven manner. For example, these firms were very satisfied with their supply chain group's performance on the following issues: after sales service performance, supplier reliability, inventory management, delivery reliability, order completeness, damage free delivery, and meeting customer service levels. However, they did not show a proactive commitment to risk management. However, these questions were asked on 1 to 7 scale (strongly disagree to strongly agree): 1) We are prepared to minimize the effects of disruptions (terrorism, weather, theft, etc.); 2) Proactive risk mitigation efforts applied to the supply chain is common practice for us; and 3) We can actually exploit risk to an advantage by taking calculated risks in the supply chain. The means were very low and had small amounts of variance.

Most of the firms strongly agreed that managing supply chain risks is driven by reactions to failures rather than being proactively driven. Most managers agreed that they have had supply disruptions that have caused financial hardships in the past 24 months. There was no indication that managing risk was being driven by anything other than failure and remediation. However, the largest gaps in performance for reducing disruptions were in tighter financing conditions, exchange rate fluctuations, and commodity cost volatility (see Table 1.2). While supplier failure is a high risk factor for all the firms and will increase in risk for several of the firms, 13 firms did say that they expect supplier failure to be less of a risk in the future. A close assessment of these 13 firms reveals that they have done the most to build risk considerations into as many SCM applications as possible.

The respondents were asked if each supply chain risks would increase, stay the same, or decrease in the next 1-2 years?

Risk will decrease in the next 1-2 years	Risk will not change in the next 1-2 years	Risk will increase in the next 1-2 years
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## Increase, Decrease, or No Change in Supply Chain Risk in the next 1-2 years

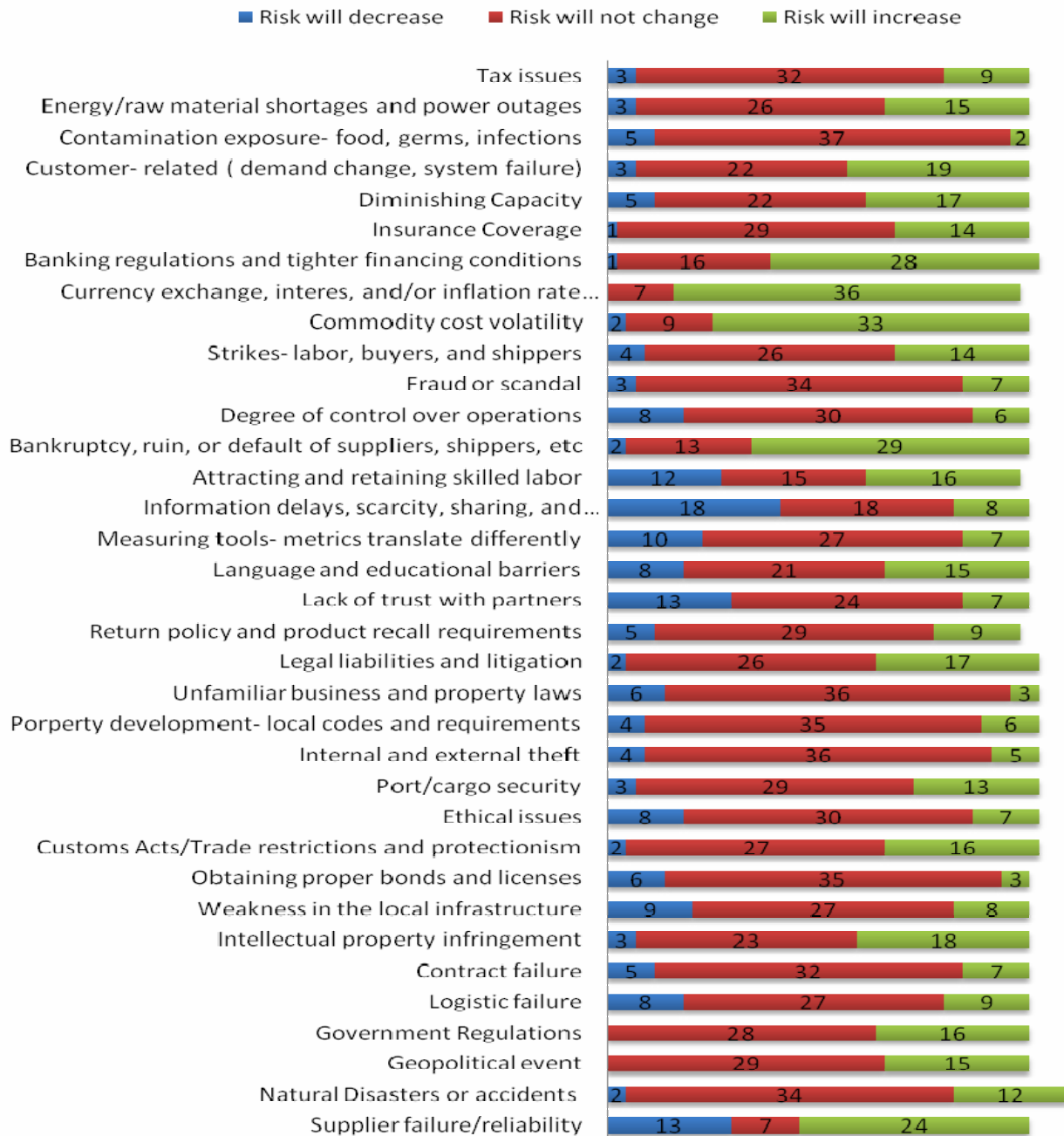


Table 1.2

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### **Conclusions and Recommendations:**

There was no indication that risk management has become a main part of the firms' SCM activities or that it even helped SCM meet the organization's objectives. It is recommended that corporate risk management groups focus on positioning the entire organization to try to avoid supply chain disruptions, and to develop strategies to manage the impact of them should avoidance not be possible. More tools are needed to assist in risk management at the supply chain level and not just at the level of the individual firm. This study concluded that the use of managing risks in the supply chain was complacent. It appears that in developing supply chain strategies which focus on cost reduction, these firms have played down the risks from supply chain disruptions. Risk considerations are still reactive in nature but have the potential of adding value in a proactive, strategic, and long-term manner.

The recommendations of this study describes ideal conditions as being where there is a supply chain risk manager who is responsible for development and implementation of managing risks in the supply chain. This supply chain risk manager should also work closely together with corporate risk management, as well as with the supply chain managers. In this study, a gap was suggested as firms failed to use supply chain managers who work closely with corporate risk management and managers did not fully understand the activities being performed by their risk management groups.

Supply chain managers should also use the tools and processes developed my supply chain risk managers to analyze, assess, and manage risk in their supply chains. In the absence of risk management applications, the supply chain managers in this study are building risk considerations into existing traditional SCM applications (e.g., spend, contract, & inventory management, demand planning, benchmarking, etc). This study shows that mostly supply chain managers run and coordinate the work to maintain an optimal balance between risk exposures and costs for damages versus protection activities. Supply chain managers are the interface to other functional areas and they are also responsible for risk management in the supply chain. Core production should of course support SCM with risk management issues. This means that many different players could be involved in sharing responsibility for implementing and maintaining a system for risk management. This could make roles unclear, so responsibilities need to be defined. However, the key responsibility lies with supply chain managers that should run risk management work in their respective parts of the supply chain.

## **FACTOR 3. PROCESS MANAGEMENT**

### **Data and Observations:**

This study showed that documenting the likelihood & impact of risks was not a key part of SCM and that supply chain risk information was not readily available to key-decision makers. Furthermore, very few of the firms are actually able to exploit risk to an advantage by taking calculated risks in the supply chain and even fewer were prepared to minimize the effects of disruptions. These questions were asked on 1 to 7 scale (strongly disagree to strongly agree): 1) A key part of our supply chain management is documenting the likelihood & impact of risks (mean=4.20, var.=2.86); and 2) Supply chain risk information is accurate and

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readily available to key-decision makers (mean=3.87, var.=2.78). There was some debate as to the validity and usefulness of tools to operationalize the process. The managers did tend to prefer approaches which combine subjective and objective measures because this allows them some freedom rather than being pushed into taking decisions solely on complicated numerical analysis. Failure Mode Effects and Analysis (FMEA) is a mainstream tool used to collect information related to risk management decisions for most companies in an engineering capacity, but not in a supply chain capacity. There were several documented procedures to complete an FMEA across industries in this study, especially in automotive. Most managers supported a modified version of the tool that could be used to help evaluate the risk of SCM decisions.

Several of the firms used financial reports and questionnaires during supplier approval to compare supply candidates to the business requirements of the buyers or project teams. When justified by a perceived level of risk, a few of the firms went one step further and had candidate comparison matrices (e.g., supplier profiling form and supply Chain PFMEA). Additionally, most had formal processes for supplier visits (e.g., Rapid Plant assessment, site verification of the supplier questionnaire, etc.). Some firms actually used life cycle management with supplier report cards and their buyers would conduct periodic supply chain reviews. In one firm, sourcing was assigned risk ownership and they used FMEA principles to evaluate risk impact. For each risk, they would assess what the financial impact would be in the event of a disruption. They then assigned a probability to each risk area and then they prioritized by multiplying the financial impact by the risk probability. Again, most firms are only using existing SCM applications for managing risk with no formal risk management system in place. In the absence of risk management applications, these firms are building risk considerations into traditional SCM applications.

### **Conclusions and Recommendations:**

Managing supply chain risks should occur at all levels of the supply chain, and the process should support integration with supplier and customer risk management activities. The process should be active in all stages of the acquisition life cycle, starting with technology development and continuing through acquisition, production, maintenance, repair, and disposal. The scope of the process should include all types of risks appropriate for the supply chain. In addition to the common causes of disruption, risk identification should consider economic, political, environmental, regulatory, manufacturing readiness, and technological obsolescence issues. All levels of management should be actively engaged in risk management, including strategic, business, program, technical, and tactical levels. The process should both leverage common tools for assessing risk, but also develop specific SCM mitigation tools and solutions.

A method for analyzing supply chain risk must be a cross-functional process that involves senior management as well as key stakeholders from finance, operations, internal audit, and risk management. However, the companies in this study have not adopted this boundary spanning process. Instead, they have managed risks within functional areas. However, it was acknowledged that the most effective forms of risk management demands involvement across multiple areas of the organization.

The process begins with an assessment of the supply chain. This can usually be done with internal resources but might require the assistance of outside consultants. In either case, it was agreed that this

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assessment would take the most effort. While generally lacking among firms, this study indicates the importance of having a process that will allow an organization to analyze, prioritize, and measure the economic impact of risks in the supply chain. Such a process should provide decision makers with financially justified value propositions for initiatives that are aligned with the company's strategic goals. Though a number of different risk management processes have been put forward, most tend to follow the generic process offered in this study with the following key elements.

- **SCM Risk Planning**: develops an overall plan for assessing, handling, and communicating supply chain risks. It identifies how risk priorities are established, how risks are communicated, the training resources required, and the stakeholders responsible for each of the risk management activities.
- **SCM Risk Identification**: uses tools that enable a thorough investigation of all possible sources of risks within a supply chain. To be effective, this part of the process must be conducted throughout the supply chain and life cycle of the program.
- **SCM Risk Analysis**: assess each risk in terms of its likelihood of occurrence, and the estimated impact should the risk occur. This study recommends a modified version of the FMEA tool that could be used to help evaluate the risk of SCM decisions.
- **SCM Risk Handling**: stakeholders rank order the risks and determine what options exist to mitigate the most likely and/or serious risks. Mitigation strategies can either lower the likelihood that the risk will occur or reduce or eliminate the impact should it occur. These plans must be assessed both in terms of their cost as well as their impact on the likelihood and severity of the risk. Based on this analysis, mitigation strategies are selected that provide the greatest return to the company. Our study shows that many risks are actually common across a large number of suppliers and industries. What is implied is that the same mitigation strategy may be successful in addressing a broad range of supply chain risks.
- **SCM Risk Monitoring**: systematically track the risks and the risk handling plans against cost, schedule, and performance metrics, to ensure that risks are being managed as planned. In other words, measure and monitor performance to maintain a balanced risk profile.

Understanding the risks within a supply chain requires an in-depth knowledge of business operations. To develop this understanding, the company must begin with interviews and workshops typically involving a cross-functional team of subject matter experts representing sourcing, manufacturing, and logistics. The company must collect its financial and risk performance data (e.g., average lead times, safety stock levels, other inventory levels, etc.) and benchmark it against industry and functional comparisons. This process enables the organization to develop a detailed picture of its supply chain, which in turn helps it identify potential risks more

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easily. A few managers took the view that effective supply chain risk management does not need to be a highly formalized and structured process. However, this study favors a more formal, structured process for managing risk.

## **FACTOR 4. PERFORMANCE METRICS**

### **Data and Observations:**

All of the firms in this study have developed and monitor a set of performance metrics to maintain a risk profile for their supply chains. They do so by using an assortment of tools and techniques such as: initial supplier evaluations, QS audits, industry benchmarking, supplier questionnaires, report cards, capacity planning, lead-time analysis, financial risk assessment, business continuity plans, risk analysis based on accounts payable performance, historical data, technical capability assessment, on-site capability reviews, forecasting techniques and analysis, data tracking with customers to identify demand trends, supplier performance measurement, etc. The majority of the firms also used supplier risk rankings, similar to credit scores used in the financial industry, to measure suppliers on stability, contingency planning, and on-target delivery performance. These tools allow the firms to ask some basic questions such as: Do suppliers maintain consistent quality and delivery performance and is lead-time volatility increasing? While most of the firms track this type of performance through supplier scorecards to monitor leading indicators that impact risk, none had an ongoing risk-review process to ensure that they keep their risk profile within an optimal range of economic impact.

This study also demonstrates that the measurement of risk factors does not necessarily require a new or unique set of performance measures. For example, one firm used average on-time delivery as a measure of supplier performance and chose to look more closely at the peaks and valleys of this indicator to determine the supplier's risk impact on its own delivery performance. In another example, key metrics were established to measure the risk associated with key suppliers and their performance against service level agreements. Supplier agreements were then aligned with the established levels negotiated with the company's key customer agreements.

In general, the development of proactive risk management performance metrics in the supply chain was lacking in this study. The supplier scorecards were not balanced, optimal, and supported reactive decision making. The firms in this study do equip themselves with management scorecards that can identify some trends in advance. They often referred to them as dashboards, reviews, audits, etc., and they allowed managers to view the progress of their supply chains according to a collection of performance indicators. In this manner, they do get some early warning signs if suppliers or carriers are underperforming. However, they fall short on having systems with event-based alerts that let them know when their supply chains are at risk. Until that happens, managers will not take appropriate and well managed risks (e.g., they will outsource to low cost regions to meet their cost savings goals and not stay within an optimal range on the risk management side).

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In general, no one was compensated or incented in their day to day job to look at and evaluate the risks within an optimal range of economic impact. For example, a typical off-shore target for several supply chain managers was to achieve x million dollars of component off-shore in y years. Such situations forced managers to inevitably compromise on risk issues as they focused on achieving cost efficiency. None of the firms have developed some sort of on-demand platform that helps them predict supplier failures before they occur. Managers were mostly concerned with risks on the supply and demand sides of the supply chain. It is not that they ignore operations risk, but typically operations risk management resides in other departments such as corporate risk or finance, and is covered by buying insurance or hedging foreign exchange exposure.

### **Conclusions and Recommendations:**

A key component of the supply chain risk management framework is to develop and monitor a set of performance metrics to maintain an optimal risk profile of an organization's supply chain. In response to this, it is recommended that a risk-adjusted view of current and traditional SCM performance metrics be used. In addition, key risk measures may be added to monitor potential upstream and downstream disruptions in the supply chain. New measures might also be added to monitor supplier contingency planning processes and procedures that already exist as traditional SCM applications. Establishing a set of supply chain risk measures across an organization's supply chain can culturally institutionalize the importance of managing risks in the supply chain. As decisions are weighed in terms of both the financial benefits and the impact to supply chain risks, the results should lead to a more proactive approach with long-term benefits to the entire supply chain.

This study suggests that performance metrics are an important determinant of the temporal perspective of supply chain managers. If the reward system only rewards those who achieve their objectives irrespective of due attention to risks, then managers will strive to achieve objectives at the cost of disproportionate risks. In most of the firms in this study, the major objectives were to reduce inventory, improve in-stock availability, and cut costs. Most of these firms had specific targets for off-shore sourcing that that forced managers to inevitably compromise on risk issues. Managing risks in the supply chain was perceived as something that contradicts the process of achieving these company objectives.

The most appropriate strategy might not be adopted because of factors such as performance metrics. Developing metrics that accurately and fully tap the impact of effectively managing risks in supply chains will drive managers to take appropriate and well managed risks. Although the development of specific performance metrics is beyond the scope of this study, it is certainly an area ripe for future research.

## **FACTOR 5. INFORMATION & TECHNOLOGY**

### **Data and Observations:**

In this study, firms had information of what goes on in other parts of the supply chain. An issue on information was not suggested as it was asked on a 1 to 7 scale (not satisfied to very satisfied), How satisfied are you with your supply chain group's performance on "Visibility" (detailed knowledge of what goes on in other parts of the supply chain – e.g., finished goods inventory, material inventory, WIP, pipeline inventory, actual

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demands and forecasts, production plans, capacity, yields, and order status). The mean was modestly high (4.26) with a very small amount of variance, as was their agreement that their company uses real-time inventory information and analytics in managing the supply chain. Furthermore, the questions were also asked on 1 to 7 scale (not used to extensively used), To what extent are the following used in managing your supply chain and risks within it: 1) Information gathering; and 2) Establishing good communications with suppliers. The means for both questions were very high (well above 5.00) and had small amounts of variance. In this study also, information delays, scarcity, sharing, & infrastructure breakdown was seen overwhelmingly as one of the lowest rated risk factors both currently and for the future.

These findings are not surprising given that firms in this study showed that a wide variety of information-based technology and applications are being spent for their SCM efforts (e.g., ERP configuration systems, electronics reverse auctioning, radio frequency identification, Collaborative Planning Forecasting and Replenishment – CPFR, etc.), but very few firms showed that their technologies are being used to support risk considerations. Respondents agreed that the key to improved supply chain visibility was sharing information among supply chain members. However, there was only one company that demonstrated an increased focus on inventory optimization to deal with the risk of out-of-stocks or to buffer against the increased risk of supply disruptions. The role of supply network design and optimizations tools is still evolving on the SCM side. Some of the firms in this study do indeed make use of network design tools for infrequent, long-range decision making, such as manufacturing location or distribution capacity given long-term demand expectations. However, there was no indication that there are new cases of usage, such as helping companies understand, model, and cope with increasing levels of uncertainty in the supply chain or network.

Few of the firms used technology applications to do the following (with the exception of the 3 electronics and 1 food manufacturer): joint technology development initiatives, data warehousing, network design analysis programs, demand signal repositories, inventory optimization tools, and forecasting techniques (e.g., to pre-build & carry additional inventory of critical items). These techniques would be useful in managing risk and continuity with regard to new product launches as might be more required for electronics manufacturers than say automotive. These firms were more inclined to embrace techniques such as scenario planning and capacity modeling. The electronics industry is known for risk stemming from short product lifecycles and high demand uncertainty. The food manufacturer made use of exploring a range of alternative supply sources and transportation routes between its distribution centers and customers. This was the only indication of a firm turning network analysis into a continuous process of refinement that allows them to reduce risk while identifying opportunities.

The firms in this study did not use their technology to evaluate their supply chain networks and lacked disciplined network-analysis programs. The more advanced firms in this study did leverage their technology to periodically assess strategic decisions about where to locate distribution centers and manufacturing capacity. They did look at what network design would allow them to service customer demand at the lowest cost and risk. None of them however were using network-design tools in innovative ways such as modeling the networks of their key competitors to test various scenarios and to perform frequent what-if analysis. None

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were also employing network-design tools to assess risks in the design of the network or even using simulation techniques to test network-configuration options.

Most of the technology supported the following SCM applications for the purposes of managing risk: information gathering, partnership formation and long-term agreements, supplier development initiatives, supplier performance measurement systems, consistent monitoring and auditing of a supplier's processes, using an approved list of suppliers, visiting supplier operations, establishing good communications with suppliers, inventory management (buffers, safety stock levels, optimal order & production qty.), spend management and analysis, credit and financial data analysis, business process management, contract mgmt (e.g., leverage tools to monitor performance against commitments), and contingency planning (jointly with suppliers).

Inventory management in particular was a critical SCM application used to buffer risk and serve as a de-coupler between echelons of the supply chain. Some companies have adopted software tools to address multi-echelon inventory optimization. Firms are using these tools to apply probabilistic forecasting techniques to make inventory policy and configuration decisions and to evaluate different inventory strategies, though none of them used it to evaluate postponement strategies. Used effectively, they can help companies improve customer-service levels and fill rates, dampen the impact of supply disruptions, reduce risk, and yield better trade-off decisions between customer-service levels and required inventory investment.

Overall, the firms in this study did not engage in proactive modeling exercises as part of a concerted sales and operations planning process. As an example, they lacked a strong what-if capability and could not do cost versus delivery trade-offs. It was agreed though that internet-based systems will become the common platform for supply chain integration and that the use of supply chain planning software will increase dramatically.

### **Conclusions and Recommendations:**

Technology has emerged as a key enabler to realize data and information integration in the supply chain. Making use of technology in general, results in reducing disruption risks in the supply chain. Current information technologies allow for improved integration of information flows and supply chain visibility among all participants. Shared information reduces uncertainty and reduces the need for non-value added cost drivers such as safety stocks. As a result, the system becomes more responsive and eventually could become demand driven rather than forecast driven. A few select samples from this study demonstrates that information driven supply chains hold the potential to perform significantly better than those that do not have access to information beyond their corporate boundaries.

Confidence in a supply chain is weakened when the length of time it takes to complete all the needed steps in the end-to-end pipeline process is longer and inconsistent. Associated with this length and inconsistency is the lack of visible, accurate, and real-time data. A key element in dealing with supply chain risk goes beyond documenting the likelihood and impact of risks, but also getting visibility to risks when they occur and translating that risk information to key decision makers so that they can evaluate and act on information. Throughout the supply chain, key operational data and information such as inventory, demand,

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forecasts, production and shipment plans, work in progress, yields, capacities and backlogs should be accessible easily by key members of the supply chains. Such information should be accurate and timely, rendering it useful for all parties for planning and re-planning purposes. Thus, it is important that data and information are tightly managed and that any updates are made as timely as possible. The accuracy of the data should be a source of confidence to the parties using the data.

## **CONCLUDING COMMENTS**

Managers agreed that without a systematic analysis technique to assess risk, much can go wrong in a supply chain (i.e., unexpected cost, extended lead times, poor quality, or numerous other negative performance variables). Analyzing the risk associated with SCM is a relatively new subject, and little has been done to assist managers with this process. But one thing is certain, documenting and analyzing risk must be an essential part of continuous improvement. It becomes critical to have an easily understood method to identify and manage risk.

FMEA is a mainstream tool used to collect information related to risk management decisions for most companies in an engineering capacity, but not in a supply chain capacity. There were several documented procedures to complete a FMEA across industries in this study, especially in automotive. Most managers supported a modified version of the tool that could be used to help evaluate the risk of SCM decisions. For several of the firms in this study, FMEA is a well documented and proven technique commonly used to evaluate the risk for failures in product and process designs. SCM decisions can be evaluated in much the same manner as product and process defects.

Most managers felt that proactive risk mitigation efforts applied to the supply chain is not common practice, but is required for minimizing disturbances. There was a general impression that with a FMEA based SCM risk assessment tool, unforeseen problems that might have impacted the success of SCM efforts can be avoided. Most managers want to develop an implementation tool for FMEA in a supply chain environment and they want to know the issues occurred in the implementation process. They also want a procedure for integrating FMEA across the supply chain, they want to know how to implement the procedure in the supply chain, and they want to know the common problems occurred in its implementation under a supply chain environment. Managers were concerned with the inconsistencies in the ranking of severity, occurrence, and detection and the inaccuracies that may delay effective FMEA implementation in a supply chain. Managers want guidelines for customers in correcting these problems in FMEA applications, so they can adopt and integrate their FMEA process into a supply chain environment.

While many factors have been cited as influencing the predisposition towards having a system for managing risks in the supply chain, certain factors were identified as having a critical impact on predisposition and progress towards this. These factors included: Corporate Strategy, Supply Chain Organization, Process Management, Performance Metrics, and Information & Technology. These factors describe a situation where the respondents saw managing supply chain risks as an extension of SCM. They also describe a situation in which respondents recognized that success with managing risks requires cross-functional teams and

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cooperation. There seems to be recognition that succeeding requires more than simply introducing a new program or department. Rather, it is an undertaking that requires the participation of multiple parties working together. It is argued that these various factors act to pre-condition the firm and its systems to the introduction, acceptance, and progress on managing risks in the supply chain.