

**Effective Practices in Business Continuity Planning
for Purchasing and Supply Management**

By:

George A. Zsidisin, Ph.D.

Gary L. Ragatz, Ph.D.

and

Steven A. Melnyk, Ph.D.

Department of Marketing and Supply Chain Management

The Eli Broad Graduate School of Management

Michigan State University

Please direct all correspondence to:

George A. Zsidisin

(517) 353-6381

zsidisin@msu.edu

July 21, 2003

© Michigan State University, June 2003

Table of Contents

INTRODUCTION	1
RESEARCH METHOD AND COMPANY BACKGROUNDS	3
BCP – OVERVIEW AND FRAMEWORK	5
PRINCIPLES FOR EFFECTIVE SUPPLY CHAIN CONTINUITY PLANNING.....	8
EFFECTIVE PRACTICES.....	10
RESEARCH AGENDA AND ACTION LIST.....	24
CONCLUDING COMMENT.....	26
REFERENCES	28
APPENDIX A: Individual Case Study for Firm A.....	30
APPENDIX B: Individual Case Study for Firm B	49
APPENDIX C: Individual Case Study for Firm C	64
APPENDIX D: Case Study Research Protocol	73
APPENDIX E: Interview Questions.....	75

INTRODUCTION

All business organizations are exposed to operational risk. Most managers, when they think about such risk, tend to focus on those risks that affect internal operations. Accidents, natural disasters, and intentional malicious acts all have the potential to seriously disrupt or shut down internal operations. While critical, all risks are not internal. Increasingly, as more and more firms begin to rely on the supply chain and the capabilities of their suppliers, managers and researchers are coming to realize the true impact of supply-side disruptions. Business failures, disruptions or shutdowns among a firm's suppliers or in its inbound logistics channels can easily create a ripple effect of business interruptions throughout the supply chain. They can also seriously and strategically impact overall performance. Consequently, there is a need for a formalized system that identifies such risks, qualifies the associated risks and then provides procedures, strategies and tactics aimed at either minimizing or eliminating such risks. This system is that of ***Business Continuity Planning*** (BCP).

As originally conceived, Business continuity planning is an integrated set of formalized procedures and resource information that firms can use to recover from a disaster that causes a disruption to business operations (Barnes, 2001). Initially, much of the attention in business continuity planning focused on dealing with loss or damage to information or information systems. To a certain extent, this focus is understandable since the events of September 11, 2001 gave a major impetus to the need for BCP. One of the major impacts created by the events of this day involved the major loss and disruption of information and information systems. Yet, we are beginning to realize that BCP deals with more than simply information. Business disruptions can and do impact all of the resources and resources systems needed by the firm and provided by its supply base. Yet, like supply chain management, BCP is a relatively new development and

concept. Consequently, there is relatively little known about preventing and managing risk of disruptions from the inbound supply chain. Yet, while there is relatively little known about BCP, our awareness of the need for this system is increasing. As supply chains increase in importance, we recognize that the buying organization becomes increasingly vulnerable to disruptions emerging from the supply chain. It is therefore important for firms and their management to understand and manage this risk. Effective processes and tools are needed to help firms assess their risk and develop strategies and techniques for avoiding and/or mitigating risk of disruption in their supply chains. More research is needed into Business Continuity Planning, its systems, tools, and procedures. This fact has been realized by many researchers and managers. It has also been recognized by research foundations, such as the AT&T Research Foundations, which has chosen to fund five research projects into selected, specific areas pertaining to BCP. This report, and the study on which it is based, is the result of one such research project carried out within the Department of Marketing and Supply Chain Management at Michigan State University.

The purpose of this research study is to empirically identify and analyze effective practices for business continuity planning in supply management. To accomplish this task, the research team has:

1. Identified companies with established, effective supply chain BCP processes
2. Conducted case studies of these firms and their practices, through the implementation of a grounded case study research protocol (Yin, 1994)
3. Produced this report synthesizing best practice findings with a managerial focus on processes for creating supply chain continuity plans, tools and techniques for assessing risk, and strategies for managing that risk.

The purpose of this report is to share with the AT&T Research Foundation the initial findings of this study into effective practices for BCP in supply management. The report begins with an introduction into the research method and the three case study firms. The overview of the research findings is then presented in a framework that synthesizes effective practices from the case studies. Principles for supply chain continuity planning are discussed, followed by examples of effective practices drawn from the case study firms. A research agenda, action list, and summary comments conclude the report.

RESEARCH METHOD AND COMPANY BACKGROUNDS

The primary research method consisted of conducting case studies with firms that have established business continuity planning (BCP) and risk management processes in supply management. An interview protocol was established before data collection (see Appendices D and E) and semi-structured interviews were conducted with key personnel from the case study firms. The interviewees comprised individuals with titles such as commodity manager, quality management specialist, vice-president of procurement, risk management specialist, supplier development liaison, risk manager, and others. Evidence of BCP processes was also collected during the case studies in the form of documentation such as standard operating procedures, reports, and internal memorandums.

The interview protocol was created to increase the reliability of data collection and to provide the investigators a guide for carrying out the case studies (Yin, 1994). The protocol contains an overview of the project, field procedures, case study questions, and a guide for the case study report. An overview of the case study protocol was provided in advance to case study participants.

Before the interview protocol could be administered, candidate firms had to be identified. The research team drew on a number of sources to identify potential candidates. These included (but were not limited to): expert opinion, past experience and knowledge of the research team, and, citations within the relevant literature. For a firm to be included in the study, it can to be acknowledged as being a “leading” practitioner of BCP principles and practices by more than one source. This identification process generated a “short” list of companies. The firms from this list were then pre-screened through initial telephone and personal contacts for understanding their organization’s involvement with BCP in supply management.

As of the June 30 2003, three case studies have been conducted at the companies’ locations to date. The first case study (Firm A) was conducted at a U.S. plant of a large international aerospace supplier that provides critical sub-components for both military and civilian aircraft. The purpose of the pilot case study was to provide the researchers refinement of the case study protocol and procedures (Yin, 1994), as well as to obtain initial insights to business continuity planning with supply management. The second case study was conducted with a large European telecommunications corporation (Firm B). The third case study firm that participated in this study is in electronics manufacturing (Firm C). All three of these firms have detailed processes established for addressing risk with inbound supply and incorporate various tools and processes to ensure continuity of inbound supply.

Data generated in the case studies has been subject to open, axial, and selective coding analysis, as per the guidelines set by Miles and Huberman (1984), Strauss and Corbin (1998), and Yin (1994). Open coding breaks down case study data in order to analyze, conceptualize, and develop categories for the data. Axial coding is a technique that makes connections among

categories. Axial coding groups issues during first level coding and summarizes the issues into themes. Selective coding consists of integrating and refining theory.

A summary of our overall research findings is discussed in the following three sections. We begin with a “Supply Chain Business Continuity Planning Framework,” which outlines the key elements of supply chain continuity planning. Next, we identify a set of principles for effective supply chain continuity planning, and in the third section, we describe examples, drawn from the case studies, of effective practices for supply chain continuity planning.

BCP – OVERVIEW AND FRAMEWORK

We have identified four major elements of supply chain business continuity planning: Awareness, Prevention, Remediation, and Knowledge Management. These interrelated elements form a framework for an effective supply chain continuity planning system (see Figure 1).

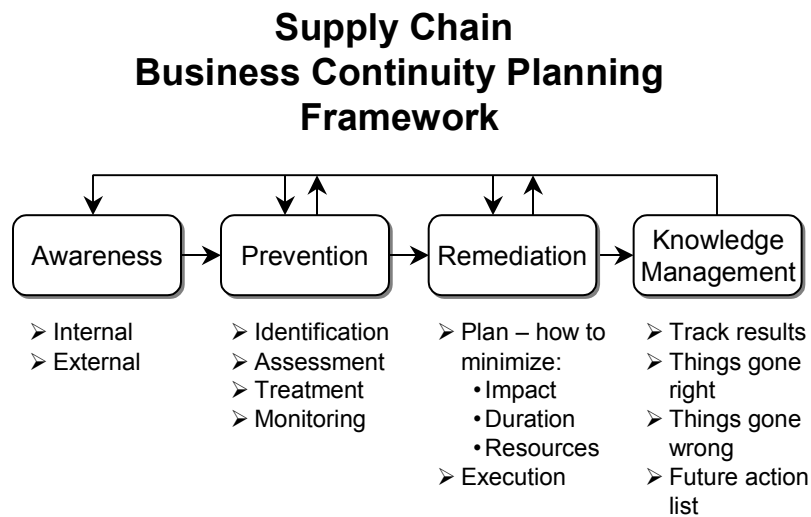


Figure 1. Business Continuity Planning Framework

Awareness

The first element of the framework is *Awareness*. Awareness is developed when the firm recognizes that it is exposed to risk of supply chain disruptions, and realizes the potentially serious consequences of such disruptions. This awareness must develop *internally*, at multiple levels of management, so that resources can be allocated and appropriate processes and tools can be developed and deployed to manage the risk. It is also important to push this awareness out into the supply chain, to customers and suppliers, so that their help can be enlisted in the effort to manage the risk.

Prevention

The second important element in continuity planning for the supply chain is *Prevention*. The focus here is reducing the likelihood and/or the impact of supply chain disruptions.

Prevention comprises four key processes:

- *Risk Identification*: carefully enumerating the various causes/sources of potential supply chain disruptions.
- *Risk Assessment*: evaluating the likelihood of occurrence and the impact that event will have on the business for each cause or source of potential disruptions.
- *Risk Treatment*: prioritizing the various causes/sources of potential disruptions and developing strategies for reducing their likelihood and/or mitigating their impact on the business.
- *Risk Monitoring*: monitoring developments in the supply chain that may increase or decrease various risks on an on-going basis. These developments might include changes

in the economic or political environment, changes in supply markets, or the status of individual suppliers.

Remediation

The third element of the continuity planning framework is *Remediation*. While the firm takes steps in the *Prevention* stage to reduce its exposure, risk cannot be completely eliminated and disruptions to the supply chain cannot always be avoided. Thus, firms need a course of action to follow in order to recover from a disruption when it occurs. The firm should consider how it might shorten the duration of the disruption, minimize its impact on the business, and identify in advance the resources that will be needed to carry out this plan.

Knowledge Management

The last element of the framework is *Knowledge Management*. When supply chain disruptions occur, it is important that the firm *learn from the experience*. That requires a post-incident audit that identifies important lessons learned – things gone right, things gone wrong, and the results of the remediation effort – along with feedback to the earlier stages in the continuity planning process so that the firm can benefit from these lessons by carrying out a “post-mortem.”

Supply disruptions are an indication that something went wrong and that the existing plans and contingencies in place may not be adequate. Even if the plans were adequate and the effects of the disruption were minimal, management must review what happened and carry out what is essentially a debriefing. Based on the review, the existing BCP must be revised with the

goal of addressing the deficiencies while simultaneously keeping the strengths of the existing plans and tactics.

PRINCIPLES FOR EFFECTIVE SUPPLY CHAIN CONTINUITY PLANNING

A number of principles for effective supply chain continuity planning emerged from an examination of prior related work and from the three company case studies. Grouped by the four key elements of the supply chain continuity planning framework, the following principles have been identified to date:

Principles:

Awareness:

1. Create internal awareness from the bottom up and from the top down.
2. Drive awareness into the supply base through the supplier selection and supplier management processes.

Prevention:

3. Prioritize suppliers and commodities to focus attention.
4. Consider the full spectrum of resources and flows managed within the supply chain.
5. Understand both probability and impact of supply chain disruptions.

Issues:

- Risk of supply chain disruptions is real
- Disruptions can have serious financial and competitive impact
- Take a systems view
- Operational personnel are closest to the supply base and have better appreciation of risk sources
- Top management controls the resources needed and must endorse supply chain continuity planning
- Establish key processes for communicating with the supply base
- Motivate suppliers to recognize and manage risks
- Resources are limited and must be properly allocated
- Focus efforts on critical commodities and their suppliers
- Focus on high-risk commodities and suppliers
- Multiple resources flow in the supply chain and are critical to smooth operation
 - Materials
 - Information
 - Services
- Must consider exposure related to all of these flows
- Risk is a function of the dimensions of probability and impact
- Classic risk assessment focuses on expected value
- In practice, disastrous impact may overwhelm low

probability

6. Eliminate/reduce exposure where feasible; buffer or mitigate where elimination is not feasible.
 - Eliminating or reducing exposure is the ideal solution, but not always feasible
 - If exposure cannot be reduced, buffering strategies can limit impact
7. Develop and monitor *predictive* BCP-specific indicators
 - Indicators are needed that will help identify changing risk levels *in advance* of a disruption
8. Use multiple information sources to monitor risk.
 - Different organizational areas focus on different aspects of risk
 - Multiple information sources help to triangulate observations
9. Revisit these issues on a regular basis.
 - Supply chains are dynamic
 - Sources and levels of risk will vary over time
 - Changes to supply chain structure
 - Economic developments
 - Environmental changes
 - Political developments
 - Periodic review is needed

Remediation:

10. Plan for disruptions
 - It is impossible to totally eliminate risk of supply chain disruptions
 - It is critical to have a *plan* and *processes* in place to deal with the disruptions when they occur
11. Manage the impact of disruptions.
 - Consider both the *cost* and the *duration* of the disruption
 - Four stages to a disruption:
 - Interruption
 - Response
 - Recovery
 - Restoration of operations

Knowledge Management:

12. Take a *continuous improvement* view of supply chain continuity planning.
 - Exposure to supply chain disruption cannot be fixed overnight
 - Protecting the supply chain requires on-going attention and effort
13. Make a post-event audit of supply chain disruptions standard operating procedure.
 - Learn from mistakes
 - Examine what went right and wrong, what worked and what did not
14. Share knowledge of supply chain continuity planning throughout the organization.
 - Share what has been learned
 - Avoid re-inventing the wheel

EFFECTIVE PRACTICES

The principles described in the previous section lay down the conceptual framework for effective supply chain continuity planning. Beyond the principles, it is important to consider some of the *practices* firms can use to put the principles to work. In this section, we describe a number of “effective practices” for supply chain continuity planning that have been drawn from the case studies.

Supply Chain Risk Audits

The audit is a critical element in creating awareness of supply risk, its nature, and the current state of preparedness. The audit is intended to provide key supply chain organizations with a baseline that captures the following information:

- What is the risk that exists within the specific supplier being evaluated?
- What are the implications of risk (as measured in terms of time, money, output)?
- To what extent does the supplier have secured processes (i.e., alternative backup processes that have been proven to perform as expected and are considered to be viable and acceptable substitutes for the existing process, should it fail)?
- What is the current state of preparedness on the part of the supplier in dealing with risk?
- To what extent are these risks controllable?
- Which sources of risk are the most important (and why)?
- What actions does the supplier intend to implement in addressing risk?

- What is the buying organization going to do to handle this risk?

The use of audits was most advanced in Firm B. These audits are recognized as being critical in ensuring that an accurate picture of risk within the supply chain and the extent to which the supply chain is ready and able to deal with it are in place. Yet, in reviewing the audits at Firm B, an interesting issue emerged – the intention of the audit was for management personnel of the buying organization to be responsible for its execution. The results could not be interpreted by the suppliers without the assistance of the personnel from the buying organization. This appeared to limit the utility of the audit as a vehicle for self-assessment.

Supply Chain Mapping

Supply Chain Mapping is a technique frequently used by management to lay out the structure of the supply chain (Fine, 1998; Scott and Westbrook, 1991). One of the major objectives of supply chain mapping is to not simply graphically describe the structure of the supply chain, but to help identify critical or bottleneck suppliers within the supply chain (Kraljic, 1983). Such suppliers, as pointed out by the management of one of the firms visited, are often encountered at the second and third tier. Once these suppliers have been identified, they can be monitored and appropriate corrective and contingency plans put in place.

Supply chain mapping is a major undertaking with a fairly steep learning curve. However, it was the consensus that once a person or team became familiar with this tool, developing a new supply chain map would take about a week to complete. It was the view of several managers interviewed that effective BCP could not take place in the absence of supply chain mapping.

Assessing Probability and Impact – Expected Values and Extreme Values

When describing a risk within the supply chain, managers identified two critical dimensions. The first is the probability, or likelihood of a disruption occurring. This dimension is typically stated as a value ranging between 0 (a disruption will never occur) and 1 (the disruption will take place with complete certainty). The second dimension is the impact or total effects generated by the disruption, typically stated in terms of dollars. The traditional approach is to multiply these two dimensions to generate an “expected value,” and prioritize the risks for attention based on the expected value. Using this prioritized list, attention can focus on those areas with the highest expected values.

Managers at Firm B consider these expected values, but they also recognize the importance of what might be called “extreme values.” Certain risks have a very low probability, but extraordinarily high impact in the rare event that they do occur – perhaps threatening the very survival of the firm. Although the expected value of such an event may not be high, the extreme impact, in the eyes of the managers at Firm B, merits special attention. Thus at Firm B, risks with high expected values have a high priority for prevention and mitigation, but so do risks with extreme values for impact on the firm.

Product and Process Standardization

The threats to supply continuity are greatest when the buying organization must deal with a supplier who is a potential bottleneck. Such circumstances often arise when the designers and engineers within the buying organization design and subcontract parts that are unique and that can only be delivered by a handful of suppliers. By definition, such suppliers are a threat to

business continuity since any problems encountered within their operations affect the performance of the entire supply chain. Because they are unique, there are no acceptable substitutes. When faced by such a situation, it is often in the best interests of the buying organization to redesign the product so that a more standard component can be used in place of the current “unique” component. This means that purchasing has to be involved in the design process. It also requires that business continuity concerns be raised and addressed when parts, assemblies, and products are designed. When possible, unique parts are to be avoided; standards are to be actively and constantly encouraged. At Firm B, the percentage of unique components to total components was regarded as a good indicator of potential sensitivity to business disruptions.

Under certain conditions, such threats cannot be avoided. As the managers at Firm B pointed out, when designing and delivering ASIC computer chips, the development time is very long and costs are very high. Under such conditions, it is difficult to have a second supplier. To change the product and its associated items (e.g., software) is often regarded as being too expensive and requiring too much lead-time. Consequently, the risks of dealing with unique suppliers are viewed as being justified.

Developing, Implementing, and Monitoring BCP-Specific Metrics

To maintain visibility of BCP risk within the firm (especially at the top management levels) and to show the impact of policies and procedures aimed at managing and reducing supply chain risk and disruptions, management must develop, implement and report BCP-specific metrics. These must be unique to BCP and they must capture the impact of risk in terms of dollars (a unit of measure meaningful to top management). During the course of the project,

several examples of such metrics were observed. At Firm B, management had developed the Business Interruption Value (BIV) metric as a measure of business risk. While the specific details of this metric and its calculation were considered proprietary and not shared with the research team, it was evident that this metric was being used to develop and maintain an awareness of business risk throughout the firm.

Another metric that was observed in use was Business Interruption Time (BIT). This metric captured and reported the total time lost due to business disruptions. It was expressed in both time and in cost. When dealing with cost, BIT is stated in terms of loss of gross margin plus some extra costs. These costs consider such components as production installation, cost of sale, gross margin, administration, selling, and research and development.

Supplier Risk Profiling

Effective BCP embodies the Pareto Principle – focus on the critical few, not the trivial many. This principle applies as well to supply management. It is in the best interests of the buying organization to develop profiles of high-risk suppliers. These profiles are then used to identify those suppliers that should be monitored on an on-going basis.

Firm A and Firm B employ this practice to varying degrees. At Firm A, the managers interviewed had a very clear picture of such high-risk suppliers. Typically, such suppliers were described as small “Mom and Pop” operations employing less than 75 employees, providing a critical or unique component/service, and with sales less than \$50 million. The managers interviewed justified these traits on the following grounds:

- Being small, these firms were very sensitive to the loss of customer business. This was a major concern during any economic downturn. If they lose a major customer, they may not have the resources to survive the revenue loss, even if it is only temporary.
- Being “Mom and Pop” operations, their systems are often informal and dependent on certain critical personnel. Losing these key personnel (for whatever reason) can adversely and significantly harm and limit the operation of the firm.
- If they provide a critical or unique component/service, that supplier becomes a bottleneck. A problem encountered at the supplier can and will have an immediate impact on the flow of goods and services.

Likewise, at Firm B, the management had identified five traits that were evaluated and monitored when assessing risk in a supplier. These traits include assessing quality levels, technology under development or being invested, financial stability, volume flexibility, and key personnel stability.

Developing and Monitoring *Predictive* BCP Metrics

While profiles of potential high-risk suppliers are important, such profiles, by themselves, are not enough. They must be augmented by predictive metrics. Predictive metrics are measures that are used to identify potential problems before they occur. In the case of BCP, predictive metrics capture supplier behavior that indicates financial distress, which subsequently affects the continued viability of the supplier. If a supplier is no longer viable, then the flow of goods and services provided by that supplier is in jeopardy.

A good example of such metrics could be found in procedures observed at Firm A. Management had identified a series of such metrics, including suppliers offering significant discounts in exchange for immediate payment. For example, if a supplier would approach the buyers from Firm A and offer to accept \$200,000 now rather than waiting for the \$400,000 owed to the supplier over the next three months, this would indicate a supplier who may be experiencing financial difficulties. Such suppliers must now be monitored to determine if the financial problems facing them still exist.

Differentiating Between Current-State Risk and Transitional Risk.

Some risk encountered within supply occurs from the flow of goods and services in the supply chain. Yet, there are some risks that occur because of *transitions* in responsibilities or tasks. The best example of this type of risk was observed in Firm A. Within this firm, many of the products are engineered to order. When dealing with such a product, prototypes have to be built. Typically, small firms skilled in this area do these. These firms often have high levels of knowledge embedded within a few design engineers. After the challenge of the prototype has been met, the production of the prototype part must be passed over to a different firm – a firm that is experienced in larger volume production. This transfer takes place because the skills that are needed by the prototype firm are very different from those encountered in the firm responsible for large volume production. Yet, as the management at Firm A observed, the people who were involved in the prototype production were unable to articulate all of the skills and requirements needed to make the part. Consequently, there were problems and, more importantly, disruptions encountered at the larger volume-production supplier. The management at Firm A is now working at plans and procedures intended to simplify this transition.

Managing Cost and Time of Disruptions

A disruption or break in supply continuity can be envisioned as consisting of three major stages, as described by Firm B (see Figure 2). A disruption begins at the start of the interruption and it ends when production is restored to pre-disruption levels. The disruption's total effects are a function of both time and cost. Any effective business continuity plan must reduce these two effects in each of the stages of an interruption. The first stage, interruption, occurs from the onset of the disrupting event until the system is stabilized. During this first stage, the firm must rely on its suppliers to provide it with timely and accurate communication regarding the event, its magnitude and corrective actions being taken. Even if the problem can be immediately and effectively contained at this stage, the supplier must keep the buying organization informed in order to take appropriate corrective actions – a practice best illustrated by the policies of Firm B. Without immediate feedback, the buying organization can expect to encounter delays and increased costs.

Once the interruption begins, the buying organization must assess the extent of the incident. First, the purchasing organization needs to assess its ability to address the interruption. Then, time is needed by the supply organization to remedy the problems, and the resulting costs of either staying with the existing supplier or sourcing the materials with alternative suppliers.

Response, the second stage, involves addressing the underlying causes and stabilizing the supply flows so that no further deterioration in supply is encountered. This stage is equivalent to “stopping the bleeding after an accident.”

The Stages of a Business Interruption

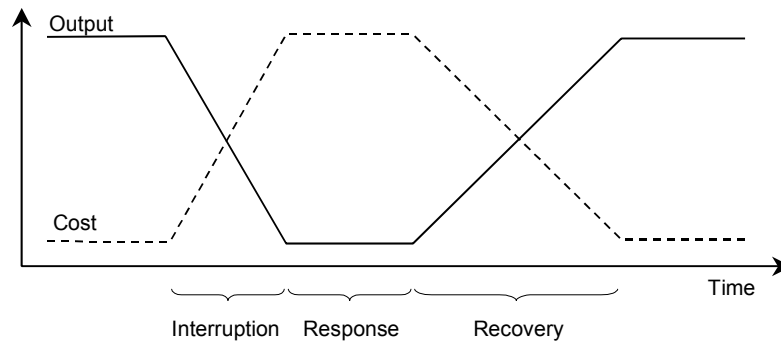


Figure 2. The Stages of a Business Interruption

In the next stage, recovery, the buying organization works to reverse the effects of the interruption and to increase the resulting flows of goods and services. Recovery ends once the production is brought back to the original levels. Each stage has its own set of activities; each must be managed so that the total impact on the firm and its customers is kept to an absolute minimum.

The Risk Register

At Firm A, the “Risk Register” is a standardized tool to aid in the assessment and monitoring of risk in various parts of the firm, as found in Table 1. This tool originated at the corporate level of the organization, with an emphasis on financial risk, and has been deployed to other functional areas, including supply chain management.

The Risk Register has multiple parts, and provides a standard process to drive the assessment and monitoring of risk. The register is reviewed on a regular basis and updated as appropriate. The tool also forces assignment of ownership of each risk and identification of a plan of action to deal with each identified risk. Each of these tools is described in greater detail in Appendix A.

Table 1. Purchasing Risk Register

- Fourteen identified risk categories
 - Assess probability and impact for each – FMECA-type methodology
 - High/Medium/Low rating
 - Expert opinion/consensus
 - Relate each category to a business process
 - Identify an “owner” for each risk
 - Identify actions/control measures for each risk
 - Identify owner for each action/control measure
 - Track progress on each measure
 - Assess probability and impact post-action (“residual”)
- Sole Source Register
 - Identify suppliers and commodity supplier
 - Describe situation – why sole sourced
 - Track progress on risk reduction
- “At Risk” Register
 - Identify specific suppliers who are “at risk”
 - Reason for at risk situation
 - Planned actions for each

Multi-Source Risk Monitoring

Firm A uses multiple sources of information to monitor supply chain risk associated with its supply base:

- Dun and Bradstreet (D&B) to monitor financial statements of key suppliers
- A weekly “media review” that summarizes items that have appeared in the business press regarding any of the firm’s key suppliers

- Commodity team leaders meet twice monthly to discuss key suppliers' health. In addition to D&B ratings and information coming out of the media review, the discussion covers a variety of “soft” indicators – everything from suppliers asking for early payment of invoices to a lack of vehicles in the supplier's parking lot – that might suggest financial stress. As the leader of this group put it, “there's no substitute for ‘face time’ with suppliers.”

Quality Management and Risk Management

Business continuity planning in supply management does not have to be a stand-alone process. Several of the effective BCP practices at the organizations studied were rooted within the philosophies of the firms. For example, Firm C is focused on Total Quality Management (TQM) within their organization. The *Material Supplier Quality Assessment* (MSQA), a tool which emerged from the TQM philosophy at Firm C, has a dedicated section for ensuring supplier business continuity and product flows to Firm C. From this case study, it became apparent that the focus on quality management has direct implications on forming relationships with suppliers, and focusing on continuous improvement, which lead toward ensuring business continuity, both internally and externally. Figure 3 presents a simplified model of how strong supplier relationships lead to continuous improvement, which subsequently leads to ensuring business continuity. With a focus and philosophy on quality, a buyer and supplier can engage in a close relationship that results in continually improving interorganizational processes, which therefore reduces the chance of process failures that result in product flow stoppages.

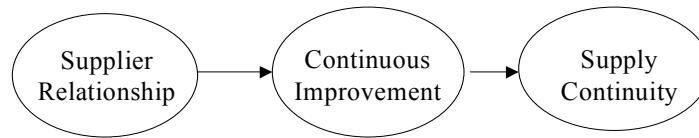


Figure 3. Model of Supplier Relationships and Business Continuity

Importance of Visibility

Another effective practice identified in this study focused on implementing tools that promotes visibility throughout the supply chain. Threats to business continuity from supplier organizations cannot be managed if they are not identified. Visibility throughout the supply chains was important for all three of the case study firms studied. Visibility can be assessed formally through techniques such as the At Risk Register, Purchasing Risk Register, Financial Appraisal Report, and Sole Source Register at Firm A; Supplier Audits, Risk Rating System, and Incident Report Checklist at Firm B; and the IT Contingency Plan and Material Supplier Quality Assessment at Firm C. In addition, informal methods such as frequent communications with suppliers, periodic visits to supplier facilities, and reviewing media reports, can provide visibility to potential supply management problems. Visibility facilitates awareness, which becomes a necessary condition in the BCP for preventing and managing the potential discontinuity of supply, and using the knowledge obtained for preventing or avoiding future supply problems.

Supplier Preparedness as a Part of Regular Supplier Assessment

Firm C includes, as a part of its annual assessment of key suppliers, an evaluation of each supplier's readiness to deal with a disaster or disruption to its business. The assessment includes seven questions related to this issue (see below). Each question is scored on a 10-point scale. In order to meet minimum requirements, the supplier must achieve "Full implementation of source documentation for the requirement and complete confirmed evidence of implementation effectiveness."

- Is there an emergency Disaster/Business Recovery/Business continuity plan established in the Supplier Company?
- Is this plan deployed according to all existing sites?
- Is this plan addressing management succession and identification of key staff?
- Is this plan identifying, for all products delivered to Firm C, a primary source and a back-up source?
- Is this plan identifying all "strategic" materials and equipments and their identical sources of replacement?
- Is there an off-site storage of vital records?
- In case of disaster are there procedures to restart minimum service level and to organize transport to a back-up site?

This practice helps Firm C communicate to its suppliers the importance Firm C places on supply chain continuity. The regular revisiting of these issues in the annual assessment makes supply chain continuity planning a routine part of Firm C's supply base management process.

Supply Chain Continuity as Part of a Larger Strategy

At Firm C, supply chain continuity planning is not a stand-alone issue. Rather, it is viewed as a part of the firm's broader Total Quality Management/Continuous Improvement philosophy. This philosophy drives the firm, and through purchasing's supplier management practices, its suppliers to strive for continuous improvement in performance, quality, and consistency. These efforts result in higher levels of reliability within the supply chain.

Communication is a key element of this approach. Firm C works hard to communicate requirements and expectations to suppliers, and expects suppliers to keep them informed when there may be issues developing. As one Firm C manager put it, the suppliers understand when there's a problem, "... we don't want to read about it first in the newspaper." While the firm has a variety of policies and procedures in place to facilitate this effort with its suppliers, what's really important here is the *relationship*.

Dual Sourcing Policy

Firm C follows a dual sourcing policy for all direct materials. In combination with a structured supplier qualification process, this policy provides the firm with a means to maintain some competitive tension in long-term supplier relationships, and also gives them an "insurance policy" should some unavoidable problem develop with a primary supplier.

Supply Chain Continuity Included in IT Contingency Plans

Firm C has developed explicit contingency plans to deal with an information technology disaster. Several supply chain systems, such as CAD, factory automation, and warehousing systems are among the most critical/highest priority systems for the firm. For each of these

systems, specific steps are defined to minimize the duration of any disruption to the supply chain. The plan also identifies recovery team members and responsibilities.

RESEARCH AGENDA AND ACTION LIST

During the course of conducting this study, the research team became aware of the need for additional work that was beyond the initial scope of the research project. To a large extent, this was not a surprise. BCP is, after all, a fairly new concept and a new approach to managing risk. For every question answered or issue addressed, there appeared to be one or more new questions. Consequently, the research team began to develop an “action list” – a list of questions and research needs that were encountered but not addressed. The following list contains some of the most important items from this “action list.” They are important in that addressing them would yield insights that are interesting, insightful and, most importantly, useful to both researchers and practitioners.

- ***Additional Case Studies investigating BCP are needed.*** In order to gain richer insights to these processes, approximately two to four additional case studies need to be conducted, or at least until a point of data saturation arises (Strauss and Corbin, 1998). We have hired a well-known supply management expert to provide us access to several additional firms.
- ***Craft and administer a survey aimed at identifying and quantifying the current state of practice in BCP.*** The research team is aware of the extensive efforts carried out prior to this study that have focused on surveying typical firms to identify their implementation of BCP. However, these studies have for the most part focused on BCP as it pertains to information systems. They have also limited their sample to primarily North American

firms. Yet, BCP deals with more than simply information; it deals with all the inbound resources needed by the firm. In addition, it became evident to the research team that there was a distinct difference in the way that American and European firms approached the BCP process. Consequently, it is recommended that new, broader surveys be developed and administered.

- ***Craft and administer a broad-based BCP audit.*** Audits are becoming increasingly more important in today's environment. They enable firms and managers to assess their systems and to identify areas where improvements are most needed. They create a sense of awareness. There is a definite need for such a vehicle in today's environment.
- ***Develop and publish Best-in-Class Case Studies.*** It is not enough to have a properly prepared and implemented BCP audit as a means of creating management awareness. The audit must be augmented by a series of Best-in-Class case studies that identify the companies, the development and implementation of their BCP processes, and the subsequent benefits gained as a result of these processes. The firms must be willing to become involved in the process of educating managers. What this means is that they must be willing to answer questions and to host visits from firms and managers interested in BCP.
- ***Identify Appropriate BCP Benchmarks.*** Necessary for developing the audit and the case studies, benchmarks have to be identified, developed and publicized. Currently, there are no real benchmarks. What is available tends to "ad hoc" and situation specific.
- ***Identify Appropriate BCP Metrics.*** Metrics play an important role in every corporation. They report performance; they identify opportunities for improvement; they facilitate

communication. At present, there are few metrics present in BCP. For BCP to really develop as a formal and widely accepted approach to risk management, BCP-specific metrics must be developed.

CONCLUDING COMMENT

Risk is a fact of life. If firms choose to draw on the capabilities and potential offered by supply chain management, then, by necessity, those organizations are exposed to the risks present in the supply chain. Ignoring risk does not make it go away. However, firms can manage and live with risk. A key ingredient in this risk management process is Business Continuity Planning. Like supply chain management, BCP is a relatively new development. Being new and potentially important, there is a need for structured research into this topic. This report represents the initial findings of one such BCP-oriented research project – a project that has focused on how certain firms have managed supply-side risk in the supply chain.

The purpose of this research was twofold. Our first goal was to examine the current status of business continuity planning in supply management. Secondly, this study aimed to understand effective practices in business continuity planning for supply management with regard to processes, tools and techniques for risk assessment, and strategies and methodologies for managing supply risk. The case studies conducted to date have provided us initial insights for understanding these best practices. They have also reinforced the view that while risk cannot be ignored, it can be managed. Failure to manage supply chain risk can have devastating results. Effective BCP is more than simply keeping critical data in more than one spot; it is a structured and formal process that identifies, manages, and reduces all forms and types of supply chain risks.

This study offers intriguing insights into this new development; it also demands more research. No firm that relies on the supply chain can afford to be without a BCP. Yet, if firms and managers are to develop and implement effective and efficient BCPs, they need more insights into this system – insights beyond the scope of this report.

REFERENCES

- Barnes, J.C. (2001). *A Guide to Business Continuity Planning*, John Wiley & Sons, Chichester, UK.
- Fine, C.H. (1998). *Clockspeed: Winning industry control in the age of temporary advantage*. Perseus, Reading, MA.
- Kraljic, P. (1983). "Purchasing must become supply management," *Harvard Business Review*, Vol. 61, No. 5, pp. 109-117.
- Miles, M.B. and A.M. Huberman (1984). *Qualitative Data Analysis: A Sourcebook of New Methods*, Sage Publications, Beverly Hills, CA.
- Strauss, A. and J. Corbin (1998). *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*, (2nd ed.), Sage Publications, Thousand Oaks, CA.
- Scott, C. and R. Westbrook (1991). "New strategic tools for supply chain management," *International Journal of Physical Distribution and Logistics Management*, Vol. 21 No. 1, pp. 23-33.
- Yin, R.K. (1994). *Case Study Research: Design and Methods*, Sage, Thousand Oaks, CA.

APPENDICES

APPENDIX A: Individual Case Study for Firm A

INTRODUCTION

The introduction section describing the effective business continuity planning (BCP) process in supply management for Firm A will begin with a brief company background, a description of the case study execution, and the corporate and supply chain strategy for Firm A. This will be followed by a broad description of the effective BCP process discovered at Firm A. Conclusions of this case study are then drawn.

Company Background

The first case was conducted at the end of January 2003 with “Firm A.” This company is a major supplier of critical components in the aerospace industry, providing vital technology for civilian and military aircraft. The industry is cost and reliability driven, and requires extensive research and development. Their products represent significant cost and safety contributions to the aircraft where they are installed, and require extensive sustained product development efforts, often taking 3-4 years and with total investments of \$500-600 million before returns are realized. Further, supplier-provided components represent approximately 65-80% of the value of Firm A’s products.

The overall business of Firm A is 40% DoD, 40% passenger, and 20% energy/marine. At the main plant visited in the Mid-West United States, they have approximately 4,500 employees, approximately half of them salaried and the other half hourly.

Case Study Execution

The majority of documented reports and procedures associated with BCP in supply management were provided to the research team beforehand. A series of interviews were conducted with several key informants, to include the vice-president of procurement, two purchasing directors, a director for supply chain operations, a director for make vs. buy decisions, a director of finance, two customs compliance managers, a supplier quality development engineer, and a supplier contact engineer. Each interview lasted between 45 minutes to 2 hours. In addition to the initial documents sent, several other examples of business continuity planning processes were provided to the research team during the interviews.

Corporate and Supply Chain Strategy

The purchasing function serves a critical role at Firm A. Key roles in supply management include those performed by commodity buyers, product introduction controllers, operational buyers, plant supplier quality controllers, and supplier development leaders. Key activities of purchasing directors include defining and managing customer expectations, creating operational strategies for make vs. buy decisions, managing product introduction, managing delivery with operations, defining supply chain design, ensuring the correct usage of process, and managing resources for local personnel.

There has also been a greater emphasis on outsourcing to key supplier organizations, particularly due to significant reliance with purchases from suppliers consisting of well over 60% of the overall cost of goods sold. This shift in philosophy in ensuring cost management, as well as quality and reliability, has put a much greater emphasis on managing inbound supply and supplier organizations.

EFFECTIVE PRACTICES

The case study data from Firm A revealed numerous processes and procedures related to ensuring business continuity in supply management. These techniques include 1) a *Purchasing Risk* register, with sub-components of an *At Risk* and *Sole Source* registers, 2) supplier financial appraisal reports, 3) a risk listing for corporate social responsibility (CSR), and 4) the C-TPAT. Each of these practices is discussed below.

Purchasing Risk Register

The *Purchasing Risk* register includes fourteen categories for identifying, assessing, and managing supply risk. Various personnel are responsible for assessing each of the fourteen identified risk characteristics, all of which relate to a specific business process. For example, purchasing directors are responsible for risk characteristics such as supplier financial distress and market imperfections that result in uncontrollable price movements. Each characteristic is evaluated for its probability and impact in qualitative terms of high, medium, or low. Business processes that may be effected are listed, as well as the individual responsible for addressing the risk. Actions for managing and controlling the risk are then provided and tracked. After management/control measures are established, a residual risk effect is again qualitatively estimated for probability and impact. A modified purchasing risk register is provided in Table A-1, with an example of one of the fourteen risk characteristics provided in Table A-2. Two important parts of the *Purchasing Risk* Register are the *At Risk* Register and *Sole Source* Register, which are described next.

The *At Risk* register documents specific suppliers that are identified as posing a risk in meeting Firm A's purchased requirements. Risk factors include financial problems such as the filing of Chapter 11, dependency on the supplier firm, business consolidation, and location issues. Information in the *At Risk* register is provided for specific supplier organizations and by group. Criteria evaluated in the *At Risk* register include if a dual source exists, if there is a planned exit of the relationship, if an acquisition of the supplier is planned, the date of when the supplier was identified at risk, lead time for the purchased items, if engineering drawings are available, and if engineering approval was completed. An example of an *At Risk* register is provided in Table A-3.

One threat to business continuity comes from sole supply sources. When only one supplier is available, either through a monopoly supply market or a conscious decision to use a single source due to the significant expense of tooling, it becomes critical from Firm A to ensure continuity of supply. The *sole source* register, as shown in Table A-4, identifies the suppliers and commodities that are considered sole sources, describes why they are a sole source, and tracks the progress of Firm A in reducing the risk associated with that supplier.

Table A-1. Purchasing Risk Register

Risk No.	Title	Initial Risk Prob	Initial Risk Impact	Business process	Risk Owner	Residual Risk Prob	Residual Risk Impact
1	If suppliers are in financial distress then delivery will be impacted	h	m	Supplier Network	Purchasing Directors	m	m
2	If suppliers have quality problems then delivery will be impacted	h	m	Supplier Network	Supp Quality Director	m	m
3	If key suppliers become totally incapacitated then delivery will be impacted	l	h	Supplier Network	Purchasing Directors	l	h
4	If there are volatile movements in base materials and alloys then cash will be affected	h	m	Manage Cash	Finance Director	m	m
5	If there are Market imperfections then there will be uncontrollable price movements	h	m	Supplier Network	Purchasing Directors	m	m
6	If key suppliers fail to generate sufficient cost reduction then FYC profit and cash levels will not be achieved.	m	h	Dev Supp Chain Performance	Purchasing Directors	m	h
7	If SAP / ERP data is incorrect, then we will be unable to manage our tasks and meet our commitments	h	h	Fulfill Orders	VP Supply Chain	m	m
8	If there are skill shortages within Purchasing then the FYC will be impacted	h	h	People & Knowledge	Human Resources	m	m
9	If we do not pay suppliers on time then the FYC will be affected.	h	m	Manage Cash	Finance Director	m	m
10	If there are sudden changes in load then supplier performance will be impacted	m	h	Plan the Business	VP Supply Chain	m	h
11	If the supply base is not restructured and parts transfers not correctly managed then the FYC will be impacted.	m	m	Create Customer Solutions	Purchasing Directors	m	m
12	If design changes are not implemented correctly then supplier cost reduction performance will be impacted.	h	h	Create Customer Solutions	Purchasing Directors	h	h
13	If we fail to align reward to business and personal performance then objectives will be less likely to be met	m	m	People & Knowledge	Human Resources	m	m
14	If supplier Diversity goals are not achieved, we will not be awarded government contracts.	h	h	Manage Cash	Purchasing Directors	m	h

Table A-2. Risk Example

Risk 1. Actions			Initial	Residual
Risk Description – If suppliers are in financial distress then delivery will be impacted.		Probability: Impact:	High Medium	High Medium
Background - Changes in economic factors, supplier capability, or in Firm A or other key customer workload and dependency, may increase the risk of suppliers becoming insolvent. This may expose us to ransom demands or disruption should the supplier go into receivership / Chapter 11.				
Actions / Control Measures	Owner	Date	Status	
Identify high risk suppliers (using D&B ratings and intelligence from supplier visits.)	Supplier Intelligence	Ongoing	Green	
Supplier risk assessments of top 100 suppliers, private companies and suppliers difficult to switch.	Purchasing Executives	Ongoing	Red	
Bi-Annual financial appraisals of top 100 suppliers plus ad-hoc as needed.	Supplier Intelligence	Ongoing	Green	
Consolidation of supply base.	Purchasing Director	Ongoing	Amber	
Quarterly Risk meeting	V.P. Supply Chain	Quarterly	Green	

Table A-3. At Risk Register

Supplier	Risk	Dual Source	Planned Exit	Brokered Acquisition	Date	Lead Time (Weeks)	Drawings Available	Eng Approval	Action
A	Chapter 11	✓	▪	▪		22	✓	✘	Dual sourcing
B	Chapter 11	▪	✓	▪	1-Aug-02	36	✓	✓	Dual sourcing
C	Vol dependency/ Financial			▪		18	50%		60 days to 30 day payment
D	Financial (Chapter 11)	✓	▪	▪		4	✓	✓	
E	Financial	▪	▪	▪		36			Research and development parts
F	Financial	▪	▪	▪	31-Dec-02	10			Review of business by YE 2002
G	Vol dependency		▪	▪	▪	▪	▪	▪	Manage via integration
H	Vol dependency		✓	▪		1	✓	✓	Bulk of exit completed
I	Vol dependency		✓	▪		26-52	✓		Exit plans underway
J	Business Consolidation		▪	▪	▪	▪	▪	▪	Watching Brief
K	Location	✓	▪	▪	-	32	✓	✓	Watching Brief
L	Location	✓	▪	▪	-	12	✓	✓	Watching Brief
M	Location	✓	▪	▪	-	12	✓	✓	Watching Brief
N	Exiting Business		✓		2-Dec-02	6	✓	✓	D Blood leading exit

Table A-4: Sole Source Register

Source	Commodity	Supply Chain	Progress	Progress
Supplier AA	Fan & Compressor Systems	Machining	Milling process on Fan cases is unique to Supplier AA. Machining options are being investigated	
Supplier BB	Fan & Compressor Systems	Kevlar	High switching costs mean high cost to existing engine programs, but it is unlikely that kevlar wrapping of the fan case will be used on future engine designs	
Supplier CC	Nacelles & Externals	Fan Cowl Doors	Dual source would require re-certification and tooling at a cost of \$50m. This would be hard to justify on low volume parts.	Questionnaires sent out, chasing response. Visits to suppliers in February, BCP will be discussed.
Supplier DD	Nacelles & Externals	Exhaust Components	Dual source would require re-certification and tooling at a cost of \$50m. This would be hard to justify on low volume parts.	Questionnaires sent out, chasing response. Visits to suppliers in February, BCP will be discussed.
Supplier EE	Finished Components	Composites	Dual source would require re-certification and tooling at a cost of \$50m. This would be hard to justify on low volume parts.	No further progress
Supplier FF	Transmissions & Installations	Bearings & Gearboxes	Currently single source of supply. Mitigation to develop second source is undergoing, but commercially sensitive at this time	Business continuity review as part of the supply management documentation process scheduled for 14th Feb.
Supplier GG	Transmissions & Installations	Bearings & Gearboxes	Bearing and Gearbox designs are owned by suppliers as part of the certification process. Resource times are in excess of 2 years.	Business continuity review as part of the supply management documentation process scheduled for 1st May.
Supplier HH	Transmissions & Installations	Bearings & Gearboxes	Bearing and Gearbox designs are owned by suppliers as part of the certification process. Resource times are in excess of 2 years.	Business continuity review as part of the supply management documentation process scheduled for AP3.
Supplier II	Turbine Components	Castings	Bearing and Gearbox designs are owned by suppliers as part of the certification process. Resource times are in excess of 2 years.	Supplier II have no disaster recovery plan in place currently.
Supplier JJ	Turbine Components	Surface Finishing and Coatings	Only aerospace supplier who can supply very large complex titanium and steel castings at the required level of quality and technology	

Supplier Financial Appraisal Report

One area considered important in Firm A for ensuring the inbound flow of goods and services is appraising the financial strength of suppliers. If a supplier is having cash flow problems, it can result in either poor performance or even the loss of business. Firm A tracks supplier financial performance two different ways. One method used is a “Media Review.” This weekly form, compiled by the Finance Director and distributed throughout the organization, disseminates potential financial problems of supplier organizations as obtained in the public press. An example of this form can be found in Table A-5.

Another technique used by Firm A in assessing supplier financial risk to ensuring business continuity is the use of financial appraisal reports. These reports provide financial information about suppliers such as growth and profitability ratios, dependency ratios, liquidity and working capital management, gearing, and an overall financial rating of the supplier. The results of this analysis are provided in summary form, as found in Table A-6.

Table A-5. Financial Appraisal Example

Date: June 30, 2003

Ref: Fin App 784

FINANCIAL APPRAISAL

“Fly-Right” Corporation

REASON FOR REQUEST

Various Global sourcing strategies

PRINCIPAL ACTIVITIES

Fly-Right corporation is a leading supplier of innovative products and services to the aerospace, defense and space industries around the globe.

NOTES

The financial year-end for this company is December and financial statements to December 200X have been analyzed.

SIZE, GROWTH & PROFITABILITY

The company has turnover in the region of \$735m and has been growing rapidly for the past five years. A major consequence of this increased growth has included increased interest commitments and poor cash flow as capital has been injected into the businesses infrastructure and R&D activities. Over the same period profitability has dropped from 13.5% in 1996 to 9% in 2000; however, it should be noted that absolute profits have risen from \$22m to \$38m in the same period.

During 1999 Fly-Right increased its capacity through various minor acquisitions and major investment in capital equipment. The fixed asset base rose from \$163m to \$358m in this period.

LIQUIDITY

Liquidity refers to whether the company has enough cash to pay its short-term debts if they all become due at once. Firm A prefers suppliers to have a current ratio of no less than 1.4 and a quick ratio, which excludes stock, of no less than 1.0.

Fly-Right's liquidity is poor and over the past two years has worsened. This is generally in relation to increased interest charge on debt used to fund the above-mentioned capital investment. The company is reliant upon an overdraft in the region of \$62m; it would appear that this credit line has also increased dramatically over the last two years. Current and quick ratios are 1.2 and 0.5 respectively.

GEARING

Gearing refers to how far the company is financed by debt rather than shareholders. If there is too much debt, then a business may not be able to borrow enough extra capital to expand. Firm A prefers its suppliers to have debt to asset ratios of less than 40%.

Fly-Right is geared at around 34%, however this does not take into consideration the overdraft and credit facilities they have with their bank. It is unlikely that Magellan would be able to access a great deal more debt finance at present until their cash flow and current debt levels improve.

CONCLUSIONS

Fly-Right has grown their business well and as an ever-increasing presence in the aerospace industry is beginning to reap the rewards of aggressive investment and acquisition activities. The company's cash management is poor and the over-reliance upon an overdraft has the obvious consequences on profit and liquidity. From a negotiation point of view, Fly-Right are still making pre-tax profits of around 10%, if Firm A is to have any degree of buying power over this supplier, this fact could be a leverage point in negotiations.

ACTIONS

Table A-6: Media Review Example

Supplier Q

- Supplier Q has completed the disposal of a business unit to an Electronic firm. The move is part of a major strategy to organize the business around their Aerospace and Defense businesses. Supplier Q has not confirmed what it intends to do with the cash generated from the sale of this business, but it is likely that it will be used in further capital investment or to repay outstanding loans.

Supplier Q Press Release

[By selling part of their industrial business, Supplier Q is further reliant upon the aerospace market. Supplier Q may be more receptive to Firm A's demands due to their exposure to Aerospace markets, this may be of strategic advantage.]

Significant Supplier Appraisals Completed this Week

- Alloy supplier [*This company is a rising star and looks set to take the number one position from a major rival*]
- Supplier X [*Looking good and indications are that the company will be able to manage itself through the next couple of years*]
- Energy Supplier [*mainly an Energy supplier. They have been doing well, but liquidity and debt are a concern.*]

If you require a copy of these appraisals please contact Mr. "Brown"

Receiverships and Bankruptcies registered this week

- None registered this week.

Corporate Social Responsibility (CSR) Risk Listing

One of the underlying philosophies of Firm A is to ensure corporate social responsibility. No single definition of CSR exists at Firm A. However, the intent and meaning of CSR are best explained in the following excerpt from documentation at Firm A.

“Investors and other stakeholders are increasingly evaluating the present and future health of a company on issues such as brand strength, a company’s approach to managing its impact on the environment, and how it manages its reputation with customers, suppliers and employees. These topics are often labeled under the umbrella of Corporate Social Responsibility (“CSR”). However there is no single definition for CSR and its scope and impact is peculiar to each organization.”

As evident in the excerpt above, supply management is an important facet for Firm A in supporting CSR. This philosophy has a trickle-down effect throughout Firm A, its customers, and overall stakeholders. Business continuity, to include that of supplier organizations, is an essential element in CSR. Risk from numerous sources, including customers, internal, environmental, and inbound supply, threatens business continuity, and is constantly evaluated by Firm A. The manner in which risk sources are ranked by Firm A to ensure business continuity is described in Table A-7. The practice for describing, assigning responsibility, and treating risk is presented in Table A-8.

Table A-7: Criteria for high, medium and low likelihood and consequence

<u>Likelihood</u>	
High	Greater than 25% likelihood
Medium	Between 10% and 25% likelihood
Low	Less than 10% likelihood
<u>Consequence</u>	
High	Greater than \$1m impact on cost or, Leads to uncontained quality failures with customer impact, or Greater than 3 months delay or interruption to business, or Firm A publicly highlighted as not meeting legislative or regulatory requirements
Medium	Greater than \$100k impact on cost or, Leads to uncontained quality failures, or Greater than 1 months delay or interruption to business or, Firm A publicly highlighted as not meeting legislative or regulatory requirements
Low	Less than \$100k impact on cost or, Adversely impacts existing quality measures 1 - 3 week delay or interruption to business Firm A operates to industry norms but does not operate best practice

Table A-8: Risk Listing in CSR

Description of event If.....	Description of consequence Then.....	P	I	Ranking	Risk & Treatment Status	Residual Risk
Firm A has no policy or standards for CSR in the supply chain	There is increased risk of an incident, particularly in emerging markets, that makes it difficult to identify and address problems, we may receive adverse publicity and be perceived as socially irresponsible and environmentally ambivalent, it will be difficult to create positive stakeholder perceptions.	M	H	3	Risk is currently medium as Health and Safety, integrity, gifts, confidentiality, conflict of interests and ISO14001 are already covered either in the Purchasing Quality manual. Creating a common Code of Practice in the Purchasing Quality Manual and adding items on Compliance with Laws and Treatment of Suppliers will provide further improvement and clarification for internal and external stakeholders.	Training and awareness of purchasing personnel and suppliers
Labor exploitation, abuse of local communities/ quality of life/ resources or child labor are highlighted in any of our suppliers	There may be damage to Firm A's reputation or criticism from stakeholders	L	H	5	Probability is considered Low as ISO9000 approval is independently audited and requirement for use of aerospace materials, processes, record keeping and surveillance (by both Firm A and regulatory authorities) requires high level of training and experience in suppliers. When Code of Conduct is published conduct risk assessment to identify high risk suppliers	Need to include as part of regular risk management
We use suppliers in countries with low standards on labor and HSE and known problems of exploitation	There may be damage to Firm A's reputation or criticism from stakeholders	H	H	2	Risk is high as currently CSR issues are not assessed when placing work overseas. Conduct risk assessment to identify counties and suppliers/JV's at risk and create mitigation plans as necessary	Need to include as part of regular risk management

Description of event If.....	Description of consequence Then.....	P	I	Ranking	Risk & Treatment Status	Residual Risk
If we continue to source in counties with dubious regimes or poor human rights records	We will be perceived as being weak on CSR and political or public pressure may close or embargo sources e.g. cobalt from Zaire	H	H	2	Risk is high as currently CSR issues are not assessed when placing work overseas. Conduct risk assessment to identify counties and suppliers/JV's at risk and create mitigation plans as necessary	Need to include as part of regular risk management
Stakeholders demand CSR in the supply chain and Firm A has no policy or are invisible	We could loose customers or be seen to be hiding something	L	L	10	Currently there is little pressure for CSR in the supply chain, or evidence that it is a competitive threat or advantage. Addressed by Risk 1 -4	Need to ensure on going policy satisfies stakeholders
We are not aware of CSR incident or are drawn in to a supplier problem and don't have a CSR policy that addresses the most likely issues	We will be unable to react to a CSR based crisis and deal with stakeholder criticism and perceptions and manage bad news in the supply base	H	H	2	Risk is high as current assessment and reporting concentrates on quality, cost, delivery and reliability. Actions for Risks 1 - 4 will raise awareness, need to include Code of Conduct on future assessment criteria	Suppliers not advising us of potential or actual incidents
The global nature of the organization and supply chain	Drives longer working hours due to time differences	M	M	4	Working hours not reducing, need to keep under regular review by all management	EU legislation on working hours

U.S. Customs-Trade Partnership Against Terrorism Act (C-TPAT)

The C-TPAT is a joint government-business initiative to build cooperative relationships that strengthen overall supply chain and border security. Customs has been asking businesses to ensure the integrity of their security practices and communicate their security guidelines to their internal and external business partners within the supply chain. Firm A was contacted directly by U.S. Customs and asked to make an application for participating in this program. Case study participants believe that U.S. Customs will take a negative view on large corporations who choose not to participate, and its ramifications can include potential delays of imported purchases at Customs due to additional inspections.

Firm A, at the time of the case study, was conducting a comprehensive self-assessment of their internal supply chain security using the C-TPAT guidelines which address procedural security, access controls, manifest procedures, and conveyance security with logistics, physical security with facility management, personnel security with human resources, document processing with information technology, and education and training programs to promote supplier awareness. Suppliers will be required to document internal controls for the selection of their foreign suppliers, and provide financial assessment processes to determine supplier business viability.

CONCLUSIONS

Findings from the case study of Firm A reveal that business continuity in supply management is addressed through both formal and informal mechanisms. The vast majority of direct purchases at Firm A are highly technical in nature, characterized by a supply market consisting of a handful of qualified suppliers who have worked with Firm A for a period of time.

A recent directive of Firm A is the reconfiguring of its supply chain structures upstream. Specifically, this will require suppliers to serve more as integrators. As a result, many prior first-tier suppliers are now becoming second-tier supply sources. The results of this corporate strategy are evolving to an improved emphasis on supply management, and greater reliance on supplier organizations to ensure the effective and efficient use of supply chain resources, and closer relationships with those remaining first tier suppliers. In this manner, business continuity is addressed informally through strategic supply chain management.

On the other hand, Firm A, through the use of formalized protocols, also addresses business continuity in supply management. The tools created and utilized by Firm A to ensure business continuity are managed at different organizational levels and functions. For example, supplier financial information is gathered and analyzed by financial experts, supplier quality issues by quality engineers, and sourcing issues by procurement directors and managers. Many of these techniques, such as CSR and the *Purchasing Risk* register, have been in place for only a short time. In addition, these protocols for ensuring business continuity are often generated at the corporate level, and tailored to meet the unique facets of the business unit that participated in this study.

From further discussions with key informants, it appears that business continuity is just one of many proactive supply management activities established at Firm A. Additional strategic initiatives at Firm A include the extensive use of target pricing/ target costing, early supplier involvement, and supplier development. Therefore, it appears that business continuity planning may not be a stand-alone process, but instead is an important building block for having a world-class supply management function. The ability for many firms, including Firm A, to ensure continuity of inbound supply is a critical first step for creating value and a competitive advantage

in the marketplace. In looking at the classic input – conversion – output model, how can organizations meet or exceed their customer requirements if there is no “input” in the first place?

APPENDIX B: Individual Case Study for Firm B

INTRODUCTION

Firm B is one of the largest supplier of mobile systems in the world. Currently, the world's 10 largest mobile operators are among the customers of Firm B and some 40% of all mobile calls in the world are made through the systems provided by Firm B. Firm B strives to provide total solutions covering everything from systems and applications to services and core technologies for mobile handsets. This position is reflected in Firm B's mission statement:

Our mission is to understand our customers' opportunities and needs and provide communication solutions faster and better than any competitor. In doing so, we shall generate a competitive economic return for our shareholders.

Consistent with this focus on a total solution, Firm B provides the following products and services:

- Mobile systems
- Multi-service networks
- Enterprise Services
- Transmission and transport technologies
- Mobile platforms
- Power modules
- Network technologies
- Microwave systems

Firm B targets operators and service providers from around the world with end-to-end solutions in mobile and broadband Internet. Firm B has a presence in more than 140 countries, where it employs some 61,000 personnel (a major reduction in personnel levels from some five years ago). To improve its position in the cellular hardware market, Firm B has recently entered into a joint venture with a major multi-media company.

Firm B is now facing a significant shift in customer demand. A new market is emerging – a market that consists of developing countries. It is difficult to forecast the demand in these markets because requirements can emerge quickly without any prior warning. This occurs because developing countries make large investments in their infrastructure during a very limited period of time. Yet, the size of this demand makes it very attractive.

Corporate and Supply Chain Strategy

Firm B is currently undergoing a major transformation. Nowhere is this transformation most evident than in the increasing importance being played by suppliers and the supply chain. Prior to this change, most activities were vertically integrated (i.e., product design, manufacturing, installation, and support). This change can be attributed, in part, to the increasing rate with which new products were being demanded and introduced in the marketplace. Simply put, Firm B was previously not able to respond quick enough to market changes when relying on its in-house capabilities and capacities. Consequently, a strategic decision was made to outsource more activities. This strategic refocusing has allowed Firm B to downsize and to channel its activities into its core competencies, which is developing mobile technology and platforms. Activities now outsourced include Research and Development and Information Systems/Information Technology activities. As a result of these outsourcing activities, the 65 factories that were run by Firm B beginning in the 1990s have been reduced to less than 10. Currently, it is feeling of the managers interviewed that there is very little left to “lean out.”

BUSINESS CONTINUITY PLANNING AT FIRM B

The assessment of the Business Continuity Planning (BCP) System at Firm B took place over a two-day period. During this time period, the research team interviewed 10 managers who were involved either with BCP, products, or supply chain management. These managers were drawn from such areas as Electronics (i.e., memories, passive resistors, Printed Circuit Boards, ASICS), business processes, Supply Chain Development, Risk Treatment, Incident Management/Handling, Risk Assessment, Business Continuity Planning, and Dimensioning Management. These managers provided the research team with a complete picture of BCP at Firm B. They also shared with the research team documentation pertinent to BCP.

The Origins of BCP

There were several factors that contributed to the development of BCP at Firm B. Currently, business continuity planning can be best described as a journey that is now just finishing its fifth year. This journey was initiated by the insurance market. In Europe, it was common practice for firms to protect themselves against possible disruptions to their activities from supply side problems by “buying” business insurance. Over time, those firms offering this insurance became aware of the full costs that could be incurred by such disruptions. Consequently, they forced firms such as Firm B to assume more of the responsibilities for identifying and managing the risks present in their supply chains. In addition, this “pressure” from the insurance market encouraged the management at Firm B to take a long-term perspective in risk management.

One of the first activities undertaken by the management at Firm B was the implementation of an audit of risk – an audit that focused on bottleneck suppliers. The focus in these initial audits was on facilities, equipment and tooling. This audit was complicated by the fact that the

equipment and tooling were owned and designed by Firm B but located in the supplier's operation. The audit involved everyone in Firm B, from top management down. As a result of this audit, the management at Firm B implemented a strategy of having at least two suppliers for every product, even though this approach ran counter to the movement towards single sourcing that was emerging during this same time.

The second was the Millennium Project that took place from 1998 to 1999. This project reviewed all internal suppliers. The critical question asked was that of identifying what the consequences to Firm B would be if there was a problem at the supplier. This project was critical because it formed what is essentially a BCP impact statement. This statement explicitly identified the implications for the firm if the supply chain system did not work. It also forced the company to explicitly identify what backup systems were available and what backup systems should be available.

A second factor that caused the management at Firm B to become aware of the need for BCP is an incident that occurred in 2000. One of the major suppliers for Firm B experienced a major disruption in supply. This supplier also worked with one of Firm B's major competitors. The supplier assured both Firm B and its competitor that this disruption would not adversely affect them. Firm B took the supplier at its word; its competitor did not. The competitor quickly determined that the nature of the disruption was more severe than initially indicated. Within 48 hours, it had identified replacement suppliers and able to readjust its supply flows. Firm B, in being slow to react, found itself unable to secure the necessary replacement suppliers. This failure had a significant negative strategic and financial impact on Firm B. This became a lesson to the management – it was something that top management indicated that they did not want to experience again.

The third factor emerged from supply chain mapping. In the process of mapping its supply chain, the management at Firm B became aware of two factors. The first was that the various supply chains were simply too complex and consequently subject to problems. The second factor was the awareness that many of its suppliers were not as capable as Firm B. As a result of these factors, the management at Firm B began to develop and implement the elements of BCP beginning in early 2000.

BCP AT FIRM B

Business Continuity Planning in this firm is a formal company-wide system that attempts to continuously to identify, quantify, and appropriately manage supply-side risk. It is a system that draws on a number of techniques and approaches. It makes extensive usage of audits, which are part of its risk assessment procedure. This audit is sent to suppliers and is done by the suppliers. It covers 26 items, using a 0-3 scale, as shown in Table B-1.

Table B-1: Supplier Audit Areas

Management systems	Buildings	Critical equipment and tools	Computer rooms
Risk management policies	Resource shortages	Service and maintenance	Interruption handling
Risk management organization	Fire prevention	Spare parts	Business continuity plans
Audits and inspections	Extinguishing equipment	Bottlenecks	Crisis organization
Natural hazards	Site protection	Employees	Incident handling
Man-made hazards	Handling of chemical products	Information security	
Secure sourcing	Disturbances	IT platforms	

While self-assessed by the suppliers, the results have to be interpreted by management at Firm B (a potential limitation). Suppliers were noted to be very positive to the audit and its use. This audit is relatively new and it has been given primarily to critical (“red”) suppliers.

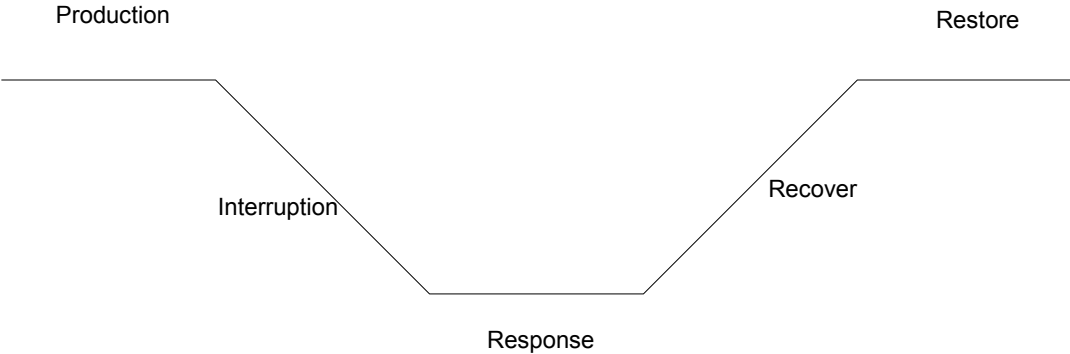
In addition, the BCP system is broad in that it seeks to manage the four major segments of a supply-side disruption (see Figure B-1). For each stage of the disruption, the BCP is designed to reduce or minimize the two major dimensions: duration and impact. This minimization objective is very evident in the strategies, tactics, and systems observed in Firm B.

The BCP system recognizes that supply-side risk is affected by the relationship between the number of suppliers and the number of customers, and that in some conditions the acceptance of risk is economically justified. The level of supply-side risk is highest in those cases where there is one supplier serving one customer. There exist certain conditions when these risks cannot be avoided. For example, when dealing with ASIC components, the development times are long and very costly; it is very difficult to justify having a second supplier. Risk is also very high when dealing with those products where a product redesign requires extensive changes and

incurs major costs. With these products, there typically is one supplier (and only one supplier) working with many customers.

Firm B recognizes that supply-side risk runs, from highest to lowest, by 1) single source, 2) second source, and 3) secured source. The secured source is a critical concept. It is not enough to have multiple sources. Rather, what the management at Firm B found was that it was important to have a supplier with a secure sourcing planning, including regularly updated Business Continuity Plans. Included in this planning, the supplier must provide a back-up site, with resources identified and dedicated to this by each relevant site. Secured suppliers are responsible for keeping Firm B aware of any changes to these plans, identifying backup sites and the key personnel involved, reporting when key personnel leave and the actions that have been take to cover their responsibilities, and for reporting of all incidents and the precautionary actions taken to protect Firm B against disruptions.

Figure B-1: The Four Stages of an Interruption



To communicate the degree of supply-side risk, the management at Firm B developed and implemented a Risk Rating System, as shown in Table B-2.

Table B-2: Risk Rating System

Rating	Description
Green	Part source from two or more fabs
Yellow	Part qualified in more than one fab
Orange	Process is qualified in more than one fab
Red	Process in qualified in only one fab

For “red” rated suppliers and products, Firm B has developed a policy of having greater reliance on buffer stocks when it is not possible for the supplier to qualify parts and processes in more than one fab.

When managing supply-side risk, one feature that has helped Firm B gain better control over the risk is that the linkage between the suppliers and Firm B begins at the top managerial levels. Another factor facilitating supply-side risk was the practice of having one person responsible for contact with the supplier. This person – the “single throat to choke” – is held accountable for reporting any disruption that could affect supply. On the supplier side, it is expected that key personnel should be appointed and reasonably trained on Firm B specific requirements.

Supplier risk is reviewed on a regular basis. Currently, the management has developed an Excel spreadsheet that is linked to supplier color (green/yellow/orange/red) that consists of 13,000 rows (unique part numbers) and 14,000 interactions (suppliers*components*risk). This spreadsheet is reviewed four times a year, and updated on an “as needed” basis. Overall, management recognizes that while this is a very time-consuming activity, it is nevertheless necessary.

Two critical elements of the BCP system at Firm B involves the use of supply chain mapping and the movement towards common components/standardization. At present, the

supply chain has been mapped up to the fifth tier supplier. In addition, Firm B has recognized that the presence of unique components or parts increases the sensitivity to risk. Consequently, there is a movement to encourage the use of standard/common parts or components and modular bills and designs.

Finally, the BCP system emphasizes immediate reporting of any incident, irrespective of how minor it is. All incidents are categorized using a checklist containing the following items that can be found in Table B-3.

Table B-3: Incident Reporting Checklist Items

Information to risk manager	What can the supplier do for us
Letter to supplier	What is needed during the next three months, etc.
Actions taken by supplier	Check spot market
What is our position at the supplier (if or not preferred customer)	Check if there is possible components from other manufacturers
Supplier’s customers	Allocate material

The next step for BCP at Firm B involves the development and implementation of a series of BCP-related metrics. One of the metrics discussed was BIV or the Business Interruption Value. This was used as a measure of business risk. This is currently at the early stages of development, but cannot be explained in detail due to confidentiality agreements.

EFFECTIVE PRACTICES AT FIRM B

In reviewing BCP at Firm B, the following activities were deemed to be examples of effective practices:

- The *audit* is critical element in creating awareness of supply risk, its nature, and the current state of preparedness. The audit is intended to provide everyone within the supply chain a baseline that captures the following information:
 - What types of potential risks to the supply chain exist within the specific supplier being evaluated?
 - What are the implications of these risks (as measured in terms of time, money, output)?
 - To what extent does the supplier have secured processes (i.e., alternative backup processes that have been proven to perform as expected and are considered to be viable and acceptable substitutes for the existing process, should it fail)?
 - What is the current state of preparedness on the part of the supplier in dealing with these risks?
 - To what extent are these risks controllable?
 - Which types of risks are the most important (and why)?
 - What actions does the supplier intend to implement in dealing with these risks?
 - What is the buying organization going to do to deal with this risk?

- *Supply Chain Mapping* is a necessary requirement for BCP. One of the major objectives of supply chain mapping is to not simply graphically describe the structure of the supply chain but to help identify critical or bottleneck suppliers within the supply chain. Such suppliers, as pointed out by the management of one of the firms visited, are often encountered at the second and third tier. Once these suppliers have been identified, they can be monitored and appropriate corrective and contingency plans put in place.

- The buying organization's success in BCP depends on its *power* relative to the suppliers. The ability of Firm B to influence the plans and actions of the critical suppliers is influenced by the "power" of buyer. This power is influenced by factors such as:
 - The time commitment of the order (the longer the order or contract covers, the greater the power).
 - The volume in the contract (the larger the volume, the greater the buyer's power).
 - The attraction of being a supplier to the buying organization (the more attractive the buying organization is as a buying organization, the greater its power).

This last factor was very important to Firm B. Many suppliers that want to have Firm B as a customer are willing to participate in the BCP system.

- When possible, *standardize*. The threats to BCP are greatest when the buying organization must deal with a supplier who is a potential bottleneck. Such suppliers are generated when the designers and engineers within the buying organization design and subcontract parts that are unique and that can only be delivered by a handful of suppliers. By definition, such suppliers are a threat to business continuity since any problems encountered within their operations affect the performance of the entire supply chain. Because they are unique, there are no real substitutes for them. When faced by such a situation, it is often in the best interests of the buying organization to redesign the product so that a more standard component can be used in place of the current "unique" component. This means that purchasing has to be involved in the design process. It also

requires that business continuity concerns be raised and addressed when parts, assemblies, and products are designed. When possible, unique parts are to be avoided; standards are to be actively and constantly encouraged.

Under certain conditions, such threats cannot be avoided. As the managers at Firm B pointed out, when designing and delivering ASIC computer chips, the development time is very long and the development costs are very high. Under such conditions, it is difficult to have a second supplier. To change the product and its associated items (e.g., software) is often regarded as being too expensive and requiring too much lead time. Consequently, the risks of dealing with a unique supplier are viewed as being justified.

- After each supply-side disruption, carry out a *post-mortem*. When a disruption in the supply occurs, for whatever reason, this is a strong indication that something went wrong and that the existing plans and contingencies may not have been adequate. Even if the plans were adequate and the effects of the disruption were minimal, management must review what happened and carry out what is essentially a post mortem. This review must identify the positive (what went right) and negative (what went wrong) aspects of the existing plans and actions. Based on the review, the existing Business Continuity Plans must be revised with the goal of addressing the deficiencies while simultaneously keeping the strengths of the existing plans and tactics.

DISCUSSION

In reviewing the BCP at Firm B, several practices were flagged as being interesting:

1. Lack of supplier involvement in the audits. As previously noted, the suppliers completed the audits. Yet, Firm B interpreted the audits and action lists were created without any real supplier involvement. This lack of involvement is interesting for several reasons. First, the potential inputs and insights offered by the suppliers are not available to the management of Firm B. This could influence the effectiveness and efficiency of the resulting BCP. Second, without supplier involvement, the issue of the extent to which the suppliers have really “enrolled” in the resulting BCP system must be questioned.
2. The emerging importance of metrics. The latest activity being undertaken by the management at Firm B focused on the development of metrics. Metrics are important since they help create awareness on the part of top management for understanding the impact of BCP activities on managing risk. The metrics also help capture the potential impact of disruptions on the performance of the firm (further enhancing the ability of metrics to create awareness). This issue should be monitored and studied in future studies.
3. The emphasis on impact of supply-side disruptions rather than on probabilities and impact. When describing a risk within the supply chain, the managers identified two critical dimensions. The first is the probability, which captures the likelihood of a disruption occurring. This dimension is typically stated as a value ranging between 0 (a disruption will never occur) to 1 (the disruption will take place with complete certainty). The second is the impact or total effects generated by the disruption. Typically this

dimension is stated in terms of dollars. The tendency is for most managers to multiply these two dimensions to generate an expected value and to rank order the expected value of a disruption from highest to lowest. Using this prioritized list, attention can then be focused on those areas with the highest expected values. However, as the managers clearly demonstrated at Firm B, this approach is fatally flawed. In reality, probability assumes two values – 0 (the disruption did not occur) and 1 (the disruption did take place). Consequently, attention must be focused on the size of the impact. It is the impact and its effects on the buying organization and its operations that must be measured and evaluated. A disruption that threatens the survival of the buying organization, even though it has an extremely small probability of taking place, is far more important than a disruption that has a higher probability of occurring but that has a minor impact. The management of the buying organization must be able to answer the question, “Can we absorb the costs generated by this specific disruption, should it take place?” The larger the impact of a disruption at a specific supplier, the more critical the supplier becomes and the more important that the buying organization develop and implement plans and programs aimed at reducing the impact of a disruption at that specific supplier.

CONCLUSIONS

Firm B presents the reader with an interesting approach to BCP. It is a system that contains many elements and components. It is comprehensive but it is also more of an amalgam of systems and procedures rather than an integrated system. It has many of the elements that one would expect in an effective and efficient BCP. It is also an approach that is emerging and

developing over time. This is an approach that should be revisited in the future to see how it has evolved and changed.

APPENDIX C: Individual Case Study for Firm C

INTRODUCTION

The introduction section describing the effective business continuity planning (BCP) process in supply management for Firm C begins with a brief company background, a description of the case study execution, and the corporate and supply chain strategy for the firm. This is followed by a broad description of the BCP process found in Firm C, and a set of conclusions.

Company Background

The third case study in this project was conducted in early May of 2003 with “Firm C.” This company is a major player in a global high-technology industry. The industry is cyclical, with a heavy emphasis on innovation and cost control. Firm C’s major markets are in North America, Europe, and East Asia, and the firm has manufacturing facilities in each of these regions.

The facility visited for this case study is located in the Southwestern United States. All capital equipment purchasing and all contract purchasing is handled out of this facility. MRO purchasing is decentralized at the individual plants.

Case Study Execution

The case study interviews were conducted in a group setting during a one-day visit. The key informants included a director of regional purchasing, two managers of regional purchasing, and a regional logistics manager. During the course of the interviews, the firm provided the

interviewers with a variety of presentation materials and documents related to supply management's role in the firm and business continuity processes and practices.

Corporate and Supply Chain Strategy

Cost control is a critical competitive priority for Firm C. Several important purchasing/supply initiatives relate directly to this issue. First, the production cost for Firm C is heavily influenced by the performance of capital equipment. Purchasing at Firm C has adopted a "life cycle management" approach with its capital equipment suppliers to drive continuous performance improvement in capital equipment, striving for best-in-the-industry performance. Second, during the current economic downturn, the firm is also concerned about the health of their suppliers – both in terms of their ability to provide adequate service now, and their ability to react quickly when the economy recovers. Third, the firm is pursuing a variety of inventory reduction initiatives aimed at reducing operating costs through supply base reduction, just-in-time deliveries, and some use of consignment inventories.

EFFECTIVE PRACTICES

The case study data at Firm C revealed a number of processes and procedures related to ensuring business continuity in supply management. These techniques include 1) a well-structured IT Contingency Plan, 2) the C-TPAT, 3) a *Material Supplier Quality Assessment* (MSQA), which includes assessment of the supplier's disaster recovery preparedness, 4) a supplier performance evaluation system that explicitly includes supplier contingency planning, and, 5) a "second sourcing" policy for direct materials that promotes competition as well as

providing a back-up source in case of a supply disruption. The latter three techniques fall broadly under the heading of “supply base management.” Each of these practices is discussed below.

IT Contingency Plan

Firm C has deployed an IT Contingency Plan addressing disaster recovery for important systems, including telecommunications, CAD, Logistics (warehouse), office automation/Internet-Intranet, Computer rooms, CAM system, factory automation, and applications for engineering data analysis. In the plan, each system is assigned to one of three “importance categories,” which are:

- E: essential-needed for survival-must have
- I: important-needed to meet business goals-Could manage without it for a short time
- O: Optional - not strictly needed-nice to have. Will not be covered by a recovery plan

Each Essential and Important function is assigned an “Urgency” category to indicate how quickly it must be rectified:

- 0: immediate – no delay
- 1: within 24 hours
- 2: within 3 days
- 3: within 7 days
- 4: within 30 days

The priority for recovery is determined based on the combination of “importance” and “urgency.” The plan then goes on to document the various types of failures that might occur and, for each type of failure, how the organization will recover and what resources are needed to perform the recovery.

The IT contingency plan, with a modified sample provided in Table C-1, also has implications for the purchasing function in ensuring business continuity from supply sources.

Many of the systems, such as EDI, are directly linked with key supplier organizations. In addition, there is Intranet systems that convey information among different organizational functions. The inability to communicate internally and externally can have detrimental cost implications for the firm and its supply chains.

Table C-1. IT Contingency Plan Example

Business Function	Importance (E/I/O)	Urgency (0-4)	Priority	Computer Applications	Usual Computer/Computer Room	Backup Computer/Computer Room
Automation	E	0	1	Automation interfaces	Location A	Location Q
CAM/Automation	E	0	1	Photo GUIs, Loading GUIs	Location B	Location R
Manufacturing Schedule	I	3	4	AUTOMOD		
Engineering Data Analysis	I	2	4	System Y	Location C	Location S
Manufacturing Reporting	I	2	5	SQL, ISS	Location D	Location T

U.S. Customs-Trade Partnership Against Terrorism Act (C-TPAT)

Like Firm A, Firm C is currently pursuing C-TPAT certification. Although Firm C does not purchase large amounts of material from non-domestic sources, it does make frequent inter-facility shipments which cross national borders. C-TPAT certification is seen as important in making sure these shipments proceed in a timely fashion. Firm C uses EDI extensively, and believes that this will facilitate certification.

Supply Base Management

To a large degree, the view of supply chain continuity planning at Firm C is that it is not a “separate” activity or process, but an essential part of managing the firm’s supply base. Efforts to insure supply chain continuity can be seen in several tools Firm C uses to manage its suppliers.

First, key suppliers are subjected to a *Material Supplier Quality Assessment* on an annual basis (this may be stretched to once every two years for exceptional suppliers). The MSQA includes a section dealing with the supplier’s preparedness for disaster recovery that could affect Firm C’s supply continuity. Including this information as part of the MSQA gives Firm C valuable information about their risk exposure, and also helps communicate the importance of this type of preparedness to the supplier. Tables C-2 and C-3 below describe the scoring procedure used in the MSQA and the specific questions related to supplier disaster recovery planning.

A second element of supply base management that Firm C uses to address supply chain continuity planning is the “Key Performance Indicator Evaluation” conducted annually for important suppliers. The KPI Evaluation looks at not only the supplier’s contingency *planning*, but also evaluates the supplier’s response to actual events and the impact that such events had on Firm C’s operations.

The third element of supply base management related to supply chain continuity at Firm C is their second sourcing policy. This policy mandates that for all critical materials, the firm must have *two* qualified sources. The policy has two objectives. One is to create some competitive tension in the suppliers, to encourage more aggressive pricing and better performance. The other purpose is to provide a readily available back-up source if/when supply

from the primary source is disrupted. A formal, well-structured supply qualification process supports the second sourcing policy. This process is summarized in Table C-4.

Table C-2. Material Supplier Quality Assessment Scoring Method

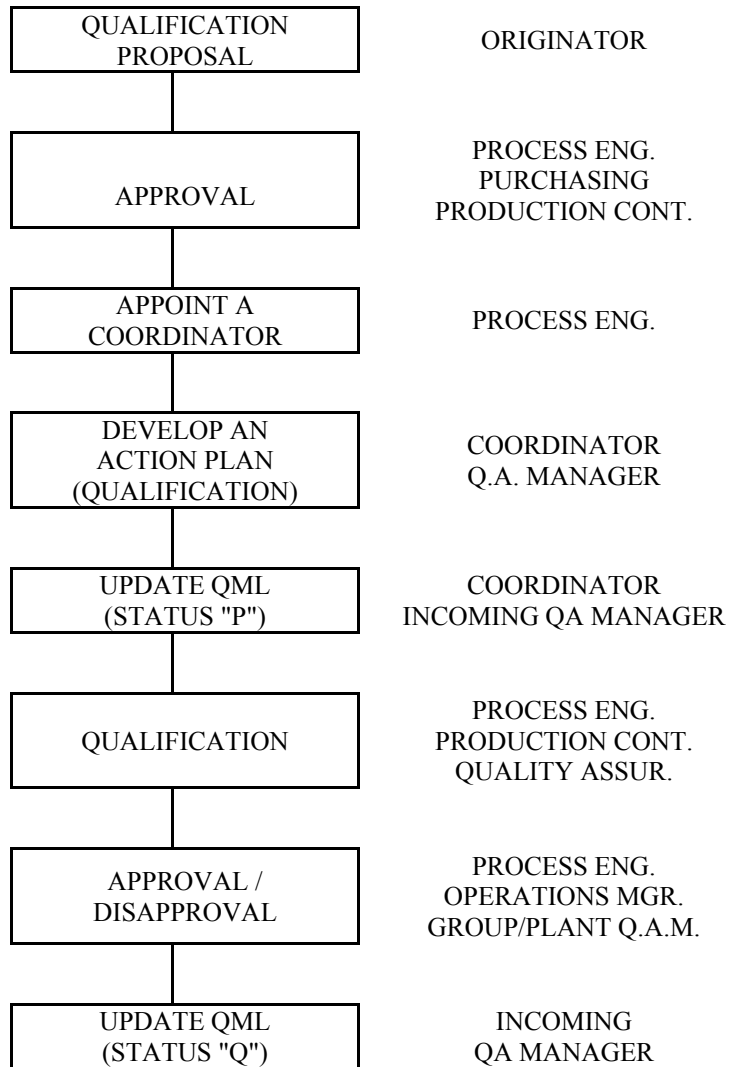
Material Supplier Quality Assessment Scoring Method	Score
* Supplier is not familiar with the requirements of the element and has no relevant source documentation (flow charts, forecasts, plans, procedures, strategies, etc.) in this area.	0
* Supplier is familiar with the requirements of the element but there is no evidence of source documentation, planning or implementation.	1
* Supplier is familiar with requirements of the element and has preliminary source documentation with incomplete plans for implementation.	2
* Source documentation is available. Implementation (with assigned responsibilities) as just started, (0-30% complete) .	3
* Source documentation is available and implementation is in progress (30-60%) . Deficiencies have been identified but improvements are not quantifiable.	4
* Implementation has progressed (60-80% complete) and there is preliminary evidence of relevant results.	5
* Implementation is nearly complete (80-95%) and documented evidence of implementation effectiveness exists.	6
* Full implementation of source documentation for the requirement and complete confirmed evidence of implementation effectiveness. The supplier has met minimum requirements.	7
* Analysis of results and on-going continuous improvement can be demonstrated in Key areas linked with customer satisfaction.	8
* Supplier has reached world-class performance and is able to show growth beyond QS-9000 requirements and continuous improvement in all areas.	9
* Supplier is best-in-class and is able to demonstrate significant innovation in new ways to show relevant results beyond the customer requirements. The supplier sets the industry benchmark.	10

A MINIMUM SCORE OF SEVEN IS REQUIRED ON EVERY APPLICABLE QUESTION OF THE 24 ELEMENTS.

Table C-3: MSQA Section Relating to Supplier’s Disaster Recovery Planning

Element	Requirements	Status	Evidence & Location	Action Plan Y/N	Score 0/10
4.24.1 DISASTER RECOVERY PROGRAM	24.1 Is there an emergency Disaster/Business Recovery/ Business continuity plan established in the Supplier Company?				
	24.2 Is this plan deployed according to all existing sites?				
	24.3 Is this plan addressing management succession and identification of key staff?				
	24.4 Is this plan identifying, for all products delivered to Firm C, a primary source and a back-up source?				
	24.5 Is this plan identifying all "strategic" materials and equipments and their identical sources of replacement?				
	24.5 Is there an off-site storage of vital records?				
	24.6 In case of disaster are there procedures to restart minimum service level and to organize transport to a back-up site?				

Table C-4: Material Supplier Qualification Process Flow



CONCLUSIONS

The most important learning from the case study at Firm C is the idea of making supply chain continuity planning a regular part of doing business with the supply base. Firm C has in place specific recovery plans for disruptions to its own information technology and systems, and they are also taking steps, through C-TPAT certification, to minimize their exposure to logistical delays. But the heart of Firm C's approach to managing supply chain continuity is the way it 1)

builds and manages relationships with its suppliers, and 2) strives for continuous improvement, which are both fostered through its philosophy of Total Quality Management (TQM).

One of the primary tools that Firm C uses to ensure business continuity is through their MSQA scoring method. One section of the MSQA is dedicated to understanding the business continuity plans established at supplier firms, but goes beyond that facet of BCP by focusing on supplier and internal continuous improvement. The increased communication flows between suppliers and Firm C facilitates identifying, communicating and rectifying potential problems together before it can manifest into a significant supply issue.

Creating an awareness of and concern for supply chain continuity into supplier relationships is done through both formal and informal means. The KPI Evaluation and the regular MSQA audits send a clear and formal message to suppliers that their ability to avoid and/or minimize disruptions to Firm C's supply lines is among the requirements Firm C has of them.

On an informal level, the managers at Firm C talked about building a *relationship* with suppliers in which a concern with supply chain continuity was an *expectation*. This is encouraged through frequent, open communication in both directions. Firm C has convinced suppliers that it's to their mutual benefit to identify problems early and work together to resolve them. Suppliers have come to understand that when there is a problem or potential problem with supply, Firm C doesn't "want to read about it in the paper."

Firm C takes a continuous quality improvement approach to managing its supplier relationships, and they believe this approach will drive the kind of supplier performance, over time, which will lead to maximum security of supply.

APPENDIX D: Case Study Research Protocol

Business Continuity Planning for Purchasing And Supply Management

1. Goal: 3-5 Business Continuity Plan (BCP) profiles from supply management
 - a. Interview Questions – see interview questions
 - b. Statement of Purpose
 - i. Examine the current status of business continuity planning in supply management
 - ii. Develop an understanding of effective practices in business continuity planning in supply management
 1. Processes
 2. Tools and techniques for risk assessment
 3. Strategies and methodologies for managing risk
 - c. Unit of Analysis – Business Continuity Plans and planning process
2. Methodology/Case Study Design
 - a. Each case as an experiment, a replication, not as a single response to a survey
 - b. Write up each case individually – develop a standard case format
 - i. Open coding
 - ii. Axial coding/Pattern matching
 - iii. Selective coding
 - iv. Implications
 - c. Sample selection
 - i. 3-5 firms with known business continuity plans and effective planning processes
 - ii. Organizational cooperation
 - d. Pilot Study
 - i. Choose a firm that is accessible, convenient, with a strong reputation for proactive supply management
 - ii. Not a “pretest,” but to help refine data collection plans such as content and procedures
 - iii. Write up content and procedural implications
 - e. Collecting Evidence
 - i. Three essential ideas
 1. multiple sources of evidence - any 2 or more sources converging on same facts
 2. case study data base - make information traceable, keep in one place
 3. chain of evidence that links questions asked, data collected and conclusions drawn
 - ii. Sources of evidence
 1. Documentation-internal memos, reports, announcements, proposals, formal studies, news clippings, etc.
 2. Interview - key source of information
 - a. Key informants - open ended interview; key events and perceptions of those events - why did your firm adopt BCP? Corroborate with other evidence
 - b. Focused - respondent is interviewed for a short time period; certain sets of questions may/may not be open ended
 - f. Establish a data base - improve case study reliability, contains:
 - i. Case study notes
 1. interviews

- 2. document analysis
 - ii. Case study documents gathered, including any notes explaining documents
 - 1. Tabular materials - any summaries created or tabulated
 - 2. Narratives
- 3. Data Analysis
 - a. Pattern Matching
 - i. BCP content
 - ii. BCP processes
 - iii. Supplier involvement
 - iv. Item or service purchased
 - v. Classification of purchases
 - vi. Market perceptions of risk
 - vii. Participants in BCP process
 - viii. Production philosophy and processes
 - ix. Organizational characteristics
 - 1. Size
 - 2. Industry
 - 3. Other
 - b. Explanation Building
 - i. Exploratory best practice case studies
 - ii. Derive linkage between BCP process and catastrophe impact
- 4. Time Table
 - a. Identify Pilot Case Study Firm –completed
 - b. Identify Additional Case Study Firms – In process
 - c. Complete Pilot Case Study – March 1, 2003
 - d. Case Analysis/Write-up – conducted for three firms
 - e. Submit Final Report – June 30, 2003

For further information, please contact Dr. George A. Zsidisin, (517) 353-6381, zsidisin@msu.edu

APPENDIX E: Interview Questions

For purposes of this research, business continuity planning (BCP) is defined as “an integrated set of procedures and resource information that firms can use to recover from a disaster which causes a disruption to business operations.”

Background

Name	Company
Division	Industry
Job Title	Years in Position
Years with Company	Years in Purchasing

1. What is the major business of your company?
2. What are the key issues/competitive challenges facing your firm?
3. How is the purchasing function organized? May I see a copy of your organizational chart? (Names may be deleted if necessary). Where does the purchasing function report within the firm? (Reporting chain).
4. Are you currently undergoing, or have you undergone any major changes in your purchasing organization or practice in the past year? Of these changes, have any of them focused on inventory reduction? Please discuss.
5. Does your firm have an internal business continuity planning (BCP) process in place? If so, could you please briefly describe that process?
6. What philosophy or policies best describes your organization’s production? For example, does your organization follow TQM or JIT principles, lean production, build-to-stock, or build-to-order? Please explain.

BCP Processes

1. Does the purchasing organization have a business continuity planning (BCP) process in place for inbound supply?
2. Is the BCP process used for new product introductions, repetitive buys, or both?
3. In the BCP process, are any of the following supply characteristics evaluated?

<u>Risk</u>	<u>Y/N</u>	<u>Definition</u>	<u>Has this occurred within the past two years?</u>	<u>Impact</u>
1. Shortage in supply market				
2. Disasters				
2a. Man-made				
2b. Natural				
3. Border closings				
4. Labor actions				
5. IT/Communication failures				
6. Legal liabilities				
7. Inability of supplier to handle volume increases				
8. Political risk (i.e. tariffs, regulation, etc.)				
9. Transportation/Logistics				
10. Supplier financial failure				
11. Other _____				
12. Other _____				

4. Of the supply characteristics that exist for your organization, what are the three most important to include in the BCP process? Why are they considered the most important (i.e. likelihood of occurrence, impact, and/or ability to manage that risk)?
5. How long has your organization had a BCP process in place? What triggered your purchasing organization to have a business continuity planning process for inbound supply? Was there a “champion” for developing these processes? Was this person(s) internal or external to your firm?
6. Why did you develop the process for conducting the BCP process?
7. Which corporate functions or departments participate in developing and implementing the BCP process?
8. May we see a copy of a BCP process, to include checklists or worksheets that may accompany the BCP?
9. Please describe the BCP process. Please provide a few examples of how the process works.

Organizational Involvement:

10. Which corporate functions are involved with changes or updates to the plans, if any?
11. How often does your organization review and update its BCP process? Are these reviews conducted in response to external events, or do they occur on a periodic basis?
12. Is there one person/function with overall responsibility for developing the BCP process? Who?

13. Are BCP processes disseminated throughout the organization? How? How are records kept and updated? Are suppliers made aware of any plan changes for inbound supply?
14. Is notification of a potential supplier risk problem disseminated through the organization? How? Where does it generally begin? Who is involved?
15. Do you have a risk assessment tool in place for inbound supply? If so, is it integrated with the BCP process? How?
16. Since the time that events such as 9-11 have taken place, has the BCP process changed in importance? How?

Selection Criteria:

17. Which of the following factors or circumstances warrant the need to implement a BCP?
 - All suppliers
 - Critical suppliers
 - Specific products or services
 - Commodity type
 - Frequency of buy
 - Location of supplier
 - Location of using facility
 - Customer
18. What determines if these suppliers or products/services are evaluated? Please provide examples.
19. How is risk measured to evaluate potential losses in the BCP process? Is the evaluation quantitative, qualitative, or both? Who is responsible for conducting these evaluations? To whom is this information disseminated? Please explain.

Supplier Input:

20. Are suppliers involved in the BCP process? To what extent? Do suppliers make any recommendations on ways to prevent or overcome unanticipated events?
21. Do your suppliers require BCPs from *its* critical suppliers? Do they have similar criteria and measurement systems as your organization?
22. Do you require critical suppliers to have system and/or data storage back-up procedures?

Effects of Business Interruptions

23. What actions does the purchasing organization or function take in response to a disaster?

24. Has a disaster or supply failure ever occurred in your firm? Please describe one or two examples?
What was done to remedy the supply failure?
25. What was the impact of those supply failures? Approximate total dollar cost? Did it effect the ability of your organization to meet customer demand? How?
26. Is there a cost/benefit analysis conducted when constructing BCPs? If so, could you please describe that process and provide examples of those benefits derived?
27. What are the overall lessons that your organization has learned from engaging in a business continuity planning process?