**Universidade de Aveiro** Departamento de Economia, Gestão e Engenharia Industrial
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**MARIA ANGELICA VAZ FONTES**

# ECONOMIA, CADEIA DE ABASTECIMENTO E GESTÃO DE RISCO – IMPACTO NO MERCADO

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Dissertação apresentada à Universidade de Aveiro para cumprimento dos requisitos necessários à obtenção do grau de Mestre em Engenharia e Gestão Industrial, realizada sob a orientação científica do Doutora Ana Maria Pinto de Moura, Professora Auxiliar do Departamento de Economia, Gestão e Engenharia Industrial da Universidade de Aveiro

A Todos os Meus Mentores,
Obrigada

**o júri**

presidente

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Dedico esta tese de mestrado há:

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- Ao meu amor, ele sabe quem ele é.

**palavras-chave** Economia, Gestão de Risco, Cadeia de Abastecimento e Logística

**resumo**

Esta Tese de Mestrado compila alguns estudos sobre a Gestão de Risco, no âmbito da Gestão do Risco o presente trabalho divulga cinco riscos subteis que afectam as empresas, a cadeia de abastecimento, logística e economia.

Esta Tese de Mestrado descreve casos reais e o impacto dos riscos que não foram geridos.

Os governos estão a tentar melhorar alguns dos riscos que influenciaram o estado actual da economia – **Dodd-Frank Act, Basel III Reforms, "Adopts New Measures to Facilitates Nominations by Shareholders by SEC"** são exemplos dos esforços feitos pelos governos, no entanto este é só o princípio.

**keywords** Supply Chain, Risk Management, Economy

**abstract**

This Master Thesis briefly compiles Risk Management studies, white papers and rare literature. Speak about the recent present and uncovered topics are challenging but needed. Hidden Risks are brought up to surface wishing to contribute to Risk Management, Supply Chain Risk Management and Economy Risk Management literature.

The Master Thesis contains the Actual Real Cases that shows the business impact when risks aren't managed.

Government's are making an effort to improve some of the risk that lead to the actual recession – **Dodd-Frank Act, Basel III Reforms, "Adopts New Measures to Facilitates Nominations by Shareholders by SEC"** are examples of efforts that government's had done. However those should be seen as the beginning, because corporate governance still needs more developments.

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# Abbreviations

**SCM** – Supply Chain Management

**ERM** – Enterprise Risk Management

**BCP** – Business Continuity Plan

**UCC** – Union Carbide Corporation

**MIC** – Methyl isocyanate

**FDA** – Food and Drug Administration

**IBM** – Industry Business Machines

**GDP** – Gross Domestic Product

**GDI** – Gross Domestic Income

**ISO** – International Organization for Standardization

**R&D** – Research and Development

**SAP** – System Analysis and Program Development

**BBC** – British Broadcasting Corporation

**CNN** – Cable News Network

**CNS** – Cybercast News Service

**CBS** – Columbia Broadcasting System

**SEC** – Security and Exchange Commission

**SKU** – Stock-keeping unit

**ROI** – Return of Investment

**NPDL** – New Product Development and Launch

# Introduction

Globalization is a word that became common in the current century, the traditional organization that purchase and sells locally abruptly faced challenges in an economy spinning on a high velocity after the Internet commercial availability.

Opportunities and Challenges subject the organizations to re-think their production process, from a conservative and costly approach where organization tried to own and domain the upstream and downstream production processes, some organization split the different process and relocate those productions processes in different parts of the Globe claiming cost advantages, other's just focused in their core business and outsourced some parts of the production.

Totally Eliminate Stocks, Single Sourcing, Outsourcing, Make to Stock are some example of the common theories and strategies broadly applied by different organizations at the end of the last century and beginning of the current century. Those Strategies Benefits had been heavily published, however those benefits analysis only considered the organization isolated, but which would be the impact in the Supply Chain if all the organizations follow those strategies? Wouldn't that generated changes on the environment?

2008 Economic Recession brought to the surface news that had been deeply hide in the Golden Economic Growth period, a "hit" forced organization's to question processes, believes, limits, strategies and the so called "efficiencies". Fraud became a common constant word in the news, since Maddoff a guru economist respected to Goldman and Sachs Fraud: Had society forgot the limits?

People are paying an expensive invoice, since those that lost their jobs, to those that lost their houses to those that lost their hopes. The main two questions are how and Where, How the wealth suddenly disappeared? Where are those that caused the actual environment? Probably will take a long time to answer those questions.

Supply Chain Management challenges identified by IBM "The Supplier Chain Officer" study: Cost containment, Visibility, Risk, Customer Intimacy and Globalization. This master thesis focus is Risk Management: which risk's companies' needs to be aware off? Which methods and tools can be use to find solutions to mitigate those risks?

Published Studies, Newspapers, Magazines, Web Sites and Observation method will be use in this study as a Basis identifying: Risk Categories, Definition, Models, Methods, Tools and subtle hidden Risks.

# Motivations

Globe constant changes brought Risk Management to the surface as a main priority for the organizations. There are a few Risk Management literatures, therefore organizations tried to build the better response to risk.

This work compiles Risk Management knowledge from White Papers, Studies, Investigations, News and ten years of personal experience in Supply Chain Management that might help companies and economy executing improvements.

# Work Done

This Master Thesis goal brings to surface the main hidden Risk that constantly affects the Organizations, also compiles several white papers studies and investigations about Supply Chain Risk Management and Risk Management.

Supply Chain Risk Management had been identified as the main organization's challenge, however there isn't much literature about this topic; this master thesis tries to contribute decreasing such gap.

Real Actual Cases were used to demonstrate the Impact in Business when Risk's aren't managed, additionally Hidden Risk's are brought up to surface and the last Government efforts for face the actual recession are also covered – for example **Dodd-Frank Act**, **Basel III Reforms, "Adopts New Measures to Facilitates Nominations by Shareholders by SEC**".

Risk Management, Supply Chain Risk Management and Economy Risk Management subjects are been covered together in this Master Thesis.

# Master Thesis Structure

The Master Thesis is divided in three main Chapters. The first Chapter describes the TOP 25 Supply Chain rating since 2005, however also identifies the main challenges reported by the industry.

The Second Chapter analyzes the second major barrier in Supply Chain Management: Risk Management. The Chapter starts with terminology alignment through the definition of Risk, Risk Management, Supply Chain Risk Management, and Economy Risk Management and continues identifying the main Risk Management Approaches, Risk Categories, Tools, Models, Methods and Impact in Business with Actual Real Cases. There is explore a linkage between Economy Risk Management, Supply Chain Management, and Risk Management.

The last part of this Master Thesis describes the Hidden risk identified through observation in the last ten years, it also explores the implications of those more hidden risks and the last efforts that government had made for improve Global Economy - **Dodd-Frank Act**, **Basel III Reforms "Adopts New Measures to Facilitates Nominations by Shareholders by SEC**".

Conclusions are compile in the Chapter 4, identifying future works that could be done as a continuation of this Master Thesis.

# Chapter I

# Supply Chain Management – Art and Challenges

Economy is leaving the deepest recession since 1930, however not all the news is bad. On 2009 for example, some companies went into bankruptcy but others were extremely successful, for example Apple sold 7.4 million iPhones, 10.2 million iPods, and 3.05 million Macintosh computers [1].

What makes a company independently of a recession be so successful when others are passing through a potential bankruptcy?

If we would have the chance of comparing the Supply Chain Strategy of the multinationals with financial problems against the successful companies, what would be the result? Would had the companies with problems follow a Stock driven Supply Chain Strategy? Would had the successful companies follow a Demand driven Supply Chain Strategy?

## Supply Chain Management

Supply Chain Management emerges from different areas and disciplines for this reason there is a high probability of different meanings.

### Supply Chain

Supply Chain Definition in a Business Dictionary is "Entire network of entities, directly or indirectly interlinked and interdependent in serving the same consumer or customer. It comprises of vendors that supply raw material, producers who convert the material into products, warehouses that store, distribution centres that deliver to the retailers, and retailers who bring the product to the ultimate user. Supply chains underlie value-chains because, without them, no producer has the ability to give customers what they want, when and where they want, at the price they want. Producers compete with

each other only through their supply chains, and no degree of improvement at the producer's end can make up for the deficiencies in a supply chain which reduce the producer's ability to compete." [2]

The Institute of Logistics defines Supply Chain as "a sequence of events intended to satisfy a customer". [3]

There are several definitions of Supply Chain in the literature, although some restrict the Supply Chain to the material flow, we must include information, software or money as components commercialized in the Supply Chain's.

Material concept, as per Wikipedia definition, "is anything made of matter, constituted of one or more substances. Wood, cement, hydrogen, air and water are all examples of materials. Sometimes the term "material" is used more narrowly to refer to substances or components with certain physical properties that are used as inputs to production or manufacturing. In this sense, materials are the parts required to make something else, from buildings and art to stars and computers" [4].

The iPhone can be split into different products: the hardware and the software, both are commercialized through different Supply Chains. The physical phone can be purchased in the stores; however the software or different applications can be purchased in the internet (Virtual Supply Chain).

## Supply Chain Management

Wikipedia defines Supply Chain Management as "design, planning, execution, control, and monitoring of supply chain activities with the objective of creating net value, building a competitive infrastructure, leveraging worldwide logistics, synchronizing supply with demand and measuring performance globally."[4]

Several Supply Chain Management definitions are available on the literature, for example Donald Waters in "Supply Chain Risk Management" defines: "Logistics – or Supply Chain Management – is the function responsible for the transport and storage of materials on the journey from original suppliers, through intermediate operations, and on to final customers".

The previous definition is linked to the materials flow, however today a not only materials flow through the supply chain, for this reason Wikipedia defines best Supply Chain Management considering the last decade evolution.

# Top 25 Supply Chain [6]

AMR publishes the TOP 25 Supply Chain since 2004; the study recognizes the Top 25 Supply Chain.

GARTNER, a technology research company, bought AMR in 2010 and changed the study methodology in a significant way, because included the Computer Services / Software industry in 2010 analysis. The Computer Services / Software Industry had been excluded by AMR in previous studies; therefore I decided to don't include 2010 results in this master thesis.

## Demand-Driven Concept

AMR studied Global Supply Chains with operational and innovation excellence serving customers, therefore is the customer (demand driven) that drives the supply chain. Top 25 AMR Supply chain are those identified from Fortune Global 500 that best followed the demand driven concept.

AMR Demand-Driven definition is:

*"A system of technologies and processes that senses and reacts to real-time demand signals across a supply network of customers, suppliers and employees. The demand-driven model is inherently circular and self-renewing, unlike the push supply chain of our factory-centric industrial past." [6]*

Demand Driven Model covers the following areas [6]:

1. **"Supply Chain Management** – Manufacturing, Logistics and Sourcing."
2. **"Demand Management** – Marketing, Sales and Service."
3. **"Product Management** – R&D, engineering and product development."

The Demand Driven Model process relies on the usage of the areas above for satisfy customer demands, therefore visibility, communication and speed are key variables in operational and innovation Supply Chain Management.

Cost Control and delivery on time are some metrics used to evaluate Operational Excellence in the Supply Chain. "Time to value or Return on New Product Development and Launch (NPDL)" is one metric used by AMR to evaluate Innovation Excellence.

## The Methodology

On 2009, AMR pick the list of companies in Fortune Global 500 ranking as a basis, then the companies that belongs to the following sectors are removed from the study: Airlines, Banks, Computers Services / Software, Diversified Financials, Energy, Engineering / Construction, Food Services, Healthcare Insurance and managed care, Homebuilders, Insurance, Mail, Package and Freight Delivery, Crude Oil Production, Petroleum Refining, Railroads, Securities, Shipping, Telecommunications, Temporary Help, Trading, Utilities.

The companies are then evaluated in two main components: Financial and Opinion, where Financial weight is 60% and the Opinion weight is 40%.

The Financial component consists in the following metrics score using the latest available full year data:

- "ROA: ((2008 net income / 2008 total assets)*20%)"[6]
- "Inventory Turns: 2008 cost of goods sold / 2008 quarterly average inventory" [6]
- "Revenue Growth: ((Change in revenue 2008-2007)*50%) + ((Change in revenue 2007 – 2006)*30%) + ((Change in revenue 2006-2007)*20%)" [6]

The Opinion component weighted with 40% is base in two components equally weighted:

- A panel of AMR Research experts - The AMR Research included 20 specialists across industry and functions.
- A peer panel - The peer panel reflects the opinion of those professionals such as customers, supplier that have a close relation with the company. Consultants, Technology suppliers and people not working in Supply Chain roles had been excluded.

**Note:** Only those companies that receive votes in both panels are included in the ranking.

Finally the Composite Score is score in the following way:

> (Peer Opinion*20%) + (AMR Research Opinion*20%) + (ROA*25%) + (Inventory Turns*25%) + (Revenue Growth*10%)

## 2009 Winners

The AMR Research Supply Chain Top 25 for 2009 are [6]:

| | Company | Peer Opinion (20%) | AMR Research Opinion (20%) | 3-Year Weighted ROA (25%) | Inventory Turns (25%) | 3-Year Weighted Growth (10%) | Composite Score |
|---|---|---|---|---|---|---|---|
| 1 | Apple | 2887 | 336 | 12.60% | 45.5 | 32.70% | 7.97 |
| 2 | Dell | 2606 | 123 | 9.90% | 46.2 | 2.50% | 5.86 |
| 3 | Procter &Gamble | 2606 | 439 | 7.70% | 5.1 | 12.30% | 5.31 |
| 4 | IBM | 1798 | 329 | 10.10% | 20 | 4.90% | 5.08 |
| 5 | Cisco Systems | 1560 | 293 | 13.60% | 11 | 16.40% | 5.02 |
| 6 | Nokia | 1989 | 202 | 14.60% | 11.8 | 11.00% | 4.97 |
| 7 | Wal-Mart Stores | 2822 | 311 | 7.90% | 8.4 | 8.50% | 4.94 |
| 8 | Samsung Electronics | 1299 | 344 | 10.00% | 14.3 | 10.40% | 4.63 |
| 9 | PepsiCo | 1293 | 243 | 15.80% | 7.6 | 10.10% | 4.62 |
| 10 | Toyota Motor | 2319 | 298 | 5.10% | 11.2 | 11.70% | 4.36 |
| 11 | Schlumberger | 309 | 150 | 17.30% | 10.3 | 21.50% | 4.08 |
| 12 | Johnson & Johnson | 1181 | 196 | 14.70% | 3.4 | 7.70% | 3.93 |
| 13 | The Coca-Cola Company | 1505 | 100 | 14.70% | 4.8 | 12.10% | 3.88 |
| 14 | Nike | 1430 | 119 | 14.60% | 4.4 | 11.60% | 3.87 |
| 15 | Tesco | 1125 | 227 | 6.00% | 19 | 12.30% | 3.71 |
| 16 | Walt Disney | 743 | 77 | 7.00% | 33 | 6.40% | 3.43 |
| 17 | Hewlett - Packard | 1381 | 146 | 7.60% | 11.3 | 12.00% | 3.37 |
| 18 | Texas Instruments | 499 | 72 | 20.50% | 4 | -2.60% | 3.31 |
| 19 | Lockheed Martin | 307 | 135 | 9.70% | 22.1 | 4.00% | 3.2 |
| 20 | Colgate Palmolive | 428 | 17 | 17.90% | 5.2 | 10.90% | 3.18 |
| 21 | Best Buy | 1275 | 144 | 8.50% | 5.7 | 12.90% | 3.15 |
| 22 | Unilever | 635 | 96 | 13.30% | 5 | 1.50% | 2.87 |
| 23 | Publix Super Markets | 275 | 20 | 14.10% | 13.7 | 4.90% | 2.86 |
| 24 | Sony Ericsson | 716 | 38 | 9.30% | 15.4 | 9.00% | 2.76 |
| 25 | Intel | 500 | 124 | 11.10% | 4.9 | -0.20% | 2.56 |

**Figure 1 – Top 25 Supply Chain in 2009**

On 2009, The constant innovation performed by Apple lead the company to the Top 25 Supply Chain, the company also leads the performance in all the components been measured (Opinion and Financial). Intellectual property shines as a fundamental variable in Supply Chain.

Dell follows in second place with a high Peer Opinion Panel but a lower score in AMR Research Opinion Panel. The inventory turn is high bringing the financial measure up. Dell mass customization concept, were customers can customize the computer and the product will be deliver in 5 day's was a revolution for the Supply Chain.

The Supply Chain 25 Top Ranking in the last years was:

| 2004 | 2005 | 2007 | 2008 | 2009 |
|---|---|---|---|---|
| 1. Dell | 1. Dell | 1. Nokia | 1. Apple | 1. Apple |
| 2. Nokia | 2. Procter & Gamble | 2. Apple | 2. Nokia | 2. Dell |
| 3. Procter & Gamble | 3. IBM | 3. Procter & Gamble | 3. Dell | 3. Procter & Gamble |
| 4. IBM | 4. Nokia | 4. IBM | 4. Procter & Gamble | 4. IBM |
| 5. Wal-Mart Stores | 5. Toyota Motor | 5. Toyota Motor | 5. IBM | 5. Cisco Systems |
| 6. Toyota Motors | 6. Johnson & Johnson | 6. Wal-Mart Stores | 6. Wal-Mart Stores | 6. Nokia |
| 7. Johnson & Johnson | 7. Samsung Electronic | 7. Anheuser-Busch | 7. Toyota Motors | 7. Wal-Mart Stores |
| 8. Johnson Controls | 8. Walt-Mart Stores | 8. Tesco | 8. Cisco System | 8. Samsung Electronics |
| 9. Tesco | 9. Tesco | 9. Best Buy | 9. Samsung Electronics | 9. PepsiCo |
| 10. PepsiCo | 10. Johnson Controls | 10. Samsung Electronics | 10. Anheuser-Busch | 10. Toyota Motor |
| 11. Nissan Motor | 11. Intel | 11. Cisco System | 11. PepsiCo | 11. Schlumberger |
| 12. Woolworths | 12. Anheuser-Busch | 12. Motorola | 12. Tesco | 12. Johnson & Johnson |
| 13. Hewlett-Packard | 13. Woolworths | 13. The Coca-Cola Company | 13. The Coca-Cola Company | 13. The Coca-Cola Company |
| 14. 3M | 14. The Home Depot | 14. Johnson & Johnson | 14. Best Buy | 14. Nike |
| 15. GlaxoSmithKline | 15. Motorola | 15. PepsiCo | 15. Nike | 15. Tesco |
| 16. POSCO | 16. PepsiCo | 16. Johnson Controls | 16. Sony Ericsson | 16. Walt Disney |
| 17. Coca-Cola | 17. Best Buy | 17. Texas Instruments | 17. Walt Disney | 17. Hewlett-Packard |
| 18. Best Buy | 18. Cisco Systems | 18. Nike | 18. Hewlett-Packard | 18. Texas Instruments |
| 19. Intel | 19. Texas Instruments | 19. Lowe's | 19. Johnson & Johnson | 19. Lockhead Martin |
| 20. Anheuser-Busch | 20. Lowe's | 20. GlaxoSmithKline | 20. Schlumberger | 20. Colgate-Palmolive |
| 21. The Home Depot | 21. Nike | 21. Hewlett-Packard | 21. Texas Instruments | 21. Best Buy |
| 22. Lowe's | 22. L'Oreal | 22. Lockead Martin | 22. Lockhead Martin | 22. Unilever |
| 23. L'Oreal | 23. Publix Super Markets | 23. Publix Super Market | 23. Johnson Controls | 23. Publix Super Markets |
| 24. Canon | 24. Sysco | 24. Paccar | 24. Royal Ahold | 24. Sony Ericsson |
| 25. Marks & Spencer | 25. Coca-Cola | 25. AstraZeneca | 25. Publix Super Market | 25. Intel |

**Figure 2 – Top 25 Supply Evolution**

# Supply Chain Management Challenges

IBM spoke with nearly 400 senior executives across the world (North America, Western Europe and the Asia Pacific); the Supply Chain Officer study compiles the result of that analysis. The major challenges identified were [7]:

1. Cost containment – 56% *
2. Visibility – 70%*
3. Risk – 60%*
4. Customer Intimacy – 56%*
5. Globalization – 43%*

**"* Percentage whom reported that this challenge impacts their Supply Chain to a significant or very significant extent".**

Top Supply Chain's are investing in flexibility through agile supply chain to face cost volatility.

Supply Chain Managers reported that the alignment of the supply chain and business strategies, continuous business/process improvement, and cost reduction are more critical and effective activities than Integration and Visibility.

The Top three barriers for Supply Chain Visibility are Organisational Silos, Too Busy to Assist Others and Not Reward for It, the Top Supply Chain's are focused on improving Supply Chain Visibility [7].

Managers reported that Risk Management is the second challenge, risk is been monitored by 69%, however performance and risk managed together is only executed by 31%. The globalization and the supply chain interdependency increased the Supply Chain complexity; today an event can have high repercussions in different companies located in the different countries. Inadequate technologies, insufficient processes and insufficient information are the barriers preventing effective risk management. Top Supply Chain's are incorporating risk management in their plans and using IT for event disruption monitoring [7].

Risk Management includes the following areas:

1. Process controls in logistics and operations
2. Compliance programs with suppliers / providers
3. Risk Management in Supply Chain Planning
4. Event Management to monitor disruption

Supply Chain Managers consider Customers Interaction costly and time-consuming, company trends to interact more with suppliers than with customers. Customer input in the Supply Chain is requested by 53%, however 63% involves the supplier, and one out of every five companies ignores customers. [7]

63% of Top Supply Chains plans collaborate with customers on demand planning, against 53% of Others Companies supply chains, these means a 10% lead.

Financial Metrics, high performance in Supply Chain Management and Innovation that matters to the client are key combinations for survive in the market, for this reason companies will need to interact more with customers.

Globalization rank the top supply chain challenge, companies were able to get better margins and growth with the globalization but they are facing issues with global sourcing, such as unreliable

deliverable (65%), longer lead times (61%) and poor quality (61%). Globalization brought higher growth, but also higher costs and less efficiency.

# Chapter II

# Risk Management

Risk Management is the second challenge reported by managers, Top Supply Chain are incorporating Risk Management in their plans.

What's Risk? How do you define Risk Management? Which are the main Risk variables? How do we handle Risk?

The previous questions are starting point for Risk Management and Supply Chain Risk Management. There are several research papers available, however there isn't many book's about this theme.

## Risk

Risk is related to the uncertainty that a future event might occur, popular understanding is that this event usually causes "harm". This concept of risk as "Harm" is visible not only in the dictionaries, but also in Risk Associations, e.g.: Risk is defined in The Risk and Insurance Management Association Glossary as:

"**1. Possibility of loss or exposure to loss. 2. Probability or chance of loss. 3. Peril that may cause loss. 4. Hazard or condition that increases the likely frequency or severity of loss. 5. Property or person exposed to loss. 6. Potential dollar amount of loss. 7. Variations in actual losses. 8. Probability that actual losses will vary from expected losses. 9. Psychological uncertainty concerning loss."[8]**

**Wikipedia** definition of Risk is:

**"Risk concerns the deviation of one or more results of one or more future events from their expected value. Technically, the value of those results may be positive or negative. However, general usage tends to focus only on potential harm that may arise from a future event, which may accrue either from incurring a cost ("downside risk") or by failing to attain some benefit ("upside risk")." [4]**

Wikipedia Risk concept complies a Risk not as a Harm Event but a deviation of an expected event, this deviation can be positive or negative.

ISO Guide 73 supports the Risk definition as "effect of uncertainty on objectives. [9]" An effect is a positive or negative deviation changing the concept restricted to "Harm".

The literature identifies the different levels of uncertainty as [3]:

- **Ignorance**: "where we have no knowledge at all about what is going to happen."
- **Uncertainty**: "where we can list the events that might happen but cannot give a probability."
- **Risk**: "where we can list the events that might happen and can give each a probability."
- **Certainty**: "where we know exactly what will happen in the future."

Risk implicitly includes the following variables:

- Event
- Probability
- Impact
- Time

The event is a future outcome that might happen, an event hypothesis list should be identified, and the probability of each event identified (otherwise is not a risk).

Impact is the consequences that an event might have in the organization. Impact Events analysis must be performed, therefore those analysis made on a specific moment of time are time dependent. The same analysis perform on different moment of times might give complete different results.

Probability, as per **Wikipedia**, "is a way of expressing knowledge or belief that an event will occur or has occurred. The concept has been given an exact mathematical meaning in probability theory, which is used extensively in such areas of study as mathematics, statistics, finance, gambling, science, Artificial intelligence/Machine learning and philosophy to draw conclusions about the likelihood of potential events and the underlying mechanics of complex systems."[4]

The probability Theory Scope is:

"**Although an individual coin toss or the roll of a die is a random event, if repeated many times the sequence of random events will exhibit certain statistical patterns, which can be studied and predicted." [4]**

**Risk** becomes the probability that a deviation of one or more results of one or more future events might occur causing an impact to the organization and/or upstream or downstream network organizations been measure at a specific moment of time.

# Risk Management, Enterprise Risk Management, Supply Chain Risk Management and Economy Risk Management

Risk Management drives the main activities that can be applies for Enterprise Risk Management, Supply Chain Risk Management or Economy Risk Management.

Risk Management is defined by "The Risk and Insurance Management Association" Glossary as:

"**A management discipline, the goal of which is to protect the assets and profits of an organization by reducing the potential for loss before it occurs, and financing, through insurance and other means, potential exposures to catastrophic loss such as acts of God, human error or court judgments. In practice, the process consists of logical steps: risk or exposure identification; measurement and evaluation of exposures identified; control of those exposures through elimination and/or reduction; and financing the remaining exposures so that the organization, in the event of a major loss, can continue to function without severe hardship to its financial stability."[8]**

Wikipedia defines Risk Management as:

"**The identification, assessment, and prioritization of risks (defined in ISO 31000 as the effect of uncertainty on objectives, whether positive or negative) followed by coordinated and economical application of resources to minimize, monitor, and control the probability and/or impact of unfortunate events or to maximize the realization of opportunities. Risks can come from uncertainty in financial markets, project failures, legal liabilities, credit risk, accidents, natural causes and disasters as well as deliberate attacks from an adversary. Several risk management standards have been developed including the Project Management Institute, the National Institute of Science and Technology, actuarial societies, and ISO standards.**

**Methods, definitions and goals vary widely according to whether the risk management method is in the context of project management, security, engineering, industrial processes, financial portfolios, actuarial assessments, or public health and safety.**

**The strategies to manage risk include transferring the risk to another party, avoiding the risk, reducing the negative effect of the risk, and accepting some or all of the consequences of a particular risk.**

**Certain aspects of many of the risk management standards have come under criticism for having no measurable improvement on risk even though the confidence in estimates and decisions increase."[4]**

Risk Management widely support several areas such as IT, Supply Chain, financial (etc), ISO 31000 framework is wide for manage risk on the different areas.

**"Enterprise risk management (ERM) in business includes the methods and processes used by organizations to manage risks and seize opportunities related to the achievement of their objectives. ERM provides a framework for risk management, which typically involves identifying particular events or circumstances relevant to the organization's objectives (risks and opportunities), assessing them in terms of likelihood and magnitude of impact, determining a response strategy, and monitoring progress. By identifying and proactively addressing risks and opportunities, business enterprises protect and create value for their stakeholders, including owners, employees, customers, regulators, and society overall. (ERM)**

**ERM can also be described as a risk-based approach to managing an enterprise, integrating concepts of internal control, Sarbanes–Oxley Act, and strategic planning. ERM is evolving to address the needs of various stakeholders, who want to understand the broad spectrum of risks facing complex organizations to ensure they are appropriately managed. Regulators and debt rating agencies have increased their scrutiny on the risk management processes of companies" [4],** as per Wikipedia definition.

**Supply Chain Risk Management** are the activities of Identification, Analysis, Evaluation and Control of a probability that a deviation of one or more results of one or more future events might occur causing an impact to a network entities, directly or indirectly interlinked and interdependent in serving the same customer or customers.

Economy is defined in Wikipedia as:

**"An economy consists of the economic system of a country or other area, the labour, capital and land resources, and the economic agents that socially participate in the production, exchange, distribution, and consumption of goods and services of that area." [4]**

Gross Domestic Product measures an economy, Wikipedia definition is:

**"The gross domestic product (GDP) or** gross domestic income **(GDI) is the amount of goods and services produced in a year, in a country. It is the market value of all final goods and services made within the borders of a country in a year. It is often positively correlated with the standard of living, [1] alternative measures to GDP for that purpose." [4]**

**Economy Risk Management** is the probability that a deviation of the one or more results (e.g.: Gross Domestic Product, etc) of one or more future events that might occur causing an impact to the labour, capital and land resources, and the economic agents that socially participate in the production, exchange, distribution, and consumption of goods and services within a country or area.

The Supply Chain Risk Management challenge is to manage Risk Management integration across a network of organizations serving the same customer. The only organization that can influence cross organizations nationally are governments, or cross countries organizations such as European Union, FMI, etc... Risk Management enforcement is made by the government through laws. Organizations can't force other organizations to follow Risk Management, they can try to influence through contracts or purchasing negotiations, however the market condition can influence more deeply the purchasing decision than Enterprise Risk Management rules.

The first step to improve Supply Chain Risk Management is improving Enterprise Risk Management; also the first step to improve Economy Risk Management is improving Enterprise Risk Management. Therefore Enterprise Risk Management vertically affects Economy Risk Management and horizontally influences Supply Chain Risk Management.

**The actual Economic Recession might had been vertically influenced by missing Economy Risk Management strategies and horizontally globally propagated through missing Supply Chain Risk Management methods.**

Enterprise Risk Management sources and methods appear as been the core influence for Economy Risk Management and Supply Chain Risk Management.

# Risk Categories

The literature complies several Risk Categories, Peter Finch uses Information System Framework for identify if companies increased their exposure to risk by having small and medium size (SME) as partners. The following Risk Categories were identified in that study [10]:

1. **Application Level** – this includes Natural disasters, accidents, deliberate acts, Data Information Security Risks and Management Issues.
2. **Organisational Level** – this includes Legal risk, intellectual properties, strategic decision making, strategic and sustantability risks
3. **Inter-Organisation Level** – the risks associated with inter-organisational networking.

Mason-Jones and Towill suggested five supply Chain Risk Categories: "Environmental Risk Sources, Demand and Supply Risk Sources, Process Risk Sources and Control Risk Sources." [11]

The main Supply Chain Disruption causes reported by 82% management within the interval 2003 – 2005, according to a study made by Aberdeen Group were [3]:

1. Poor quality or damage goods (50%)
2. Missed or late deliveries (49%)
3. Unexpected increases in supply costs (47%)
4. Longer lead times (33%)
5. Supply capacity constraints (32%)

Chris Ellegaard compiles several Risk Categories within the Supply Chain; however highlight the following four main Risk Categories [12]:

1. Logistics Risks understood as disorder in goods, information and money flows.
2. Information Security meaning potential harm caused as a consequence of sharing information with external agents.
3. Opportunism means an entity decision made exclusively on its own interest by conscientiously keeping or distorting information.
4. Corporate Social Responsibility includes the company economic, social and environmental interactions that might cause harm to the environment.

Mauricio F. Blos, Mohammed Quaddus, H.M. Wee and Kenji Watanabe identified the following Risk Categories [13]:

1. Financial Vulnerability – Financial and Cash Flows
2. Strategic Vulnerability – "this kind of vulnerability appears when there is a "new model introduction" and some failures happen with the project management plan. Poor quality goods supplied were identified as one of major problem for the electronic industry."
3. Hazard Vulnerability – "includes internal risk drivers: malicious disruptions such as international terrorism to external risk drivers: natural hazards such as flooding, hot weather and heavy rain/thunderstorm."

IBM Global Business Services identified the following Supply Chain Risk Categories [14]:

1. Operational/ Technological – Includes "Forecast errors, component/material shortages, capacity constraints, quality problems, machine failure/downtime, software failure, imperfect yields, efficiency, process/product changes, property losses (due to theft, accidents, etc), transportation risks (delay's, damage from handling/transportation, re-routing, etc.) storage risks (incomplete customer order, insufficient holding space, etc.), budget overrun, emergence of a disruptive technology, contract terms (minimum and maximum limit on orders), communication/IT disruptions."
2. Social – Includes "Labour shortages, loss of key personnel, strikes, accidents, absenteeism, human errors, organizational errors, union/labour relations, negative media coverage (reputation risk), perceived quality, coincidence of problems with holiday's, fraud, sabotage, pillage, acts of terrorism, malfeasance, decreased labour productivity."
3. Natural/Hazard – Includes "fire, wild fire, severe thunderstorm, flood, monsoon, blizzard, ice storm, drought, heat wave, tornado, hurricane, typhoon, earthquake, tsunami, epidemic, famine, avalanche."
4. Economy/Competition – Includes "interest rate fluctuation, exchange rate fluctuation, price and incentive wars, and bankruptcy of partners, stock market collapse, and global economic recession."
5. Legal/Political – Includes "Liabilities, law suits, governmental incentives/restrictions, new regulations, lobbying from customer groups, instability overseas, confiscations abroad, war, tax structures, customs risks (inspection delay, missing data on documentation)."

ISO 31000 doesn't recommend a Risk Category System, as described above there are several Risk Categories in the literature and each company will need to develop there own system adjusted to the Risk that they faced. A Risk Category System allows the company to identify risk accumulations.

2010 MARSH Excellence in Risk Management Survey TOP 10 risk identified by management are [15]:

| Company's Top Risks | Overall Rank (Readiness*) | Risk Managers Rank (Readiness*) | C-suite Rank (Readiness*) | Finance Rank (Readiness*) |
|---|---|---|---|---|
| Property | 1 (86%) | 1 (87%) | 3 (91%) | 4 (67%) |
| Business Interruption | 2 (78%) | 2 (83%) | 5 (68%) | 1 (55%) |
| Regulatory / Compliance | 3 (71%) | 3 (74%) | 2 (62%) | 9 (73%) |
| General Liability | 4 (73%) | 6 (76%) | 1 (78%) | 2 (52%) |
| Workers' Compensation | 5 (79%) | 5 (83%) | 6 (73%) | 6 (47%) |
| Business Continuity / Crisis Management | 6 (70%) | 4 (70%) | 10 (67%) | 11 (70%) |
| Data Loss / Privacy | 7 (69%) | 9 (70%) | 4 (73%) | 7 (57%) |
| Brand / Reputation | 8 (47%) | 7 (47%) | 7 (54%) | 14 (22%) |
| Technology Failure | 9 (64%) | 8 (66%) | 9 (68%) | 10 (36%) |
| Directors and Officers Liability | 10 (63%) | 11 (65%) | 11 (65%) | 3 (47%) |
| Natural Catastrophe | ---------- | 10 (79%) | ---------- | ---------- |
| Cash Flow | ---------- | ---------- | 8 (76%) | 5 (77%) |
| Credit Risk | ---------- | ---------- | ---------- | 8 (77%) |

*** Percentage of respondents with management plan in place/ recent review undertaken of the risk**

**Figure 3 – Top 10 Risk's by MARSH**

Financial Risk are the one's more uncomfortable for the managers, surprisingly Climate Change isn't seeing as a Top Issue independently of all the publicity that has been made, perhaps because there is another similar category such as Natural Catastrophe.

There was an agreement on the top 10 risk however Risk Managers identified Natural Catastrophe in the TOP 10, although the C-Suite (CEO, CFO, etc) identified "Cash Flow Liquidity".

Would the study have the same result if executed in 2011?

## Operational/ Technological

2010 was a very active year in regards to Risk events, two events were selected highlighting Risk Management importance within the organizations.

## CASE 1: Johnson & Johnson Recalled 135 Million Paediatric Products

The FDA identified problems in Johnson & Johnson in Fort Washington plant, in 2003 tablets packs had incorrect amount of an ingredient per tablet due to a mislabelling problem.

Washington facility was audited again by the FDA in 2006 where was noted that some some equipment used to make drugs had not been properly cleaned.

The FDA found problems again in 2008 due to insufficient follow-up and investigation of consumer complaints. Usually the FDA audit the drug maker facilities any two years, however considering Johnson & Johnson background the FDA visited again Fort Washington facility finding deficiencies in the investigations into contamination of raw materials, the FDA also reported "**do not include the establishment of scientifically sound and appropriate sampling plans to ensure that components conform to appropriate standards of identity, strength, quality and purity**."

It looks like there was a changed in the Quality Management in Fort Washington Facility from 2003 to 2009, period where FDA findings were increasing; on 2010 FDA reported 20 violations, e.g. [16]:

- "Dusty and filthy conditions in the plant",
- "Incubators with a large amount of visible gray and brown dust/debris",
- "Large hole in the ceiling and thick dust covering the grill inside a filtered cabinet",
- "Batches of infant's Tylenol being "superpotent".

On May 2010, Johnson & Johnson suspended the production in Fort Washington plant, no comments has been made wether the workers were been on pay roll. Johnson & Johnson recalled 135 Millions of Paediatric products.

McNeil's Canadian facility started producing the Tylenol Paediatric products; in this way Johnson & Johnson was able to start selling again some of those paediatric products in September 2010, five month's after Fort Washington facility was closed.

Johnson & Johnson announced an investment of more than $100 million dollar on infrastructure and other improvement in Fort Washington Facility.

This event had a high cost to Johnson & Johson not only considering the fix cost of a plant with the production suspended, the legal consequences (e.g.: congress hearings) but specially the damage to Johnson & Johnson brand. [16][17][18]

## CASE 2: TOYOTA Recalled 8.5 Million Automobiles due to Manufacturing Defects

Since 2002, Toyota received 2000 complaints of unintended acceleration that after going through several government investigations should had been internally investigated. On San Diego accident, four people died on 28 August 2009 [19], this was the breaking point for Toyota assumes the responsibilities and recalled 8.5 Million Automobiles due to Manufacturing Defects:

- **Sticking Pedal Accelerator Problem**: "The issue involves a friction device in the pedal designed to provide the proper "feel" by adding resistance and making the pedal steady and stable.

  This friction device includes a "shoe" that rubs against an adjoining surface during normal pedal operation. Due to the materials used, wear and environmental conditions, these surfaces may, over time, begin to stick and release instead of operating smoothly. In some cases, friction could increase to a point that the pedal is slow to return to the idle position or, in rare cases, the pedal sticks, leaving the throttle partially open."[20]

- **Floor Mat Interference with Accelerator Problem**: "There is the potential for an unsecured or incompatible driver's floor mat to interfere with, or entrap, the accelerator pedal in the worst case, in the wide-open position. A vehicle with an entrapped accelerator pedal may be difficult to control and/or stop."[21]

Toyota Recall Vehicles Models list were:

| Toyota Recall List of Models | |
|---|---|
| **Floor Mat Recall** | **Pedal Accelerator Recall** |
| 2007 - 2010 Camry | Certain 2009-2010 RAV4* |
| 2005 - 2010 Avalon | Certain 2009-2010 Corolla* |
| 2004 - 2009 Prius | 2009-2010 Matrix |
| 2005 - 2010 Tacoma | 2005-2010 Avalon |
| 2007 - 2010 Tundra | Certain 2007-2010 Camry* |
| 2008 - 2010 Highlander | Certain 2010 Highlander* |
| 2009 - 2010 Corolla | 2007-2010 Tundra |
| 2009 - 2010 Venza | 2008-2010 Sequoia |
| 2009 - 2010 Matrix | |
| 2006 - 2010 Lexus IS 250 | |
| 2006 - 2010 Lexus IS 350 | |
| 2007 - 2010 Lexus ES 350 | |

**Figure 4 – Toyota Recall**

NOTE: "**Highlander hybrids and Camry hybrids are not involved in this action and will remain for sale. Further, Camry, RAV 4, Corolla and Highlander vehicles with VINs that begin with "J" are not involved".

Quantified those events are a difficult task however we do know that:

- Toyota paid a $ 48.8 Million Penalty Fines for the recalls to the NHTSA, [22]
- Toyota paid for all the cost fixing the recall cars
- Toyota stopped the selling of different models during some time
- Several people died

Quality has been the main Toyota Flag, however that image was injured for the several recalls since San Diego event all through 2010, visit: http://pressroom.toyota.com/pr/tms/toyota/toyota-consumer-safety-advisory-102572.aspx

## Social

An example of two Social events is:

- Bhopal Tragedy, even though 25 years later, Eight Employees Convicted
- BP's Deepwater Horizon Explodes in Gulf Mexico

### CASE 3: 15,000 died and more than 500,000 suffer some damage in Bhopal Tragedy - 25 Years Later - Eight Employees Convicted

On 2-3 December 1984, "a large amount of water entered tank 610. A runaway reaction started, which was accelerated by contaminants, high temperatures and other factors. The reaction generated a major increase in the temperature inside the tank to over 200 °C (400 °F). This forced the emergency venting of pressure from the MIC holding tank, releasing a large volume of toxic gases. The reaction was sped up by the presence of iron from corroding non-stainless steel pipelines. It is known that workers cleaned pipelines with water. They were not told by the supervisor to add a slip-blind water isolation plate. Because of this, and the bad maintenance, the workers consider it possible for water to have accidentally entered the MIC tank. UCC maintains that a "disgruntled worker" deliberately connected a hose to a pressure gauge" [4]

Indian Government recognized the death of 15,000 people, however more than 500,000 people suffered some damage, injury or traumas. From those 100,00 people continue to suffer 'chronic and debilitating illnesses for which treatment is largely ineffective' [23].

This wasn't the first accident in "Union Carbide" plant [4]:

- "In 1976, the two trade unions reacted because of pollution within the plant."
- "In 1981, a worker was splashed with phosgene. In panic he ripped off his mask, thus inhaling a large amount of phosgene gas; he died 72 hours later."
- "In January 1982, there was a phosgene leak, when 24 workers were exposed and had to be admitted to hospital. None of the workers had been ordered to wear protective masks."
- "In February 1982, an MIC leak affected 18 workers."
- "In August 1982, a chemical engineer came into contact with liquid MIC, resulting in burns over 30 percent of his body."
- "In October 1982, there was a leak of MIC, methylcarbaryl chloride, chloroform and hydrochloric acid. In attempting to stop the leak, the MIC supervisor suffered intensive chemical burns and two other workers were severely exposed to the gases."
- "During 1983 and 1984, leaks of the following substances regularly took place in the MIC plant: MIC, chlorine, monomethylamine, phosgene, and carbon tetrachloride, sometimes in combination."
- "Reports issued months before the incident by UCC engineers warned of the possibility of an accident almost identical to that which occurred in Bhopal. The reports never reached UCC's senior management."
- "UCC was warned by American experts who visited the plant after 1981 of the potential of a "runaway reaction" in the MIC storage tank. Local Indian authorities warned the company of problems on several occasions from 1979 onwards. "

Union Carbide agreed to pay $470 million plus interest, the court announced that the money was "for the benefit of all victims" and "not as fines, penalties or punitive damages"; 572,000 people should had got a compensation of 25,000 rupees (£315) for a survival victim and 62,000 rupees (£780) for a death claim. 80,000 people didn't receive any compensation because they weren't "properly entitled" and a similar number neither receive any compensation even though was entitled. [23]

India Supreme Court instructed Union Carbide to finance the building of a hospital, today Bhopal Memorial Hospital and Research Centre opened in 1998, that provides free medical care to all those designated by the government as gas victims.

"The American then-chairman of the US-based Union Carbide parent group, was named as an accused and later declared an "absconder" by the court." [24]

One of the 8 employees already died, the remaining 7 former's Indian employees were condemned in 2010 to two years jail and a fine of 100,000 Indian rupees (£1,467; $2,125) a piece, the maximum fine that can be paid in India. [24]

## Natural/ Hazard

Natural Catastrophe has been identified as the Last Company's Top 10 Risks, however it wasn't identified as top priority, might be that after 2010 company's perceptions changes, the following list some of 2010 Natural/Hazard events [15]:

- Iceland Volcano Ashes,
- Haiti Earthquake killed 230,000 people,
- 8.8 Magnitude earthquake hit Chile killed 800 people,
- Rainfall in Rio de Janeiro (Brazil) killed 200 and caused $ 13 billion economic losses,
- 6.9 Earthquake magnitude in China killed 400 and injured 10,000
- Flooding Hitted Tennessee - killed 30 people,
- Gound Zero Workers who sustained respiratory illness during their 9/11 cleanup efforts reached a $712.5 million settlement,
- Wildfires Destroyed one-fifth of Russia's crops killed more than 50 people and left 3,000 homeless
- 7.0 New Zeland Earthquake Costs $ 4 Billion
- US threaten by Hurricane Earl
- Tornado Hits New York City
- Asteroids Buzz raise fears of Armageddon scenario
- Toxic Spill in Hungary kills 9 people and injured 120 people,
- 7.7 Indonesia Earthquake triggered a tsunami more than 500 people were killed
- Snow Shut Down some European Airports
- Tornado Hits Portugal
- Rainfall cause a Major Disaster in Madeira

### CASE 4: Iceland Volcano Ashes

Nature successfully show's her wishes, **Eyjafjallajökull** Iceland Volcano Ashes simply caused the biggest airspace shut down since Second World War with a cost higher than $ 2 Billion [25] and more than 100,000 flight's cancelled [26].

On April 14, I was in Belgium, luckily I bought a train ticket to come back to the UK, the cost was 75 Pounds, however as soon as this nightmare started, the train tickets raised to hundred's pounds.

Business and holidays were completely disrupted, the impact is higher specially when the UK and the European Union is trying to get out of a recession and they need to export.

IATA accused the European Union of "no risk assessment, no consultation, no coordination, and no leadership". [27]

A deal was reached during a crisis videoconferencing between Europe Union and Transport ministers, the European skies were divided in 3 zones "a "no-fly" zone immediately over the ash cloud; a caution zone "with some contamination" where planes can fly subject to engine checks for damage; and an open-skies zone". [27]

Flight's refund was the second challenge for the traveller's, mainly because the "Act of God" falls out of most insurance policies, consequently airlines weren't insured for this event. [28]

## Economy/ Competition

2010 wasn't an exception for Economy/Competition Risk's:

- 'Repo 105' Accounting Scandal
- Greek Economy Crisis
- Ireland Economy Crisis
- Wall Street Flash Crash was caused by Trading Software on May 2010 [29]

### CASE 5: Greek Debt Crisis

Greece, the country with the 22 highest standard living [4], needed to be rescue in 2010 by the European Union, however the European Union demanded an economic plan for recover the country.

Greece parliament approved reforms and spending cuts 110 Billion Euro, after the government announcement Athens lived fearest moment in history, 50,000 protesters cross Athens street and a peaceful manifestation ended in fired, Syntagma Square was in chaos, luxury hotel balcony was on fire, stones flied over conservative minister "Kostis Hatzidakis". [30]

Goldman Sachs Name appeared again "**Goldman Sachs helped the Greek government to mask the true extent of its deficit with the help of a derivatives deal that legally circumvented the EU Maastricht deficit rules. At some point the so-called cross currency swaps will mature, and swell the country's already bloated deficit." [31]**

European Union approved a rescue plan, after changing the treaty, for countries overhelmed by debt. European Union has been facing criticism about a slow response to Greece issue, this rescue plan will allow a faster and more efficient response for new cases.

## Legal/ Political

A recession uncovered several Frauds in 2010, however also political events occurred:

- $ 550 Million Fine for Goldman Sachs Fraud Charges [32]
- $ 725 Million Settles AIG Fraud Charges [33]
- 178 Individuals arrested in the Biggest Global Massive Fraud Ring Stoling $24.5 Million
- Cyber Command Launched by U.S.
- 21 People Dead and 800 hurt in Bangkok. [34]

### CASE 6: Cyber Command Launched by the U.S.

The US launched on 2009 the "U.S. Cyber Command" that become operational in October 2010 and which goal is to protect the computer network defences from cyber-attacks operations.

On 2010, the Navy launched the Cyber Command branch, Maryland 10 Fleet was converted into Cyber security "Epicentre", and the goal is protect the Navy IT Systems against cyber attacks. [35]

National Security Agency (NSA) is an electronic intelligence-gathering unit and the new cyber command will build capabilities re-using NSA knowledge in cracking foreign networks. NSA cracked

foreign networks for information gathering purposes; however the Cyber Command will have the authority to launch cyber attacks on foreign networks. [36]

# Risk Approach, Models, Tools and Methods

Risk Management evolute through different studies in the last years, the literature proposed "Approaches" for Risk Management, also identifies tools that have been used by some companies to manage risk and additionally proposes methods.

## Risk Approach

Chris Ellegaard, in Supply Risk Management in a small company study, defines that risk management approach complies 3 of the 4 the following steps [12], the last step was added as an evolution result from other studies:

- **Increase Knowledge**: The best informs companies will be able to manage risks more effectively and efficiently, however in Chris Ellegaard study, knowledge gathering was rarely done due to time restrictions and resources restrictions, they occasionally received knowledge from their personal network under an unplanned and informal manner. The communication with the suppliers was rare consequentially sharing knowledge or learning were also rare events.
- **Reduce Probability**: Implement strategies or action for reduce the event probability is another option, the "Supply Risk Management in a small company study", small and medium size companies rather then increasing knowledge concentrate in reducing the probability of a risk event, simple strategies such as local sourcing, source loyalty, careful information management about the products ("we were careful not to reveal proprietary product knowledge to the supplier") are an example of some of the strategies used. These companies sourced locally for avoid risk such as "cultural differences", communication risk and coordination difficulties main Global Purchasing challenges.
- **Reduce Effect (Impact)**: Contracts weren't used by any of the small and medium size companies studied neither multisourcing was used, the root cause were limit resources and time. Holding reserves (including funds, capacity or inventory) was only used by 3 out of 11 companies. However Flexibility and responsiveness were the main effect Reduction's approach used.
- **Transfer, Share or Deflect the Risk** – Organizations can transfer Risk through contracts, although in a case that the risk is been transfer to a small organization that doesn't understand completely the risk environment end ups increasing the Supply Chain Risk instead of decreasing it. Trust, Loyalty, Honesty, Credibility and Dependability could be approaches used with the suppliers for Share or Deflect the Supply Chain Risk, however the market conditions

can influence the development of opportunism from some of the organizations destroying the possibilities of Sharing or deflecting the Supply Chain Risk. [37] Insurance has been also proposed by the literature as an option for share the risk [38]. VMI as an approach for deflect the Supply Chain Risk is an interesting result from the Study "The impact of transportation disruptions on supply chain performance". The study, through a simulation model, analyses the behaviour of a traditional Supply Chain versus VMI Supply Chain when a transportation disruption occur either between the warehouse and the retailer (Type 1), either between the first tier supplier (manufacturer) and the warehouse (Type 2), either between the second tier supplier and the first tier supplier (Type 3) or either the raw material supplier and the second tier supplier (Type 4). There weren't identified a significance behaviour differences between a Traditional and a VMI Supply Chain when the disruption is Type 2, 3 or 4. However a VMI Supply Chain was more efficient for a Type 1 disruption: "The maximum goods in transit to the retailer increases less than 20% in a VMI Supply Chain scenario, however in the Traditional Supply Chain Scenario increases more than 300%".[39]

## Risk Models

Several different White Papers identified different Methods and Models enriching the Supply Chain Risk Management Literature, IBM white paper "Supply Chain Risk Management a Delicate Balancing Act", identified four Supply Chain Models Categories to access, manage, mitigate and control risk [14]:

- **Deterministic Analytical Models** – "Includes mathematical programming models (e.g.: linear, non linear, programming and dynamic programming)."
- **Stochastic Analytical Models** – Includes analysis to random processes where uncertainty is present in one or more variables assuming that will follow a particular probability distribution.
- **Economic Models** – "Tend to be focused on buyer-supplier relationship".
- **Simulation Models** – Sample representation of the Real Processes (Universe).

## Risk Tools and Methods

Uta Juttner and the UK-Base Chartered Institute for Logistics and Transport (CLIT) had done a survey [11] with a sample of 1,700 Institute of Logistics Members; however the survey response rate was 8% (137 companies). On this study, there were identified "9 processing-tools for identifying and assessing Supply Chain Risks"; the goal was to identify how often the company used those tools in the Supply Chain Risk Management Assessment.

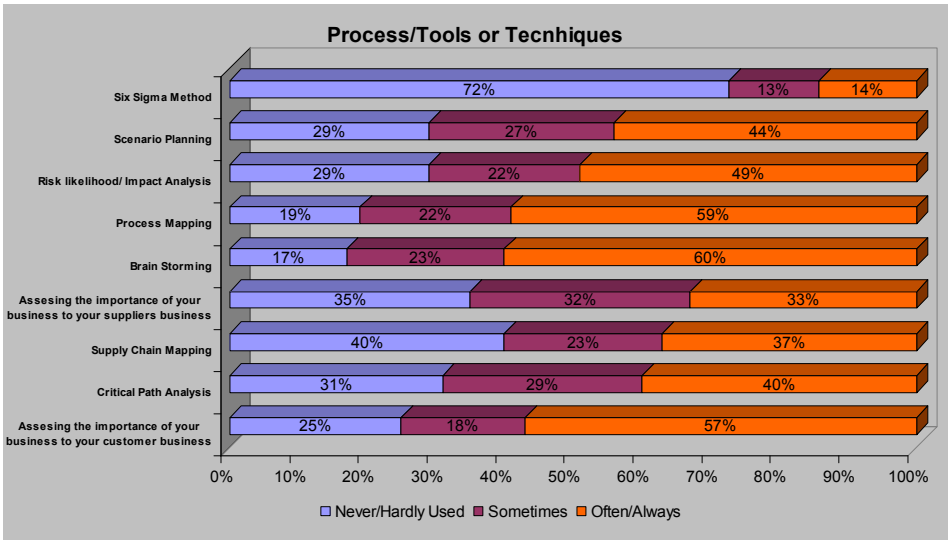


**Figure 5 – Tools and Techniques in Risk Management by CLIT**

Six Sigma was never or hardly used in Supply Chain Risk Management by 72%, the remaining tools were been used from 33% to 60% of the companies depending on the process tools or technique. The tool mostly used was the Brain Storming.

The same study, using focus group, there was recognized the importance of a Business Continuity Plan, however there was also identified the difficulties about implementing a Business Continuity Plan.

The previous study was done in 2005, the recently study "Excellence in Risk Management VII" [15] done by MARSH shows that in 2005 only 19% of the companies had an Enterprise Risk Management (ERM) program, this number significantly jump in 2010 to 69%. Although, there are 53% of the companies without an ERM program and that are neither developing one.

MARSH study identified 19 Tools/Method, the goal was to identify the mostly used and if the results were regularly sent to senior leaders [15]:

| Tools / Methodology | Our firm Uses this tool | Results sent regularly to senior leaders |
|---|---|---|
| Internal Experts | 77% | 35% |
| External Experts | 62% | 24% |
| Industry Benchmarks | 61% | 39% |
| Internally generates/ tracked risk indicators | 56% | 66% |
| Key risk indicators | 56% | 35% |
| Self assesments | 46% | 35% |
| Scenario analysis | 43% | 30% |
| Group self assessments to determine impact and probability | 41% | 31% |
| Statistical analysis / probabilistic modeling | 39% | 39% |
| Value at risk | 39% | 29% |
| External risk indicators | 38% | 51% |
| Strengths, weaknesses, opportunities, threats (SWOT) analysis | 36% | 28% |
| Risk mapping | 30% | 42% |
| Simulation exercises | 29% | 34% |
| Cash Flow at risk (CaR) | 20% | 43% |
| Earnings at risk (EaR) | 17% | 44% |
| Risk adjusted return on capital (RAROC) | 16% | 39% |
| Return on risk adjusted capital (ROIRAC) | 13% | 45% |
| Economic Value Added | 10% | 44% |

**Figure 6 – Most Used Tools in Risk Management by MARSH**

MARSH study mainly identified tools not methods, as per Wikipedia definition, a series of steps or process with the goal of achieving a result defines a "Method" according to the United States patent law [4].

Peter Finch, in 2004, identified the following major components of Risk Management [10]:

- **Risk Identification** – "Identifying and quantifying the exposures that threaten a company's assets and profitability"
- **Risk Analysis** – "Identifying and assessing the risk to which the company and its assets are exposed in order to select appropriate and justifiable safeguards".
- **Risk Reduction, Transfer and Acceptance** – "reducing or shifting the financial burden of loss so that, in the event of a catastrophe, a company can continue to function without severe hardship to its financial stability".
- **Risk Monitoring** – "continually assessing existing and potential exposures."

Donald Waters, in 2007, identify the following core steps in Supply Chain Risk Management [3]:

- **Preparation** – Acknowledgement that are risk to be managed, especially Senior Management acknowledgement is important and consequently risk management responsibilities and roles within the company.
- **Identification** – Risk Identification of **the most relevant** uncertainties within the Supply Chain. The Risk Categories identified – please see above "Risk Categories" – can be used as starting point for the companies, however those sources or categories should be tailored to the company reality. Operational people are an Internal Source useful source in risk assessment, because they usually know the main problems within the areas.
- **Analysis** – Analyze and Prioritize the Risk identified in the previous step in terms of Probability and Impact, through quantitative or qualitative approaches. The Risk Categories could be use during the assessment, because similar risks might have similar impacts.
- **Response** – Risk Response aim is define the most appropriate way of dealing with Supply Chain Risk and identify the actions that must be implemented, e.g.: Increase the Capacity, Increase the Stocks, Change the Location, Increase the number of Suppliers, Create a Multisourcing Supplier candidates that can be used in an emergency case, are examples of possible responses.
- **Monitoring and Control** – Continue Risk Management Improvement and adjustment considering External and Internal context changes.

Criticism to the previous method has been raised in the literature, mainly companies find difficult to identify the most significantly risk, "**Stemmler (2006) says that simply identifying the risks 'poses an almost insurmountable challenge for line managers**'" [3].

Business Continuity Planning appeared as another Risk Management Strategy, the goal in this case is analyze the effects of an unavailable element within the Supply Chain and create plans for restore the flow as soon as possible, instead of identifying Risks and mitigate their effects.

The Risk nature can influence the approach, perhaps Business Continuity Planning is the answer for some of the External Risk (e.g.: Natural Disasters, etc); however the Risk Management method expouse above can be appropriate for Internal Risk (e.g.: Operational Risks, etc.).

On 2009, the International Organization for Standardization launched the **ISO 31000 [40]** – "Risk Management Principles and Guidelines" that could be following by any sector guarantee a common framework within the company and across the sector's.

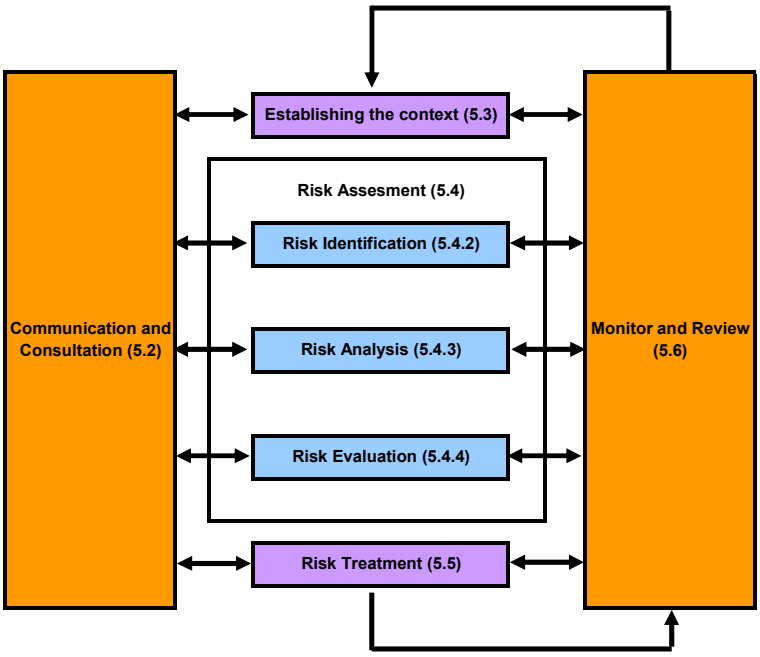


**Figure 7 – Risk Management ISO 31000**

The Risk Management steps defined by **ISO 31000** are:

- **Communication and Consultation (5.2)** – must occur during all the stages, mainly risks, causes consequences, measures, decision and decision reasoning are communicated to the stakeholders (stakeholders are all the people that can affect or be affected or think that will be affected by a decision or activity).
- **Establishing the Context (5.3)** – Settle, in detail, the objectives, Internal and External parameters that must be considered during the risk assessment, these includes the records to be kept, the responsibilities and resources definition. The external environment that can impact the organization objectives defines the External context. The Internal context is the internal organization environment that influences the organization results. Risk Criteria must be defined and aligned with legal requirements by which the organization is affected, those

criteria's must be defined initially and they must be used during the risk significance evaluation. A periodically review to those criteria's is also needed.

- **Risk Assessment (5.4)** – The Risk Identification, Risk Analysis and Risk Evaluation process defines the Risk Assessment.
    - **Risk Identification (5.4.1)** – The goal is list all the events that might influence the organization objectives, the areas that those risk might impact, the events that can occur and the causes and potential consequences. Key points are the involvement of people with suitable knowledge, the appropriate selection of tools, techniques and background information.
    - **Risk Analysis (5.4.2)** – Measure Risk Impact and Probability (Likelihood) are this step main goal. Risk attributes, existing controls effectiveness and efficiency should also be considered. The analysis should be made to the risk and to the mix of different risks, the assumptions, the limitations, uncertainties, data quality, data availability and risk sensitive conditions should be register and include in the communication to the decision makers.
    - **Risk Evaluation (5.4.3)** – The goal is make decision based in the Risk Analysis results, legal requirement and prioritizes the risk treatment considering the impact and probability mix. A "no act" decision, a re-analysis or treat the risk are possible outcomes.
- **Risk Treatment (5.5)** – Includes the implementation of one or more options for modifies risks balancing the cost and efforts against the benefits. This is a cyclical process includes assessing the risks treatment, analyzing the residual risk, if those residual risk aren't tolerable then create a new risk treatment and assessing again the treatment effectiveness.
- **Monitor and Review (5.6)** – Risk Management process should be periodically or ad hoc review considering the risk treatment results, findings, learning's, the External and Internal environment context changes and new risk information or development in the literature.

# Summary

Concepts definitions are the starting point of this chapter, ensuring that communication is clear and align in the thesis. A key point is the understanding that Risk Management is relevant for the organization, economy and supply chain.

Risk Categories and Risk Management Approaches register in the literature could be use as starting point for Risk Management Analysis, or improve the existing Risk Management Programs. The thesis compiles real cases that happened in 2010, classified considering IBM Risk Categories definition, the

hope is that those bring conscience about the catastrophiques consequences in the Globe when Risk Management is ignored.

Even though organizations had identified Natural Disaster as the last risk in their Top 10 risks priority, 2010 was the year were natural disaster's were constantly affecting people globally and highlighted in the news.

This Chapter contains the Risk Categories evolution identified in the literature, there is a focus in those risk such as Natural Disasters because their consequences can be catastrophique and easily visible. Aren't Risk's hidden in the Supply Chain that are constantly affecting the organization results? Risk's that aren't visible however can deeply affect the organization?

Enterprise Risk Management methods, tools and approaches are guidelines for Risk Management Assessment. Supply Chain Risk Management assessment is more difficult than Enterprise Risk Management assessment because needs to manage the network Risk's, however the network Risk might be lesser in the case that all the organizations had applied Enterprise Risk Management methods, tools and approaches.

This Chapter ends mentioning ISO 31000 process (method); however the framework wasn't mentioned because the similarity between both's is high. ISO 31000 brought a standard for Risk Management Framework and Methods that could harmonize the different isolate Enterprise Risk Management programs.

# Chapter III

# Hidden Risk's

Consider the scenario that there are companies producing high volume of high-tech products for theoretically decrease the costs, they score the SKU price base in the components cost per pice. The components cost per piece is score using data that hasn't been reviewed because there is no time for that.

There are spending millions harmonizing the plants through Global Business Processes without collecting the AS-IS processes of all the plants in the initial template, because that will take too much time and there isn't time for that. Consequently any time they rollout the solution to a new plant they need to adjust the template and spend more money.

They decided to move a plant to China even thought they produce high-tech products that can be copied by the competition without respecting the patents, after a short period of time competitors start selling the same products at a lower price.

The company building is rented, the resources (machines), cars and laptops are under a lease contract for this reason a high percentage of the asset is stock of products that weren't sold because the demand dropped; those are high-tech products have a short live cycle and the cash flow is burning.

Do you think that the previous scenario is unrealistic? I'm afraid to tell you that it is very realistic.

The last decade was useful to reckon the hidden risk within the companies that very few usually speak about:

1. Data Quality
2. Metrics Concept Alignment
3. Metrics Definition
4. Cultural Component

# Data Quality

Data Quality can look as an obvious requirement; however in the different projects implemented I realized that companies has a higher focus in implementing software rather than implementing solutions. A company can have the best planning software worldwide, however if the data quality that feed that software is poor, what do you think that will happen?

Data quality monitoring should be a continue focus within the companies rather than a focus only when the projects are implemented. Data quality does not only influence the operational day to day business within a company, but it also influences the decision been made by top management.

Data is converted into information provide to management through reports, this information is the basis for strategic decisions such as transfer of a production site from one country to another or the decision about where the centres of competence (e.g.: IT) should be located, etc.

How accurate is the information use by management is such decisions? Are they considering all the variables and the respective risk when those decisions are taken?

Questions like how much is the company expending? Which are the products/ services where the company expend more money? What is the cost of producing the product X? look like simple questions, however the shareholders will be surprise that companies (not only small or medium but also multinational companies) aren't able to respond to those questions immediately, most of them need to get that information manually in a time consuming manner and most of the time with a low accuracy level.

A company value not only depends on the profit that is able to share with the shareholders today but also and mostly depends on the profit that will be able to generate in the future. How can a shareholder evaluate and securely invest their money in a company that doesn't know where is expending the money? Or what is the cost of producing the product X? Or if the cost of producing the product X is accurate? How the shareholder does know if the company knows where is expending the money or if the information has been used is accurate?

## Case 7: Data Transformation in Manufacturing within a Multinational

The case further explained is real; due to data confidentiality restrictions the company name can't be provided. In this case we examine a multinational company executing the data transformation in the manufacturing area. The company is implementing SAP across three main process areas including Customer Facing, Supply Chain and Finance.

The Data was transformed for all the different applications, however the focus will be in the Manufacturing area for the following objects: Bill of Materials and Recipes/ Routings.

- **Bill Of Materials**

The material and Bill of Material master data creation, for some of the products, has a central repository in "**Non SAP System X"**, where local and central business worked together, after the business approvals the master data was been propagated to the **Local Replaced SAP System.**

The update in the central system was taking several days until was been propagated to the local sap system, mainly due to the number of business approvals needed, consequently business updated the **Local Replaced SAP System** rather than the central repository "**Non SAP System X"**.

Parallelly the company was executing a project were the Bill of Materials of the remaining products were been migrated to "**Non SAP System X"**.

Several analyses were made to the Bill of Materials data received from the "**Non SAP System X"** versus the data been used in the **Local Replaced SAP System** and the Data required for the **New SAP System**, the main results were:

• New Functionalities were needed and implemented in "**Non SAP System X"**

• An enormous effort was made to clean the data in the central system ("**Non SAP System X"**), because they were found mismatches in more than 70% of the Bill of Material relevant for the project.

The solution went live with an excellent Bill of Materials data quality in the central repository "**Non SAP System X"** that was the basis of the data migration for the **New SAP System**, however the effort involve for get those results was enormous. Remains the question: What information was been provided, before the data cleanse, by the reports that had the central system as source?

- **Recipes / Routings**

The previous **Local Replaced SAP System** SAP system was using Routings only for costing purposes and the new SAP System required the usage of Recipes and Routings for planning and costing purposes.

The data accuracy in the **Local Replaced SAP System** was low (machine time, setup time and quality time), for this reason mainly we just used basic information from the routings (material master, plant, task list description and resource) from the **Local Replaced SAP System** and manually gather all the remaining information needed for the Recipes and the Routings in excel files use as basis in the data conversion.

They were created around 3,000 Recipes in the **New SAP System**, for this reason a huge effort was needed for data gathering. The main advantage of gathering the data from scratch is that the data quality since the beginning was high.

The recipes are used in the product costing. The colleagues that were implementing the financial process were comparing the product cost in the **Local Replaced SAP System** against the product cost in the **New SAP System**, the product cost in the **Local Replaced SAP System** was base in the setup, machine and quality times in the routings only use for costing purposes and the product cost in the new SAP system was base in the data (setup, machine and quality times) gathered from the planners and use as basis for planning and costing.

The Financial team found several products with a variance higher to +25% or -25%, whenever this happen during a data migration, there is the need that business approves the variance.

Before the Financial team formally required the variance approval, they informed the person that was maintaining the routings about the variances that had been found, the following answer was received: "We know that the times in the routings has not been review in the last years, the new times has been provided by the planners for this reason those are accurate. The prices will need to be updated considering the new costs".

Under a recession context the margins of the products are low, if the cost of the product is higher in 25%, was the company generating profit or was it generating debt when those products were been produced? And for those products with a variance higher than -25%, how many businesses were lost because the cost forecasted was higher then the real cost?

Those differences many times aren't realized by the shareholder's because if one product was generating debt perhaps a new product is generating profit. Only at an operational level those differences will be acknowledged. Additionally top management in most of the companies usually don't required a report with the product cost before and after projects implementations, that information dies most of the time, for several reasons as you can imagine, at the operational level.

# Metrics Concept Alignment

Theoretically shareholder investment in the markets should be safe if the information provided represents and reflects the company economic situation, however the information provided is usually limited and shareholders has been forced to invest sometimes facing big losses.

US 2010 legal changes reflect shareholder uncomfortable accumulated feeling. On December 2009, SEC (Security and Exchange Comminision) approved the "Enhanced Disclosure about Risk, Compensation and Corporate Governance" rules, that requires additional information disclosure to the shareholders so they can evaluated the public companies leadership more accurately, those rules became effective from 28 February 2010 onwards and they "would help shareholders to determine whether a company has incentivized excessive or inappropriate risk-taking by employees" [41]. The new rules demands disclosure "in proxy and information statements about:

- The relationship of a company's compensation policies and practices to risk management.
- The background and qualifications of directors and nominees.
- Legal actions involving a company's executive officers, directors and nominees.
- The consideration of diversity in the process by which candidates for director are considered for nomination.
- Board leadership structure and the board's role in risk oversight.
- Stock and option awards to company executives and directors.
- Potential conflicts of interests of compensation consultants." [41]

Nearly thirty years after shareholders have been advocating a federal proxy access rule; SEC (Security and Exchange Comminision) passed a rule, on August 2010, that "Adopts New Measures to Facilitates Nominations by Shareholders" [42]. This applies to "All Exchange Act reporting companies, including investment companies, other than companies whose only public securities are debt securities" The rule was deferred during 3 year's for the "Smaller reporting companies". "Foreign Private Issuer" Companies aren't currently subject to SEC proxy rules.

SEC (Security and Exchange Comminision) got the authority for make rules "addressing shareholder access to the company proxy materials" [43] after Dodd-Franl Wall Street Reform and Consumer Protection Act.

Directors used to nominated the board members candidates, that information was included in the proxy materials send to the shareholders for them to vote their shares, rarely companies permit the shareholder participation on the annual shareholder meeting, however this is too late for nominate new candidates because the proxy votes had been already "Cast" [43].

The "Adopts New Measures to Facilitates Nominations by Shareholders" permits that shareholders nominates board member candidates under certain conditions, nominate a candidate is different from elect a candidate. Those conditions are [43]:

- Only Shareholders that own at least 3% companies share continuously in the last 3 years and through the day of the annual meeting are eligible to nominate a candidate,
- Shareholders that hold the securities with the goal of changing the company control aren't eligible,
- Eligible Shareholder can nominate one candidate or up to 25% of the company board directors whatever is greater.

Logically we can think that a candidate nominated by a shareholder elected as director will protect the shareholder investment, because member board directors have access to reports that more accurately reflect the company risks and operations. Do They?

Intra-company financial and goods flows are normal in today business, the companies within a multinational need to fight for the production volumes and the products that they will produce, as normal, they will try to get the products with the higher margins. Only the internal companies profitable for the group survive in today economic context.

Metrics are internally defined by the multinational for compare the performance of all the internal companies. Top management meeting usually occur with the manager of each of the internal companies presenting the ROI, Product Cost, Number of complaints from customer per product, Purchase Volume, Stocks Level, Moving Average Price, etc.

Management will take strategic decision base in those reports where the different companies are been compared, however the assumption constantly made is that all those metrics were score using the same concept. Were they?

## Case 8: Implementing a Central Purchasing Data Analytics Tool within a Multinational

The case further explained is real; due to data confidentiality restrictions the name of the company can't be provided. Data Analytics tools implementation by the Central Procurement department within a multinational for globally compare procurement performance. The multinational company had plants in North America, Europe and Asia.

The Central Procurement Department required a tool where they could get the procurement data analytic metrics without requiring that information to the local sites, the information must be available to the central core buyers at any time and without 3'rd Party involvement. Several metrics such as Purchasing volume, moving average price, cost avoidance, cost reduction, etc; were implemented to be measured by a new tool. The Procurement Reporting Central tool was used by top management through high level reports and by the core buyers that required detail level reports, considering the data of all the plants within the multinational.

Each one of the plants was using a different SAP System; for this reason were created jobs for send the information from the local SAP system into a central repository.

The Business Requirement phase considered workshops for gather more information regarding how the metrics were been scored. As a result, it was acknowledged that all the sites were using non-sap standard reports for score those metrics. The number of different metrics and the respective realities is too vast, for this reason the focus will be only in the moving average price of the purchased components.

**Moving Average Price = Total Value / Quantity**

The material can be valuated as a standard price or moving average price in SAP, the company strategy was the moving average price material valuation, after the material is set to be valuated as moving average price then SAP will automatically score the moving average price. SAP scores the moving average price of a product in the following way [44]:

$$Quantity_{new} = Quantity_{old} + Quantity_{receipt}$$

$$Value_{new} = Value_{old} + Quantity_{receipt} * Price_{receipt} / Price\ unit_{receipt}$$

$$Price_{new} = Value_{new} / Quantity_{new} * Price\ unit_{material\ master}$$

**Figure 8 – Moving Average Price SAP Definition**

The material master represents a product in SAP terms, e.g.: a raw material, semi-finished or finished (SKU) product.

SAP standard moving average price concept considers the goods movement of the product since the material master was created, if the material master was created 10 years ago, then the product initial price is still reflect in the moving average price. The raw materials price can have a high variance in a short time of period in some industries, one of the local purchasing departments realized that, for this reason they weren't using the SAP standard moving average price. That department scored the moving average price only considering the goods movement of the last fiscal year.

SAP moving average price and the new moving average price was quite different, the new moving average price was much lower, therefore this was the value been used in the SKU product cost.

The plants were using one of the following three main categories to report the moving average price:

1. Group A was reporting SAP Standard moving average price through non-sap standard report that also score another metrics.
2. Group B was reporting the moving average price base in the goods movement of the last fiscal year (Total Value/ Quantity).
3. Group C was reporting the moving average price base in the actual Stock Value divided by the actual Stock Quantity.

The central Data Analytics tool integrated with the different SAP System's, guarantee that the same metrics concept was used in the reports provided to top management and the core buyers.

# Metrics Definition

Economy is facing one of the deepest recession since 1930, with a decrease of the demand, an increase of the stocks and a decrease of the cash flow. How can suddenly the world face such recession? Is it possible that the money disappears from the system? Cash flow burning is the number one cause for a company bankruptcy. Most of the companies that request the bankruptcy have a low net profit or a negative net profit, assets but no cash flow. Why is that?

The recession uncovered the fact that actual regulation was insufficient for protect shareholders, the **Dodd-Frank Act** and **Basel III Reform** are examples of urgent improvements that governments were forced to implement avoiding future invoices on the tax payer account as a consequence of questionable Banks strategies, after all when Banks were distributing millions of profit the tax payer didn't receive that money.

**Dodd-Frank Act** includes "over 100 rulemaking" that complies changes in "derivates regulation, clearance and settlement activities, registration of private fund advisers, credit rating agency regulation, corporate governance and executive compensation regulation, reforms to the asset-backed securitization process, the standard of care applicable to financial intermediaries, and other improvements with investor protection." [45]

**Basel III Reform** mainly demand that Banks increase their capital and liquidity, decreasing the probability that governments (tax payer) will need to inject money in future recessions [46].

Managers had been influenced in the last years by several economics theories, such as "make to stock" for reduce the cost per product. The stock is booked as an asset in the balance sheet of the companies, as required by law; however is all the stock really an asset?

Eliyahu M. Goldratt and Jeff Cox in "The GOAL", challenges the concept that the stock should be a liability and not an asset [47]. Stock represents an investment that will be converted into products and consequently in a net profit, under this perspective stock, as demanded by law, is booked as an asset.

Companies has been producing stock following "make-to-stock" production theories for theoretically reduce the cost per product, consequently there is obsolete stock that either can't be sell because the product expired, or because there is no demand. There is also the stock with a coverage rate of years because the demand is very low. All this stock is been booked as an asset, but is it really an asset? Companies know that the probability of selling those products is null or very low; however the products aren't scrapped due to the impact in the balance sheet. Should all the stock be an asset? Or

only the stock that is not obsolete and below certain limits of coverage rate should be consider as an asset and the remaining stock should be consider a liability?

If that stock would have been booked as a liability instead of an asset, would had the market identified sooner the risk of a recession? Would be possible that the money disappears from the economic system, because it was invested in products that can't or wouldn't be sold? Couldn't this explain that a company has a strong asset, a low net profit however it went to bankruptcy because there is no cash flow for buy the raw material needed for produce the products with demand?

Do Shareholders have the complete view of the companies economic healthy through actual financial metrics such as the balance sheet, net profit, etc, when they decided to invest their money? Is accounting, a discipline created one century ago, in need of a deep review? Or is it that the actual metrics need to be enhanced, and they can't be considered individually but they need to be considered in groups and they need to be released to shareholders?

The financial metrics are been questioned, e.g., it is known that the cost per piece will increase if the number of setup increase and the batch lot decreases, the assumption is that more people is needed for execute more setups. However a company needs a minimum number of people for start the production that perhaps aren't 100% occupied, for this reason the more setups can be executed with the same costs, however the cost per piece will increase in that scenario. The decrease of the batch lot can help the companies in the decrease of the investment in stock, relising pressure over the cash flow and decreasing the lead time - if the company could split the delivery of the order in parcels [47].

The understanding of production process can help in the definition of the financial metrics, e.g.: There is the understanding that the bottleneck resource define the capacity of the plant, this means that a hour lost in the bottleneck resource means a hour lost in the total production of the plant. Eliyahu M. Goldratt and Jeff Cox in "The GOAL", challenges that the cost of the bottleneck resource per hour, defining that be equal to the total cost of the entire system divided by the number of hours that the bottleneck produces [47].

Personally, rather than that, there could be a bottleneck resource risk impact metric equal to:

**BRR = number of hours lost * total cost of the entire system / number of hours that the bottleneck produces.**

This Risk Metric could appear side by side with the standard financial metrics such as ROI. Another metric that could be include is the (Total Obsolete Stock Value includes Raw Material, Semi-Product and Product + Total Value Potential Obsolete Stock*1)/ Total Asset.

*1 This means that legally could be establish a maximum coverage of 2 years, imagine that the stock for a material has a coverage of 4 years then the 2 years stock will have a high probability that will become Obsolete with an absolute value higher then Y.

There were several companies that used leasing as a strategy for decrease the investment, however leasing also means fix rent and commitments, in a recession context the unancomplishment of those commitments also means that the company will have more difficulties to survive.

**Dodd-Frank Act** and **Basel III Reform** are the first sign of change, however should the reforms stop or should continue creating risk indicators that should be disclouse to shareholders with the actual financial metrics?

# Cultural Component

A Global Market constantly challenge the companies, only the most profitable companies survive, therefore plants are been transferred between countries proclaiming higher profits and lower costs. China, the young tiger, has been constantly announced as a lower cost country with enormous advantages for the industry, looking backwards, were all the risks considered when those decisions were made?

The Office of the United States Trade Representative, report the following in April of 2010 [48]: ""We are seriously concerned about China's implementation of 'indigenous innovation' policies that may unfairly disadvantage U.S. IPR holders. Procurement preferences and other measures favouring 'indigenous innovation' could severely restrict market access for American technology and products," said Ambassador Kirk. "Creating an environment that nurtures innovation and entrepreneurship is a worthy goal, but China must maintain a level playing field.""

Intellectual Property has been a problem in China for many years, without a confirmed short-term solution. The transfer of a plant, means the transfer of know how, that can be copied by local companies without respecting the intellectual property. Does the lower cost cover the risk?

Culture is a higher risk in economic and supply chain, however is usually ignored. What's Culture? As per Wikipedia definition [4]: "Culture (from the Latin cultura stemming from colere, meaning "to

cultivate") is a term that has various meanings. For example, in 1952, Alfred Kroeber and Clyde Kluckhohn compiled a list of 164 definitions of "culture" in Culture: A Critical Review of Concepts and Definitions. However, the word "culture" is most commonly used in three basic senses:

- Excellence of taste in the fine arts and humanities, also known as high culture
- An integrated pattern of human knowledge, belief, and behaviour that depends upon the capacity for symbolic thought and social learning
- The set of shared attitudes, values, goals, and practices that characterizes an institution, organization or group"

Habits are so deeply inconscient that most of the time people don't realize that they are restricting themselves only to what had been experienced before even when previous strategies hasn't work in the past. Tried the "new" demands face the fear of failure; "change" demands a huge effort and courage to expose yourself but mainly demands that you know yourself. People drive miles and miles looking for an adventure but sometimes they hasn't mix themselves with other cultures, they hasn't live life as per the local's, they hasn't stopped to know themselves.

Cultural diversity increased in the cities but also mini countries had risen. Rather than mix with the local people, communities had been created base in the habits transported from their original country. Humanity feels more comfortable with what they know; rethink believes, challenges philosophies, open the mind requires courage to be different from the one's that directly surround you. This could explain why when live and watch multicultural cities I reckon that usually I found groups from cultural clusters, e.g.: Asia, Europe, Africa, South America and North America. A mix is more common in couples, but more rarely seen in cross cultural clusters groups going out together.

Cultural Awareness is always important; however is a company cultural awareness just because there are different people from different countries working together? Is a city cross cultural just because there live people from different countries? Does the individuals reckon that the company organization culture should be prevail to there individual culture? Does the company organization culture prevail to the individual culture?

## Case 8: Operational Support within a Multinational

The case further explained is real; due to data confidentiality restrictions the name of the company can't be provided.

The project went live, for this reason, all the data and the processes were been used by business. Normal day to day business was been executed using the new tools implemented, as normal day to day

business one new setup group category needed to be customized. The Project team can't execute any customization after a go live, for this reason, the operational support team needs to execute that specific task.

Knowledge transfer was occurring, however the customization of a setup group is sap standard and the task takes much less than 30 minutes. The setup group customization was requested to the operational support, the answer received always was "I will do that". The operational support meeting took place and the responsible for implementing the ticket received another urgent requirement. Instead of customizing the necessary changes, he called another colleague requiring help. The sommatory of time spend in phone calls about that topic was higher than the time needed for execute the task.

My face was reflecting all my thoughts at that moment of time, my team lead look at me and told me: "You know, partially that is cultural". After a week the setup group category wasn't customized.

# Global Business Process Understanding

A Global world brought the dream of a global company, also the focus in cutting costs encourage the idea for develop Global Business Processes. Multinationals are developing templates base in Global Business Processes and consolidating their Information Technologies System accordingly.

A Global Business Process means that one specific activity can be executed in the same way in different plants that sometimes are located in different countries, however is it law equal in all the countries worldwide?

The Internal Business Process owner is the Company, for this reason, the decision maker for change the organization process is the Company, however the decision maker for implemented External Processes sometimes is the government or the market. The Government defines the processes through laws and the market defines the process through inter-company negotiations, e.g.: the accounting laws in Brazil are very different from the accounting laws in Europe.

Is it possible that a multinational create a Global Business Process for External processes when the decision maker is an external entity? If not, in that case for which areas can a Global Business Process be implemented?

Business Processes must be split in clusters, e.g.: Procurement, Manufacturing, Accounting, Controlling, Payroll, etc.

There can be the need of identify the sub-processes within the cluster that are in contact with external processes, because in that case it can happen that only some parts of the Cluster can be Global, e.g.: The Procurement process can include sub-processes such as Creation of the Purchase Requisition, Release Approval of the Purchase Requisition, Convert the Purchase Requisition into the Purchase Order, Submit the Purchase Order to the Supplier. The Purchase Order Layout that is submitted to the supplier is in contact with an external process, because by law it might need the explicitly mention of some clauses. This means that the Purchase Order Layout can be a sub-process within the Procurement cluster that needs to be region or country specific.

There can also be the scenario where the complete cluster is country specific, e.g.: Payroll or Accounting (e.g.: Brazil payroll processes are completely different from any other country).

Most of the times the Global Business Process is define either by the central department that take a few plants of the company as "the basis" for implement those processes without ensuring that the sample represent their universe. It is often forgotten that local markets can run in different ways for diverse valid reasons, however it can still be possible to define a Global Business Process as far as the AS-IS processes of the parties are included in the initial Business Requirements Collection and only afterwards the template is developed.

Time means money, for this reason the Project Timelines are so shorts, there is no time for collect the AS-IS processes, and companies most of the time pick in a one plants for developed the template. They forget that in the long term they end up spending more money.

# Summary

Hidden Risk's can influence and impact deeply the organizations; the following main hidden risk has been identified through observation:

1. Data Quality
2. Metrics Concept Alignment
3. Metrics Definition
4. Cultural Component
5. Global Business Process Understanding

Government's are making an effort to improve some of the risk that lead to the actual recession - **Dodd-Frank Act**, **Basel III Reforms, "Adopts New Measures to Facilitates Nominations by Shareholders by SEC**" are examples of efforts that government's had done. However those should be seen as the beginning, because corporate governance still needs more developments.

Financial metrics by their own are insufficient for evaluate a corporation, risk indicator's that are quantitative or qualitative should also be consider side by side when shareholders are investing their money in the stock market.

The challenge resiles in develop a standard set of Risk Indicators that bring up to the surface those Hidden Risk's that constantly and commonly affects the corporation.

# Conclusion

Companies bankruptcy were constant topic in the news in 2009, however while some companies were struggling to survive others were extremely successfully, for example Apple, therefore is not a surprise that Apple is the Number 1 Top Supply Chain company in 2009.

We started with Supply Chain Management challenges identified by IBM "The Supplier Chain Officer" study: Cost containment, Visibility, Risk, Customer Intimacy and Globalization.

Risk's vertically affecting Economies and horizontally is propagated through the Supply Chain, therefore the importance for Enterprise Risk Management, Supply Chain Risk Management and Economy Risk Management integration. This master thesis focus is Risk Management: which risk companies' needs to be aware off? Which methods and tools can be use to find solutions to mitigate those risks?

Risk concept alignment was the first step even though risk concept is usually perceived as "lost", we rather support risk definition as **"Risk concerns the deviation of one or more results of one or more future events from their expected value. Technically, the value of those results may be positive or negative. However, general usage tends to focus only on potential harm that may arise from a future event, which may accrue either from incurring a cost ("downside risk") or by failing to attain some benefit ("upside risk")." [4]**

ISO Guide 73 supports the Risk definition as "effect of uncertainty on objectives."[9] An effect is a positive or negative deviation changing the concept restricted to "Harm".

The literature identifies the different levels of uncertainty as [3]:

- **Ignorance**: "where we have no knowledge at all about what is going to happen."
- **Uncertainty**: "where we can list the events that might happen but cannot give a probability."

- **Risk**: "where we can list the events that might happen and can give each a probability."
- **Certainty**: "where we know exactly what will happen in the future."

Risk main variables are: Event, Probability, Impact and Time.

Risk Categories identified in previous studies are a starting point; we could consider Aberdeen Group risks categories [3]:

1. Poor quality or damage goods (50%)
2. Missed or late deliveries (49%)
3. Unexpected increases in supply costs (47%)
4. Longer lead times (33%)
5. Supply capacity constraints (32%)

Or we could select Chris Ellegard Risk Categories [12]:

1. Logistics Risks understood as disorder in goods, information and money flows.
2. Information Security meaning potential harm caused as a consequence of sharing information with external agents.
3. Opportunism means an entity decision made exclusively on its own interest by conscientiously keeping or distorting information.
4. Corporate Social Responsibility includes the company economic, social and environmental interactions that might cause harm to the environment.

IBM Risk Categories identified in the study "Supply Chain Risk Management: A Delicate Balancing Act" were selected as the Basis to identify risk events samples that occurred in 2010, the Risk Categories identified are [14]:

1. Operational/ Technological – Includes "Forecast errors, component/material shortages, capacity constraints, quality problems, machine failure/downtime, software failure, imperfect yields, efficiency, process/product changes, property losses (due to theft, accidents, etc), transportation risks (delay's, damage from handling/transportation, re-routing, etc.) storage risks (incomplete customer order, insufficient holding space, etc.), budget overrun, emergence of a disruptive technology, contract terms (minimum and maximum limit on orders), communication/IT disruptions."

2. Social – Includes "Labour shortages, loss of key personnel, strikes, accidents, absenteeism, human errors, organizational errors, union/labour relations, negative media coverage (reputation risk), perceived quality, coincidence of problems with holiday's, fraud, sabotage, pillage, acts of terrorism, malfeasance, decreased labour productivity."
3. Natural/Hazard – Includes "fire, wild fire, severe thunderstorm, flood, monsoon, blizzard, ice storm, drought, heat wave, tornado, hurricane, typhoon, earthquake, tsunami, epidemic, famine, avalanche."
4. Economy/Competition – Includes "interest rate fluctuation, exchange rate fluctuation, price and incentive wars, and bankruptcy of partners, stock market collapse, and global economic recession."
5. Legal/Political – Includes "Liabilities, law suits, governmental incentives/restrictions, new regulations, lobbying from customer groups, instability overseas, confiscations abroad, war, tax structures, customs risks (inspection delay, missing data on documentation)."

Johnson & Johnson 135 Million Paediatric Products recall and Toyota 8.5 Million Automobiles Recall were events classify under Operation / Technological Risk category.

Social Risk Category included Bhopal and BP's Deepwater Horizon in Gulf Mexico.

2010 Natural / Hazard risk events list is the biggest even that Natural/ Hazard risk is identify as the last of the TOP 10 Risk study done by MARSH [15] were Iceland Volcano Ashes was selected for deep analysis.

Economy recession crisis also offer several cases examples such as Greek Debt Crisis, Ireland Economy Crisis, Portugal Economy Crisis or even "Repo 105" Accounting Scandal.

Political Risk cases appear side by side Economy, samples are "$ 550 Million Fine for Goldman Sachs Fraud Charges", $ 725 Million Settles AIG Fraud Charges, Cyber Command Launched by the US.

Risk Models, Tools and Methods are instruments that shall be used in the process of facing and solving risks, Peter Finch "Supply Chain Risk Management" study and Donald Waters "Supply Chain Risk Management" study contribute with risk methods proposals. However **ISO 31000 [40]** – "Risk Management Principles and Guidelines", framework is the most complete risk method found:

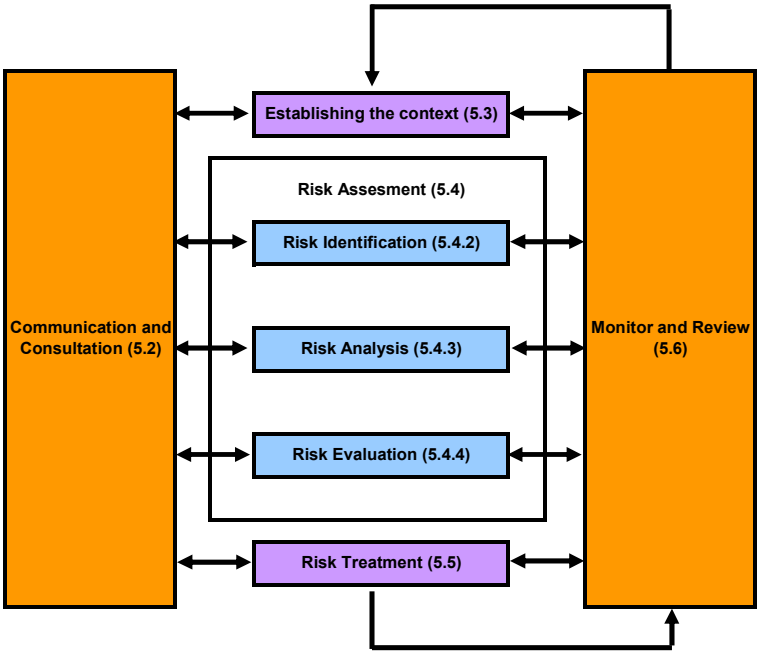


**Figure 9 – Risk Management ISO 31000**

The Risk Management steps defined by **ISO 31000** are:

- **Communication and Consultation (5.2)** – must occur during all the stages, mainly risks, causes consequences, measures, decision and decision reasoning are communicated to the stakeholders (stakeholders are all the people that can affect or be affected or think that will be affected by a decision or activity).
- **Establishing the Context (5.3)** – Settle, in detail, the objectives, Internal and External parameters that must be considered during the risk assessment, these includes the records to be kept, the responsibilities and resources definition. The external environment that can impact the organization objectives defines the External context. The Internal context is the internal organization environment that influences the organization results. Risk Criteria must be defined and aligned with legal requirements by which the organization is affected, those criteria's must be defined initially and they must be used during the risk significance evaluation. A periodically review to those criteria's is also needed.
- **Risk Assessment (5.4)** – The Risk Identification, Risk Analysis and Risk Evaluation process defines the Risk Assessment.
    - **Risk Identification (5.4.1)** – The goal is list all the events that might influence the organization objectives, the areas that those risk might impact, the events that can occur and the causes and potential consequences. Key points are the involvement of people with suitable knowledge, the appropriate selection of tools, techniques and background information.

- **Risk Analysis (5.4.2)** – Measure Risk Impact and Probability (Likelihood) are this step main goal. Risk attributes, existing controls effectiveness and efficiency should also be considered. The analysis should be made to the risk and to the mix of different risks, the assumptions, the limitations, uncertainties, data quality, data availability and risk sensitive conditions should be register and include in the communication to the decision makers.
- **Risk Evaluation (5.4.3)** – The goal is make decision based in the Risk Analysis results, legal requirement and prioritizes the risk treatment considering the impact and probability mix. A "no act" decision, a re-analysis or treat the risk are possible outcomes.

- **Risk Treatment (5.5)** – Includes the implementation of one or more options for modifies risks balancing the cost and efforts against the benefits. This is a cyclical process includes assessing the risks treatment, analyzing the residual risk, if those residual risk aren't tolerable then create a new risk treatment and assessing again the treatment effectiveness.
- **Monitor and Review (5.6)** – Risk Management process should be periodically or ad hoc review considering the risk treatment results, findings, learning's, the External and Internal environment context changes and new risk information or development in the literature.

Five Subtle Hidden Risk frequently impacting business were identified through observation: Data Quality, Metrics Concept Alignment, Metrics Definition, Cultural Component and Global Business Understanding.

Data is converted into information provided to management for strategically decisions, the product cost as basis for day to day business decision is a key figure, and however a real case was presented where Data Quality directly impacted the final real product cost figure.

Multinational managers many times compare the different plants using reports believing that they use the same key figures, however sometime only the key figure name is the common variable on those reports. A real case sample was provided were several plants within the same multinational were providing the moving average price figure using complete different methods during the score process, however those figures were been compare by management in the assumption that the method use for score the value was the same.

Multinational should challenge not only the methods use to score the Key figures, but they should challenge too the Key figures concept, and a new economy age thinkers started this work. Stock is booked today as an asset, however new thinkers challenge that indeed stock is a liability and not an asset.

Volume production, make-to-stock strategies could have been the correct approaches within an unlimited and restricted available options context, or under a context where there are only a few competitors and the sommatory of the production was lesser than the demand. This usually happens when an innovation is carried out, for example the famous "Model T" black car for the masses created by Henry Ford, or even the Internet availability for the masses.

Where is the breakpoint? The point when does strategies would start damaging the company because the sommatory of the Globe production is higher than the demand, or because the External Environment deeply changed, or because the actual strategies for the current market set have more disadvantages than advantages. Specially, how shareholder or managers knows that the organization reached the breakpoint?

Companies has been producing stock following "make-to-stock" production theories for theoretically reduce the cost per product, consequently there is obsolete stock that either can't be sell because the product expired, or because there is no demand. There is also the stock with a coverage rate of years because the demand is very low. All this stock is been booked as an asset, but is it really an asset? Companies know that the probability of selling those products is null or very low; however the products aren't scrapped due to the impact in the balance sheet. Should all the stock be an asset? Or only the stock that is not obsolete and below certain limits of coverage rate should be consider as an asset and the remaining stock should be consider as a liability?

If that stock would have been booked as a liability instead of an asset, would had the market identified sooner the risk of a recession? Would be possible that the money disappears from the economic system, because it was invested in products that can't or wouldn't be sold? Couldn't this explain that a company has a strong asset, a low net profit however it went to bankruptcy because there is no cash flow for buy the raw material needed for produce the products with demand?

Do Shareholders have the complete view of the companies economic healthy through actual financial metrics such as the balance sheet, net profit, etc, when they decided to invest their money? Is accounting, a discipline created one century ago, in need of a deep review? Or is it that the actual metrics need to be enhanced, and they can't be considered individually but they need to be considered in groups?

Government's are making an effort to improve some of the risk that lead to the actual recession - **Dodd-Frank Act**, **Basel III Reforms, "Adopts New Measures to Facilitates Nominations by Shareholders by SEC**" are examples of efforts that government's had done to improve shareholders

information availability. However those should be seen as the beginning, because corporate governance still needs more developments.

**Dodd-Frank Act** includes "over 100 rulemaking" that complies changes in "derivates regulation, clearance and settlement activities, registration of private fund advisers, credit rating agency regulation, corporate governance and executive compensation regulation, reforms to the asset-backed securitization process, the standard of care applicable to financial intermediaries, and other improvements to investor protection" [45].

**Basel III Reform** mainly demand that Banks increase their capital and liquidity, decreasing the probability that governments (tax payer) will need to inject money in future recessions [46].

Risk Management Indicators should correctly reflect the actual risks been faced by the company, for fulfil that requirement hidden risk's must brought to surface, metrics should be aligned across the company, reports should explicitly and clearly explain how those metrics where score, reports should explicitly include the sources and the time period for which the analysis was done and the date when that analysis was executed.

Those Risk Management Indicators should also cover data quality governance about how often and when the data is review and which processes or approvals must be follow when high impact data is changed, such as the data that affect the product cost.

Management should also start considering quantitative and qualitative cultural indicators when taking decision that include sites re-alocation, for example, potential losses in Intellectual Property.

Cultural awareness is also more deeply needed within the organization for reach successfully cooperation between cultures.

# Future Development's

Besides the definition of Risk Indicators that reflect all Risk Categories and also the Hidden Risk's, firstly there is the need for identify as much as possible the Hidden Risk's that are affecting the companies, some hidden risk's were identified in this thesis through observation that could be confirmed through some studies:

- How often is data review and maintain within the organization?

- What process approval if any must be follow when impact data is changed?
- Is data mostly manually maintained within the organization? Or is it automatically maintain?
- Are reports cross company aligned? This sturdy must be done at the technical detail field level, because most of the time people are using the same terms but scoring the measures using different fields.
- Does the report contains an explanation of: How the data was scored? Which were the sources used? Was there any manual manipulation or is an automatic report? The time period used in the analysis?
- Where there cultural facts that barriers the company goals? If yes, which and what was the impact?

An interesting study would be to get access to the bankrupted companies in the last 5 years for answer the following question: Are common business patterns followed by bankrupt companies?

# Bibliography

[1] Akin, B.; etal (2009) "Apple Supply Chain Performance Measurement & Factors"

[3] Waters, D. (2007). "Supply Chain Risk Management": 1 - 237. The Chartered Institute of Logistics and Transport (UK).

[6] Friscia, T.; etal (2009), "The AMR Research Supply ChainTop 25 for 2009", AMR.

[7] Moffat, R. W. (2009). "The Smarter Supply Chain of the Future", IBM.

[10] Finch, P. (2004). "Supply Chain Risk Management". Supply Chain Management – An International Journal (UK).

[11] Juttner, U. (2005). "Supply Chain Risk Management: Understanding the business requirements from a practitioner prespective". Cranfield School of Management, Cranfield University (UK).

[12] Ellegaard, C. (2008). "Supply Chain Risk Management in a small company prespective": 425-434. Copenhagen Business School (Denmark).

[13] Quaddus, etal (2009). "Supply Chain Risk Management (SCRM): a case study on the automotive and electronic industries in Brazil": 248. University of Technology - Nagakota and Curtin University of Technology - Perth (Japan and Australia).

[14] IBM Global Business Services (2008). "Supply Chain Risk Management: A Delicate Balancing Act". IBM (USA).

[15] Carpenter, G.; Wyman, O. (2010). "Excellence in Risk Management VII: Elevating the Practice of Strategic Risk Management". MARSH (USA).

[16] Kavilanz, P. (2010). "'Shocking' conditions at Tylenol plant". CNN Money (USA).

[17] Kavilanz, P. (2010). "Tylenol plant: From bad to Worse". CNN Money (USA).

[18] Kavilanz, P. (2010). "Johnson & Johnson CEO: 'We made a mistake'". CNN Money (USA).

[19] Vlasic, B. (2010). "Toyota's Slow Awakening to a Deadly Problem". The New York Times (USA).

[22] Drives, P. (2010). "Toyota to pay $32.4 million fine for recalls". CNN Money (USA).

[23] Brown, M. (2010). "Bhopal gas disaster's legacy lives on 25 years later". The Telegraph (USA).

[24] Biswas, S. (2010). "Bhopal trial: Eight convicted over India gas disaster. BBC (UK).

[25] CBS (2010). "Volcano Cloud's Impact: Some $ 2 Billion and Counting". CBS (USA).

[26] NOVINITE (2010). "Iceland Volcano Ash Disrupts 900 Flights in Europe". NOVINITE (BULGARIA).

[27] CBS (2010). "Millions of Stranded Travelers Given Hope". CBS (USA).

[28] CBS (2010). "Volcano Cloud's Impact: Some $2B and Counting". CBS (USA).

[29] Rooney, B. (2010). "Trading program sparked May 'flash crash'". CNN Money (USA).

[30] Maltezou, R.; Behrakis, Y. (2010). "Greek police clash with anti-austerity protesters". Reuters (USA).

[31] Balzli, B. (2010). "How Golman Sachs Helpded Greece to Masks its true Debt". Spiegel (Germany).

[32] BBC (2010). "Goldman Sachs agrees record $550m fine". BBC (UK).

[33] Bansal, P.; Eder, S. (2010). "AIG to pay $725 million to settle fraud case". REUTERS (UK).

[34] BBC (2010). "Bangkok clashes death toll climbs to 21, with 800 hurt". BBC (UK).

[35] Montalbano, E. (2010). "U.S. Navy Launches Cyber Command". Information Week (USA).

[36] Henricks, Mark (2010). "U.S. General Alexander Confirmed to Lead Cyber Command". CIOZONE (USA).

[37] Laeequddin, etal (2009). "Supply Chain Risk partners' trust building process through risk evaluation: the perspectives of UAE packaged food industry": 280 - 290. Express Flexi-Pack

(United Arab Emirates) and Institute of Management Tecnhology (United Arab Emirates and India).

[38] Bosman, R. (2006). "The New Risk Management Challenge: Risk Management in a Global Economy": 1 – 10. FM Global (USA).

[39] Wilson, M. "The Impact of Transportation Disruption on Supply Chain Performance": 295 – 320. College of Business Administration (USA).

[41] Securities and Exchange Commission (2009). "Enhanced Disclosure About Risk, Compensation and Corporate Governance". Securities and Exchange Commission (USA).

[42] Altschuller, S (2010). "Securities and Exchange Commission Passes New Proxy Access Rule". Foley Hoag - Corporate Social Responsibility and the Law. (USA).

[43] Securities and Exchange Commission (2010). "New Measures to Facilitate Disrector Nominations by Shareholders". Securities and Exchange Commission (USA).

[45] Schapiro, M. (2010). "Testimony on Implementation of the Dodd-Frank Wall Street Reform and Customer Protection Act by the U.S. Securities and Exchange Commision". Securities and Exchange Commission (USA).

[46] India Reuters (2010). "Central banks agreed a raft of changes on Monday to the planned Basel III reform that will make banks hold more capital and liquidity to withstand shocks without taxpayer aid". Reuters (India).

[47] Goldratt, E.. and Cox, J. (1984). "The GOAL": 158-159; 272; 239-241; 258-260. Gower (USA).

[48] Besinger, Ken; Vartabedian, Ralph (2009). "New Details in Crash that Prompted Toyota Recall". Los Angeles Times (USA).

[49] Moss, Stephen (2010). "Greek debt crisis: death and destruction in Athens". The Guradian (UK).

[50] Masters, Brooke; Jenkins, Patrick Guerrera, Francesco (2010). "Basel reforms to hit investment banking arms". Finantial Times (UK and USA).

**Sites**

[2] Supply Chain Definition – Business Dictionary: http://www.businessdictionary.com/definition/supply-chain.html

[4] Wikipedia: http://en.wikipedia.org/

[5] APICS: http://en.wikipedia.org/wiki/Supply_chain_management

[8] Risk Management Society: http://community.rims.org/RIMS/RIMS/Glossary/AlphabeticalTab/Default.aspx

[9] The Risk Management Institute: http://www.theirm.org/index.html

[20] Toyota Pressroom: http://pressroom.toyota.com/pr/tms/customer-faqs-regarding-the-sticking-153495.aspx

[21] Toyota Pressroom: http://pressroom.toyota.com/pr/tms/customer-faqs-regarding-the-sticking-153495.aspx#link%202

[40] International Organization for Standardization: http://www.iso.org/iso/home.html

[44] SAP: http://help.sap.com

[48] The Office of The United States Trade Representative - http://www.ustr.gov/about-us/press-office/press-releases/2010/april/ustr-releases-2010-special-301-report-intellectual-p

**Sites Sources:**

CNN: http://money.cnn.com/

The New York Times: http://www.nytimes.com

Los Angeles Times: http://articles.latimes.com/

BBC: http://news.bbc.co.uk

CBS: http://www.cbsnews.com

The Times: http://www.thetimes.co.uk/tto/news/

Reuters: http://www.reuters.com

Spiegel: http://www.spiegel.de

The Guardian: http://www.guardian.co.uk

Financial Times: http://www.ft.com/

The Information Week: http://www.informationweek.com

SEC (Security and Exchange Commision): http://www.sec.gov/

Climate Risk: http://blog.riskmetrics.com/esg/2010/03/proxy-season-sec-climate.html

Gartner: http://www.gartner.com/technology/supply-chain/top25.jsp