【Note】

A Comprehensive Study on Research Approaches to Supply Chain Risk Identification

サプライチェーンリスクの同定アプローチに関する研究

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(Abstract)

Purpose

The objective of this paper is to conduct an in-depth research on supply chain risk identification approaches. This study integrates the insights from several disciplines, primarily logistics, supply chain management, operations management, strategy and international business management.

Methodology/ Approach

The author firstly takes the traditional approach of literature review, i.e., examines the comprehensive research output. Secondly the author integrates the existing relevant research to illustrate the approaches used in risk identification in supply chain system.

Conclusion

The author would like to suggest a 2-axis matrix as a risk identification framework to be built across disciplines in the future as the first step to supply chain risk management (SCRM). Moreover the author advocates including a culture dimension into risk identification approach across the system.

Originality

This paper initiates a holistic approach toward dealing with a rising discipline, i.e., supply chain risk management. It lays the much needed base for further work on more comprehensive research in this field.

Limitation

It is always challenging and controversial to construct a research approach in a multi-disciplinary and still-developing field since the chosen focuses are particular and highlighted accordingly. This research is at its rudimentary step and therefore shall keep abreast with the development of this research discipline.

Keywords

Global Supply Chain Management, Risk Management, Operational Process, System Theory.

Paper Type

Research Paper

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1. Introduction

This research is the first step of a three-step research effort for constructing a holistic framework for supply chain risk management, i.e., firstly identification, secondly assessment, thirdly mitigation and elimination.

Supply chain systems are becoming increasingly lengthy and complex, reflecting the dynamic and global marketplace. The continuous quest to improve supply chain efficiency and reduce its cost has increased the risk of breakdowns. The lean practices increasingly adopted by many companies to become more efficient are in fact increasing the risk of supply chain disruption once these practices eliminate redundancies that provide back-up capabilities (Silva et al. 2011).

In addition to the lean philosophy the global configuration of the supply chain increases the likelihood of supply chain disruptions. The global outsourcing of non-core processes such as production, logistics, and information services has made the supply chains longer, slower to react and consequently more prone to disruption.

Wide product variety also plays an important role in increasing vulnerability in supply chain. It can increase the complexity of supply chain and magnify uncertainty in demand. Since more suppliers and items to manage to meet the product variety strategy, supply chains are more prone to a disruption.

Tang (2006) argues that with the kind of business disruptions that have happened in recent times (terrorist attacks, hurricanes, volcano eruption, earthquakes, and tsunamis), business continuity and supply chain risk will become as important a criterion as cost reduction in SCM.

Thus, as we know supply chain used to be a very linear model to cut cost and enhance efficiency, now the agenda is getting more complicated: how to maintain a resilient supply chain at a low cost as volumes are in decline, financial markets are unstable, and international competition is fierce.

As it becomes increasingly clear: supply chain management, at its core, is to keep the flow of the chain continuing at a desired pace. Any disruption and uncertainty will impose a heavy toll on the whole system, and thus, arises economically or ecologically loss. The name of the game is risk management.

There is a deep reservoir of researches regarding the topic of supply chain management, though supply chain risk management (SCRM) is a nascent area. Moreover Kouvelis et al. (2006) argue that firms must invest resources in trying to quantify the risks through a systematic approach. However, methodologies that assist such approaches are few and far between. Similarly, Zsidsin et al. (2008,) state that "few studies exist to explore the key constructs

necessary for assessing supply chain risk". The literature on managing risks is fairly well developed(Tang, 2006), research associated with identifying risks is still in an early stage. Therefore before embarking on further research, the question then arises: In which way shall we identify risks in supply chain so that the damage can be taken under control and the system can be resilient enough to recover from damage quickly?

The rest of the paper composes of 1. literatures review covering multidiscipline as risk management(March & Shapira, 1987), System theory(Asbjørnslett, 2008), international business(Goshal, 1987)network operation(Rao and Goldsby, 2009) and SCM(Zsdsin et al., 2004; Manuj and Mentzer, 2008a). 2. Illustrate main classification of risk identification. 3. A proposal of constructing an overarching framework for supply chain risk identification as the finding of this research. 4. Discussing the limitation of this research and its implication for future development in this field.

2. Background to Supply Chain Risk Management.

We see an explosion in strategic outsourcing by firms, globalizations of markets, increasing reliance on suppliers for specialized capabilities and innovation, reliance on supply networks for competitive advantage and emergence of information technologies that make it possible to control and coordinate extend supply chains.

For example Wal-Mart alone imports more than 80% of all its merchandise from China to the US.(Lynch, 2008). It is not hard to imagine that even a temporary halt to global transport of merchandise would have far-reaching effects on every segment of the system and the society.

Some of the very lately natural catastrophes hit many companies and economies across the globe through the tightly-related supply chain.

Iceland volcano in 2010 shut down the supply chain for many manufacturers. The Thailand flood in 2011, the worst in 50 years, destroyed the global manufacturing industry just after Japan's tsunami two months before. These natural catastrophes caused considerable supply chain disruptions in many industries. The Thailand flood and Japan Tsunami, both had huge impact to Japan economy which heavily relies on a global supply chain. According to Healings"(2011)calculation, Japan has suffered indirectly as one of the largest investors in Thailand with over 1800 Japanese manufacturers operating in the country. It is estimated that the flooded plants across the top five suppliers account for nearly 30% of global supply of hard disks.

As an aftermath of the Tohoku-Kanto earthquake, Shin-Etsu Handotai, one of the world's leading producers of silicon wafers and ingots that are used in the manufacture of semiconductors had down its Shirakawa plant's operation for lack of electric power. This plant is responsible for 22% of the world's supply silicon wafers, which means 22% of the global supply of a vital commodity is taken offline suddenly and it will last for a while. Moreover anisotropic conductive film is a key material used in the manufacture of LCD flat panel displays in TV sets, notebook computers, smartphones, and tablets. 70% of the world supply comes

from Japan, and as of March 16th suppliers have stopped taking orders (Fisher, 2011).

On the other hand, intended man-made disasters, no matter the original location it is occurred, no matter how trivial they might be thought about, they will be sure have great effect on the whole supply chain. The 9/11 attack is a wake-up call to the uncertainty of a global supply chain. Almost every supply chain is affected by the closing of US airspace grounding of the planes and by the closure of the borders that immediately followed. Ford, for example, has to shut down five of its U.S. plants, partly because it can't get enough parts from suppliers in Canada. The result is a 13 percent drop in production in that quarter (Martha, 2002). The issue of contaminated frozen gyoza occurred in the food chain between Japan and China does not only endanger many Japanese customers' health, but also jeopardizes the relationship of these two countries.

Hofmann and Greenwald (2005), shows that 885 public firms that had supply chain disruption between 1992 and 1999 found that, in the year leading up to the disruption, average operating income dropped by 107%, return on sales by 114% and return on assets by 93%. From a different set of data of 827 disruption announcements made over a 10 year period, Hendricks and Singhal (2005) found that companies suffering from supply chain disruptions experiences 33-40% lower stock returns relative to their industry benchmarks over a 3-year time period that starts 1 year before and ends 2 years after the disruption announcement date.

There is no end of the disruption of a global supply chain and its negative impact to the involved parties. When firms take preventive measures and have a disaster plan in place to mitigate risk of a potential disruption, they certainly will be better off if a disaster occurs than other firms that either don't have a backup plan or their plan is not quite consistent. This calls for an imperative of research on supply chain risk management.

2.1 Risk and Supply Chain Risk.

2.1.1 Risk

Wager (2008) points out that risk is an elusive construct that has a variety of different meanings, measurements and interpretations depending on the field of research. There is an extensive body of literature concerning risk in decision theory (Arrow 1965), finance (Altman 1968), marketing (Cox 1967), management (March and Shapira 1987), and psychology (Kahneman and Tversky 1979). Regardless of the area of interest, risk is associated with an undesirable loss, i.e. an unwanted negative consequence, and uncertainty. Risk is considered here to be the "the variation in the distribution of possible outcomes, their likelihood, and their subjective values." (March & Shapira, 1987)

What is implicative for this definition in supply chain is that risk is calculable thus controllable. Knight (1965) drives home this point by establishing the distinction between risk and uncertainty. According to Knight a phenomenon which is un-measureable is "Uncertainty" whereas one that is measurable is "Risk". In the same sense, risk is defined as uncertainty based on a well-grounded (quantitative) probability by formally, Risk=(the probability that one

event will occur) × (the consequence if it does occur). Hence, in the risk management front, this concept enables the evolution from reactively dealing with unknowns to proactively dealing with measurable possibility.

2.1.2 Supply Chain Risk

As for the definition of supply chain risk, there are two distinctive meanings. There is a persistent tension between, on the one hand, risk purely as danger and, on the other hand, risk as both danger and opportunity (Mitchell 1995). According a classical decision theory and in fields such as finance, the fluctuations around the expected value of a performance measure are used as proxy for risk. That is risk is equated with variance and consequently has both potential "downside" and "upside". Following these considerations, Juttener et al. (2003) defined supply chain risk as a "variation in the distribution of possible supply chain outcomes, their likelihood, and their subjective value". On the other hand, Zsidisin (2005) provides an encompassed definition of supply chain risk as "the potential occurrence of an incident or failure to seize opportunities with inbound supply in which its outcomes result in a financial loss for the purchasing firm." While it emphasis on the downside, it is a very isolated explanation with a focus on a single company instead of supply system as a whole. Thus, supply chain risk as an event that adversely affects supply chain operations and hence its desired performance measures, such as chain-wide service levels and responsiveness, as well as cost. It includes both the uncertainties inherent in the operational aspects of supply chain activities, such as uncertain supply and demand, as well as disruptions to its operations resulting from natural and human-inflicted disasters, like terrorist attacks (Tang, 2006).

2.2 Multiple Research Views on Supply Chain Risk Management.

Risk, in the context of supply chain management is a multi-dimensional construct (Zsidisin,2003, Zsidisin et al., 2004). According to Juttner, Peck and Christopher (2003), SCRM "aims to identify the potential sources of risk and implement appropriate actions to avoid or contain supply chain vulnerability".

The area of SCRM (supply chain risk management) is still emerging and has rather unclear boundaries at this stage, leading to questions about diversity among researchers in terms of the scope of SCRM, possibly in relation to their perception of industry needs. Moreover, with researchers having different domain expertise, questions naturally arise about the diversity of research tools and their appropriateness.

2.2.1 A Global Supply Chain Network Point of View

Most supply chains became more complex and consequently more vulnerable to disruptions than they were before since the competition increasingly required high customer satisfaction and lower cost. Moreover, external factors such as natural hazard, purposeful human agents, global outsourcing, and shorter product life cycle have heightened the risk exposure of supply chain. As Rao and Goldsby (2009) point out there has been a substantial rise in the

SCRM area in the past few years. Coinciding with this surge of interest, several researchers have developed alternate view points on the nature of the SCRM concept (Christopher, 2002, Tang, 2006), i.e., SCRM is an extension of the within-firm management ideology. Cox et al.(2001) mentions that supply chain operations typically involve a number of stakeholders, who not only provide resources, but also "appropriate value" from participating in different stages of the supply chain. A network-based framework, which encompasses a variety of inter-organizational relationships therefore, provides a robust basis for a rich description and analysis of the multi-actor supply chain operation. Also for a given network collaboration, several structures of network relationship are possible, each of which carries distinctive risk implications. Therefore any approach to SCRM needs to look at understanding and reducing vulnerability to the supply chain as a whole, rather than at a focal firm level. In other word, the quest is for a global optimum rather than a local one.

2.2.2 An Organization Strategy Point of View

Organizational efficiency and performance are enhanced when strategy to reduce uncertainty takes into account "context" and "environmental realities" (Duncan, 1972). In the case of SCRM context can be interpreted of refer to sources of risk, magnitude of risk, and its relationship to business objectives and threat of disruption in supply chains. Environmental realities can be interpreted to mean the degree of exposure to adverse events, scope of extended supply chains, supplier management practices, etc. Therefore, the essence of SCRM is to make decisions that optimally align organizational processes and decisions to exploit opportunities while simultaneously minimizing risk. Supply chain disruptions can "materialize" either inside or outside a supply chain. As Wagner and Bode (2008) point out, the financial default of a supplier and an earthquake that destroys production capacity are situations with completely different attributes and therefore has different effects on the supply chain. This observation points to the need for effective methodology for anticipating, identifying, classifying and assessing risks in supply chains.

2.2.3 A System Point of View

The supply chain systems are complex entities with multiple physical and virtual relationships, and multiple internal and external interfaces. High demands are put on both the quality of the products and services, and on the supply chain regularity and dependability. Whether the product is to be a part of a more complex product, or the final product is expected to be available when needed, and as promised. As supply chains become longer and parts of larger networks of demand and supply nodes and interacting logistics nodes and modes, they become more prone to the negative attributes of systems; indeterminacy, complexity, flexibility, sensitivity, reliability and vulnerability (Meister 1991).

Moreover, Asbjørnslett (2008) points out that the sequential, multi-country production model is what dominates now, and it's a model where little bits of value get added here or there and it is hard to see country

of origin. All the suppliers in this chain are typically operating on very thin margins and tight schedules—any disruption can have severe consequences for companies several steps down the chain as well as end users. Peck (2005) points out that uncertainty is inevitable in lean system. In the race to provide better quality at lower prices, manufacturers optimized supply chains. As Shih described in his interview with Fisher (2011), "they put all of their eggs with one supplier that had the best product at the lowest price". Paradoxically, concentrating the majority of suppliers for a particular product in one region can have serious consequences in the event of a natural disaster or political unrest.

The diversity in approaches toward SCRM researches is still in increasing, partly because of the changing dynamics of the global supply chain configurations and partly because of the lack of the consensus on the basic definition, methods and tools for this area.

Despite ongoing discrepancies on many issues, one can recognize a convergent trend on risk management in supply chains. Many scholars agree that in the dealing with risk management, the first step is to identify the risk and as White (1995), in a review of the literature suggests that the process of risk assessment is usually broken down into three stages, with risk identification which involves perceiving hazards, identifying failures, recognizing adverse consequences to be the first stage. As a result, according to many researches identification of risks and uncertainty is an initial step to manage supply chain risks and bellow the author will numerate the approaches of risk identification and followed by a modeling scheme.

3. Risk Identification

According to many researchers (Chopra and Sodhi 2004, Hallikas et al. 2004, Hauser 2003. Nanuj and Mentzer 2008a, b, Neiger et al. 2009, White 1995, Wu and Blackhurst 2006), identification of risks and uncertainty is an initial step to manage supply chain risk. In attempting to identify supply chain risks in the process of SCRM, many scholars have proposed typologies and/or taxonomies of risks. The categories of supply chain disruptions are often labeled "supply chain risk source". As such, Svensson (2000) identifies two categories (quantitative and qualitative). Juttner (2005) delineates three (supply, demand, and environmental), and Chopra et al. (2004) proposed nine (disruptions, delays, systems, forecast, intellectual property, procurement, receivables, inventory, and capacity). There is common ground in most of the researches. By incorporating the sources and characterization of risks, it will be recognized as what may trigger them and the relationship to the supply chain functioning effectively and efficiently.

As a comprehensive interpretation on the source of risk, there are mainly four factors; increasing complexity of products, processes, and technologies, increasing structural complexity of supply chains, increasing diversity and global nature of business systems, and the environmental costs and impacts of extended supply chains.

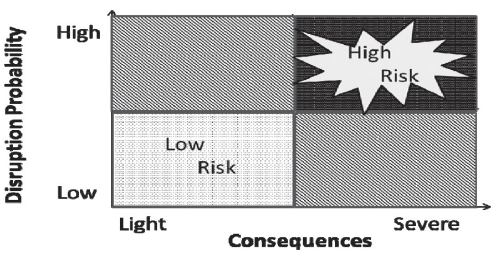
Furthermore, product, and organizational complexities as well as the extension of supply chains, all increase operational

and environmental risks that, in turn, increase supply chain fragility and costs. Many researchers provide comprehensive approaches for identification of supply chain risk.

3.1 A Supply Chain Resilience Approach

Sheffi(2005)in his book *The Resilient Enterprise* points out that a firm's risk to a disruptive event can be viewed as a combination of the likelihood of a disruption and its potential severity. Thus he introduce a metric that encompasses this two dimensions, each illustrates a continuity of degrees. Figure 1 provides a way of thinking about the confluence of probability and consequences of events, which will also, facilitates the firm to identify their risks. The vertical axis is the probability of the disruptive event and the horizontal axis represent the magnitude of the consequences.

Figure1. Dimensions of Supply Chain Risk



Source: Sheffi (2005)

According to Sheffi, such a matrix would be the product of probability and consequences. Thus, each of the four quadrants has a specific meaning. Risk is highest when both the likelihood and the impact are high. Similarly, rare low-consequence events represent the lowest levels of risk. High-probability/low-impact events are part of the scope of daily management operations, tending to the relatively small random variations in demand, unexpected low productivity, quality problems, absenteeism, or other such relatively common events that are part of the "cost of doing business." Low-probability/high-impact events, on the other hand, call for planning and a response that is outside the realm of daily activity.

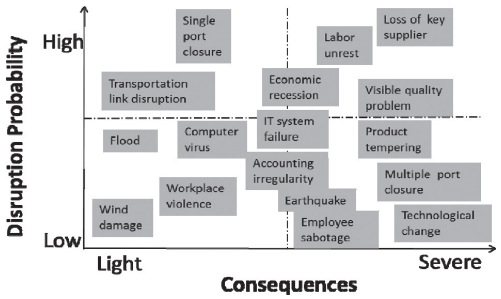
Furthermore, Sheffi suggests that the disruptions come from three risk sources as below:

1. Natural Disasters
   Many natural disasters such as typhoon, earthquakes, tornadoes, floods, etc. are frequent. Statistical models can be used to estimate the likelihood of their occurrence and their magnitude.
2. Accidents
   The consistent pattern of many small accidents foreshadowing larger ones suggests and approximates way to assess the likelihood of large accidents. To attack safety problems at their root, companies dealing with hazardous conditions have been working to reduce the number of incidents, which should reduce the accident rate and eliminate severe accidents.
3. Intentional Disruptions
   Intentional attacks are more worrisome, though, since the threat is adaptive—that is, increasing defenses or resilience in one part of the system will increase the likelihood of an attack elsewhere. And intentional attacks are not limited to terrorism; on a different scale, they also include sabotage, computer hacking, and labor actions.

Based on this typology, rick can be

identified precisely to a great extent as Sheffi plots a detailed risk identifications map bellow as Figure 2.

Figure2. Enterprise Risk Map



Source: Sheffi (2005)

Follow Sheriff's map, the probability of a risk to be identified increases since it will make clearer 3 points i.e. 3 questions. 1. What can go wrong? 2. What is the likelihood it will take place? 3. How severe will it be? All these 3 questions lead to effective preparation of mitigating risks.

3.2 An Operational Approach

Tang(2008)suggests that in operational process, risks can be identified through below aspects.

1. Supply risks
   Fewer suppliers for more efficiency. While two types of risks occur.
   A : Supply cost risks
   B : Supply commitment risks
2. Process risks
   Internal operations(including in-bound and out-bound logistics)are still susceptible to issues that can cause fluctuations in effective capacity and quality.
3. Demand risks
   Not only the demand volume unpredictable but so is the demand mix. Demand risk therefore encompasses uncertainties in both volume and mix.
4. Intellectual Property Risks
   Outsourcing or offshoring makes it difficult to protect intellectual property(IP).
5. Behavioral Risks
   Low visibility and low confidence in the supply chain will induce damaging behavior such that the entire supply chain enters a "risk spiral". i.e., each supply chain partner either " inflates " their order or " disguises" their on-hand inventory because of the lack of confidence in the replenishment lead time. Demand forecast, etc.
6. Political/Social Risks
   A global supply chain is subjected to social/political risks when multiple countries are involved.

3.3 A Work Flow Approach

Peck (2005) suggests that risks can be identified though the sources and drivers of supply chain risk which operate at several different levels.

Level 1—value stream / product or process(workflows and information flows)
Risks are principally the financial or commercial consequences of inefficiencies or sub-optimal supply chain performance, including the inability to react swiftly to volatility in demand and the changing needs of the market place.

Level 2—assets and infrastructure dependencies(fixed & mobile assets)
Represents supply chains in terms of the assets and infrastructure needed to produce the goods and information flows in Level 1. At level 2 the risk

of the network should be assessed in terms of the implications of the loss of links, nodes and other essential operating assets. .

Level 3—organizations and inter-organizational networks.(contractual & trading relationships)

View supply chains as inter-organizational networks. It looks at the level of corporate risk management, business strategy and microeconomics. Here the nodes in the networks are the organizations that own or manage the assets and infrastructure, through which the physical goods and information flow. The links become trading relationships, particularly the power dependencies between organizations.

Level 4—the environment.(social & natural environment)

The wider macroeconomic and natural environment within which organizations do business, assets and infrastructure are positioned and value streams flow. Factors for consideration are the political, economic, social, and technological elements of the operating environment(including legal and regulatory issues), as well as natural phenomenon- geological, meteorological and pathological. All can affect a supply chain at each of the first three levels of the framework. Disruptions emanating at this level are likely to be beyond the direct control of supply chain managers and business strategists.

3.4 A Value-Focused Process Engineering(VFPE) Approach

In their effort to establish a systematical methodology to mitigate supply chain risks, Nieger et al.(2009)suggests that there are literature focused on identifying sources of uncertainty and the risks emanated from them. Still to do this effectively, it is necessary to develop a consistent methodology for risk identification. They base their research on system engineering framework

The Value Focused Process Engineering(VFPE)methodology seeks to fill this gap in the literature. VFPE is based on the "extended-event-driven Process Chain(e-EPC)", representation of business activities and processes. VFPE methodology integrated value-focused thinking(VFT)and e-EPC. Nieger et al., defines a five-step process for risk identification in supply chains. These are:

1. Activity driven identification of risk objective;
2. Objective driven identification of risk objectives;
3. Synchronized decomposition;
4. E-EPC taxonomy of risk sources;
5. Combining events structure to the objective structure.

The key advantage of their methodology is that it integrates conceptual views of risk and decision sciences approach to risk analysis. The validation of the efficacy and usefulness of the proposed methodology can be pursued through action research or participant observation approach.

3.5 An Enhanced Dichotomy Approach

According to Tang(2006), there are two sources of risks in a supply chain, namely 1.Operation risks. 2. Disruption risks. This suggestion broadly typologies risks in two categories. The former is re-

lated to daily operation which is internal factor while the latter is non-operational external factor.

To push this dichotomy further, Stonebraker et al.(2009)defined that the risk that make supply chain fragile has two main dimensions .i.e. internal factors and external, with a footnote on random events.

As for the internal source he classifies risk sources as

1. Physical logistics: Mechanical breakdowns; damage en route, shipping mishaps, accidents.
2. Behavior of suppliers
3. Behavior of customers
4. Information, communication, and control system
5. People

As for the Externalities, he points out 4 dimensions to identify supply chain risks

1. Legal, political and acts of government
2. Behavior of competitors
3. Financial, accounting, and economics
4. Environmental impact

and unanticipated / random events

1. Acts of nature (weather)
2. Other external factor
3. Other factors

3.6 A Social System Approach

Wagner and Bode(2006)call a negative deviation from the expected value of a performance measure(resulting in negative consequences for the focal firm)a "supply chain risk" when this deviation is the result of a supply chain disruption. Accordingly they divide supply chain risk sources for identification into five distinct classes:

1. Demand side

Result from disruptions emerging from downstream supply chain operations (Juttner 2005) . It includes disruptions in the physical distribution of products to the end-customer and the distribution network, as well as the uncertainty caused by customers' unforeseeable demands. The so-called "bullwhip effect" emanating volatility of inventories along the chain is its classic case.

2. Supply side

Reside in purchasing, suppliers, supplier relationships, and supply networks. Supply business risks relate to events that affect the continuity of the supplier and result in the interruption and termination of the byer-supplier relationship, including financial instability of suppliers, capacity constraints or shortages. Suppliers' inability of adaption to changes suppliers.

3. Regulatory, Legal and Bureaucratic Risk

Refer to the legal enforceability and execution of supply chain –relevant laws and policies as well as the degree and frequency of changes in these laws and policies. The higher the regulatory, legal and bureaucratic risk, the lower the supply chain performance.

4. Infrastructure Risks

Disruptions that materialize from the infrastructure that a firm maintains for its supply chain operations. The higher the infrastructure risk, the lower the supply chain performance

5. Catastrophic risks

Subsumes pervasive events that have a severe impact on the area of their occurrence. Epidemics or natural haz-

ards, socio-political instability, civil unrest and terrorist attacks. Due to the globalization of markets and a surge in globe-spanning supply chain operations, local catastrophes have increasingly indirect global repercussions. Thus the higher the risks from catastrophes, the lower the supply chain performance.

3.7 A international Business Approach

On a more general and macro international business domain, Ghoshal(1987) has classified the sources of risk into four major types:

1. Macroeconomic Risks: risks linked with change in wage rates, interest rates exchange rates and prices of necessary commodities.
2. Policy risks: risks linked with unexpected changes in policy due to actions by national government.
3. Competitive risks: risks linked with uncertainty in competitor's activity in foreign markets.
4. Resource risks: risks linked with unpredicted differences in resource requirements in foreign markets.

According to this classification, a firm will identify the risks not internally but across the system on a holistic platform.

4. Conclusion and Implication

Today's supply chains span the globe and involve many suppliers, contract manufacturers, distributors, logistics providers, original equipment manufacturers(OEM), wholesalers, and retailers. This web of participating player creates complexities, making it difficult to realize where vulnerabilities may lie. It also creates interdependencies that exacerbate these difficulties. Embracing the anecdotal research approaches toward supply chain risk identification. The author suggests a 2-axis matrix that is comprehensive enough to encompass the possible realization of downside risks. One axis shows a macro environment to micro environment dichotomy and the other axis shows operational and non-operational dichotomy. Thus it provides an overarching approach to identify the risk both ex ante and ex post.

Moreover the author advocates including a culture spectrum into the risk identification approach. The pioneering work of Douglas and Wildavsky(1983) suggests that the selection of risk is value laden, culturally constructed, and reflected moral, political, economic, and power positions. So in working out approaches to risk identification, organizations with different background hold different risk valuation.

As for right now, most competitive chains are lean, with hardly any slack between nodes. Hence anywhere there is glitch, the whole chain is going to be affected. With an approach that will be able to identify risk both earlier and precisely, it will be helpful for firms to decide the right decoupling point within the whole system.

5. Limitations

Constructing a research approach in a multi-disciplinary and still-developing field is always challenging. This research is at its rudimentary step and therefore shall keep abreast the development of this research discipline. Further work will be to embody the proposed framework of supply chain risk identification through proper factors

and measurement.

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（要旨）

本稿は，サプライチェーンリスクの同定（identification）についての既存文献研究に基づいた，同定アプローチの類型化に関する研究である。とりわけ，サプライチェーンにおけるリスクという概念を提唱し，その定義および研究アプローチを統合することで，新たな研究フレームワークの構築を提案したものである。

本研究では，現在理論的な形成過程にあるサプライチェーン・リスクマネジメントを取り上げた。同分野の研究は時間および研究のインプット，とりわけ研究者の数がまだ少ないため，基礎的な理論が構築されていないのが現状である。そのため，研究アプローチを探る上で，学際的な分析・理論からの援用が必要不可欠となる。本研究では，リスクマネジメント，システム理論，国際ビジネス，組織理論，サプライチェーンマネジメント理論など，既存の研究分野におけるサプライチェーンリスクの分析を統合し，サプライチェーンリスク・マネジメント（SCRM）の第一段階であるリスクの同定のための研究アプローチを類型化した。

研究の結果，サプライチェーンリスクの同定にあたり，マクロとミクロの環境要因，オペレーションとオペレーション的要因を両軸に据え，リスクに関する文化的要因を第三の軸とする３

つのディメンションからの研究アプローチに基づいたフレームワーク構築を提案した。

本研究は，SCRMのリスクの同定に関するアプローチの類型化という研究上の独自性を有している一方，研究の草創段階にあり，多角的な視点からの議論を要する研究でもある。したがって，当分野の確立にはさらなる時間と幅広い研究者からのインプットが期待される。最後に，本稿で提示したフレームワークを完成させ，本研究の成果がSCRM研究の一端を担うことを今後の課題として挙げておきたい。

なお本研究は著者が日本大学からの派遣を受け，アメリカ合衆国ハーバード大学で行った海外研究の成果の一部である。