Uncontrollable Risks and the Role of the Board of Directors

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Abstract

Black Swan Events (BSE) and systemic risk have entered the lexicon of business around the world, largely as a result of major shocks such as the global financial crisis in 2008, the global H1N1 influenza pandemic in 2009 and the Great East Japan Earthquake in 2011. This study frames the phenomena under the rubric of *uncontrollable risks* and examines them in the context of Corporate Risk Management (CRM). An uncontrollable risk is a critical uncertainty whose nature and causality may be known or knowable but the means to predict or prevent its occurrence are not yet available.

Uncontrollable risks are similar to the "known unknowns" in risk parlance, but also encompass "unknown unknowns" because their probability and mode of occurrence are indeterminable in most instances. Examples include natural disasters, cyber-attacks and global shocks. With regard to the ex ante identification of uncontrollable risks, the Organization for Economic Cooperation and Development (OECD) and the World Economic Forum (WEF) are at the vanguard as such risks are either exogenous or systemic in nature. Moreover as they are perceived as beyond the "control" of any single institution, these risks are typically outside of the enterprise risk management remit of most corporations. All too often such a risk event is characterized metaphorically as a company's "worst nightmare."

Although the impact of uncontrollable risks on Governance, Risk Management and Compliance (GRC) are significant, there is no conceptual framework for a Board of Directors (BoD) to consider with regard to their monitoring, management and mitigation. Addressing these shortcomings at the board level requires an inter-disciplinary approach that relies upon concepts and methods developed from two emerging disciplines: complexity science and behavioral science. It also requires bridging functions such as Enterprise Risk Management (ERM) and Business Continuity Management (BCM) to develop a more holistic approach for boards to address uncontrollable risks.

This study provides a conceptual framework to assist a BoD in identifying and responding to critical uncertainties prevalent in an interconnected and interdependent global economy. The research highlights the importance of board diversity for improving the ex ante identification of uncontrollable risks. It introduces new approaches to risk mapping and scenario planning at the board level that puts greater emphasis on risk interconnectivity as well as on potentially catastrophic risks. The study also underscores the importance of organizational resilience to manage and to mitigate uncontrollable risks.

Abstract

Begriffe wie „Black Swan“ Ereignis oder „Systemrisiko“ sind heute fest im Unternehmenswortschatz verankert, hauptsächlich infolge schwerwiegender Katastrophen wie der globalen Finanzkrise von 2008, der globalen Influenza H1N1 Pandemie von 2009, oder Japans Tōhoku-Erdbeben von 2011. Diese Arbeit definiert derartige Phänomene als „unkontrollierbare Risiken“ und betrachtet sie als Gegenstand des Corporate Risk Management (CRM). Unkontrollierbare Risiken sind kritische Unsicherheiten deren Ursache und Natur unter Umständen zwar bekannt sein können, deren Auftreten sich aber dennoch weder vorhersagen noch vermeiden lässt.

Unkontrollierbare Risiken umfassen im allgemeinen Sprachgebrauch nicht nur „*bekannte Unbekannte*“ sondern auch „*unbekannte Unbekannte*“, da ihre Wahrscheinlichkeit und ihre Art der Erscheinung zumeist undeterminierbar sind. Beispiele sind Naturkatastrophen, Cyber-Angriffe und globale Schocks. In der ex ante Identifikation solcher Risiken sind die Organisation für wirtschaftliche Zusammenarbeit und Entwicklung (OECD) und das Weltwirtschaftsforum (WEF) weltweit führend, da sie vornehmlich exogener und systemischer Natur sind und gemein als außerhalb des Kontrollrahmens einzelner Institutionen und damit nicht als Bestandteil des klassischen Risikomanagements gelten. Oft werden sie metaphorisch als „*schlimmster Albtraum*“ des Unternehmens bezeichnet.

Obwohl unkontrollierbare Risiken einen signifikanten Einfluss auf Governance, Risikomanagement und Compliance haben, verfügen Aufsichts- und Verwaltungsräte über keinen konzeptionellen Rahmen um diese systematisch zu überwachen, zu managen und zu verringern. Ein solcher Rahmen bedarf eines interdisziplinären Ansatzes, der auf neuen Methoden der Komplexitäts- und Verhaltenswissenschaften aufsetzt. Er bedarf auch der Verknüpfung von Funktionen wie Enterprise Risk Management (ERM) und Business Continuity Management (BCM) zu einem ganzheitlichen Ansatz.

Diese Arbeit stellt einen konzeptionellen Rahmen vor um Aufsichts- und Verwaltungsräte zu unterstützen in der Identifikation von und Antwort auf kritische Unsicherheiten, die in eng verflochtenen globalen Ökonomien auftreten. Die Arbeit betont die Bedeutung von Diversität in diesen Gremien um die ex ante Identifikation unkontrollierbarer Risiken zu verbessern. Dazu führt sie neue Konzepte des Risikomappings und der Szenarioplanung ein, die der Verpflechtungen von Risiken und potenziell katastrophalen Folgen Rechnung tragen. Die Arbeit betont auch die Wichtigkeit von organisationeller Resilienz für das Management und die Abschwächung unkontrollierbarer Risiken.

Abstract

Des termes tels que « Black Swan Events » (BSE) ou « risques systémiques » sont entrés dans le vocabulaire des entreprises à travers le monde, en grande partie en conséquence de chocs majeurs tels que la crise financière globale de 2008, la pandémie globale de grippe H1N1 en 2009 et le séisme de la côte Pacifique du Tōhoku au Japon en 2011. Cette étude aborde ces phénomènes en tant que risques incontrôlables et les examine dans le contexte du « Corporate Risk Management » (CRM). Un risque incontrôlable est une incertitude critique dont la nature et la cause peuvent être connues, ou connaissables, mais dont l'apparition ne peut pas être prédite, ni prévue, avec les moyens actuels.

Les risques incontrôlables sont similaires à des « inconnues connues » dans le langage courant, mais comprennent également les « inconnues inconnues » dont la probabilité et le mode de réalisation ne sont, dans la majorité des cas, pas préalablement déterminables. Les désastres naturels, les cyberattaques et les chocs globaux en sont quelques exemples. En ce qui concerne l'identification ex ante des risques incontrôlables, l'Organisation de Coopération et de Développement Économiques (OECD) et le Forum Economique Mondial (WEF) sont à l'avant-garde. En effet, étant donné que ces risques sont exogènes ou systémiques par nature, et perçus comme échappant au contrôle de toute institution individuelle, ils ne sont généralement pas pris en compte dans la gestion traditionnelle des risques à l'échelle de l'entreprise. Néanmoins, ces risques sont souvent qualifiés métaphoriquement de « pire cauchemar » pour une société.

Bien que l'impact des risques incontrôlables sur la gouvernance, la gestion des risques et la conformité soient importants, les conseils d'administration ne disposent pas de cadre conceptuel pour les surveiller, les gérer et les atténuer. Remédier à cela requiert une approche interdisciplinaire se basant sur des concepts et méthodes provenant de deux disciplines émergentes : les sciences de la complexité et les sciences du comportement. Cela demande également de combler le fossé entre des fonctions telles que l' « Enterprise Risk Management » (ERM) et le « Business Continuity Management » (BCM) afin de permettre aux conseils d'administration d'adopter une approche plus holistique pour faire face aux risques incontrôlables.Cette étude présente un cadre conceptuel visant à aider les conseils d'administration à identifier et répondre aux incertitudes critiques qui prévalent dans une économie globale interconnectée et interdépendante. L'analyse met en évidence le rôle crucial que joue la diversité au sein des conseils d'administration dans l'amélioration de l'identification ex ante des risques incontrôlables. Elle présente de nouvelles approches pour la cartographie des risques et l'élaboration de scénarios qui mettent davantage l'accent sur l'inter-connectivité des risques, ainsi que sur les risques potentiellement catastrophiques. L'étude souligne également l'importance de la résilience des organisations dans la gestion et l'atténuation des risqués incontrôlables.

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Geneva, 2015 William Howell

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List Abbreviations

Art.	Article
BBC	British Broadcasting Corporation
BCM	Business Continuity Management
BIS	Bank for International Settlements
BoD	Board of Directors
BSE	Black Swan Event
CEO	Chief Executive Officer
cf.	confer (compare to)
CFO	Chief Financial Officer
CFTC	Commodities Futures Trading Commission of the United States
CGC	Corporate Global Citizenship
CHF	Swiss Franc
CO	Swiss Code of Obligations
COO	Chief Operating Officer
COSO	Committee of Sponsoring Organizations of the Treadway Commission
CRM	Corporate Risk Management
CRO	Chief Risk Officer
CRS	Congressional Research Service
CSR	Corporate Social Responsibility
CTO	Chief Technology Officer
DJIA	Dow Jones Industrial Average
DOJ	Department of Justice of the United States of America
ed.	Edition
et al.	and others

EOS	Executive Opinion Survey of the World Economic Forum
ERM	Enterprise Risk Management
FAA	Federal Aviation Administration
FINMA	Financial Market Supervisory Authority of Switzerland
GCR	Global Competitiveness Report of the World Economic Forum
GDP	Gross Domestic Product
GPS	Global Positioning System
GE	General Electric Company
GRC	Governance, Risk Management and Compliance
GRPS	Global Risks Perception Survey of the World Economic Forum
HR	Human Resources
HSA	Host State Act of Switzerland
ICC	International Chamber of Commerce
Ibid.	Ibidem
Id.	Idem
ISO	International Organization for Standardization
Ltd.	Limited Company
MNC	Multinational Corporation
NAT	Normal Accident Theory
NCG	New Corporate Governance
NYSE	New York Stock Exchange
no.	Number
OECD	Organization for Economic Co-operation and Development
PD	Positive Deviance Approach
RRN	Risk Response Network of the World Economic Forum

SA	Situation Awareness
sec.	Section
SEC	Securities and Exchange Commission of the United States of America
SIFI	Systemically Important Financial Institutions
SOX	Sarbanes-Oxley Act
SWIFT	Society for Worldwide Interbank Financial Telecommunication
TEPCO	Tokyo Electric Power Company
USD	United States Dollar
vol.	Volume
VUCA	Volatility, Uncertainty, Complexity and Ambiguity
WEF	World Economic Forum

Part One: Introduction

I. Problem Analysis

A. Practical and Theoretical Relevance

Black Swan Events (BSE) and systemic risk have entered the lexicon of business around the world, largely as a result of major shocks such as the global financial crisis in 2008, the global H1N1 influenza pandemic in 2009 and the Great East Japan Earthquake in 2011. This study frames the phenomena under the rubric of *uncontrollable risks* and examines them in the context of Corporate Risk Management (CRM).

Uncontrollable risks are similar to the "known unknowns" in risk parlance, but also encompass "unknown unknowns" because their probability and mode of occurrence are indeterminable. Examples include natural disasters, cyber-attacks and global shocks. In this study an uncontrollable risk is defined as a critical uncertainty whose nature and causality may be known or knowable but the means to predict or prevent its occurrence are not yet available.

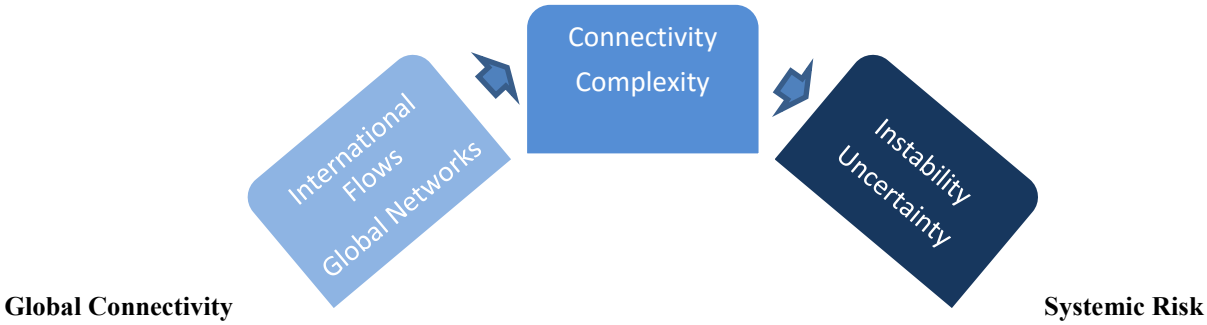
As they are perceived as beyond the "control" of any single institution, risks are typically outside of the Enterprise Risk Management (ERM) remit of most corporations. Moreover, uncontrollable risks are often characterized metaphorically as a company's "worst nightmare." Although the impact of uncontrollable risks on governance, risk management and compliance are significant, there is no conceptual framework for a Board of Directors (BoD) to consider with regard to their monitoring and mitigation.

1. Rise of Global Connectivity

This study is premised on the notion that uncertainty and complexity are reshaping the business environment worldwide. Both are increasing as a result of an exponential flow of goods, services, capital, people and data. These flows have resulted in an increasingly interdependent and inter-connected global economy that today require a BoD to address the impact of uncertainty and complexity on their corporate governance and risk management responsibilities. Global connectivity is arguably "the defining characteristic of our age"[1] given the multidimensional cross-border flows and their expanding network effects. This study posits that global connectivity is driving higher levels of complexity that generate uncertainty as well as systemic risk (Figure 1).

[1] Goldin, I. & Mariathasan, M. (2014:10).

Figure 1: Global Connectivity and Systemic Risk



Source: Author.

A BoD therefore faces growing uncertainty as "[a] multitude of trends, developments, driving forces and obstacles are at work which will affect in important ways the nature of risks and the context in which they are managed."[2] Concurrently boards are also confronted with increasing complexity because there is "[o]ften little incentive for individuals to take a systemic view that examines interconnections and interdependencies between different parts or agents of a complex system."[3]

2. Influence of Major Events

These conceptual shifts are supported by a succession of major risk events that were initially considered highly improbable or even implausible until their dramatic occurrence. In 2011 the Organization for Economic Co-operation and Development (OECD)[4] highlighted that its member countries:

> "[h]ave suffered international terrorist attacks in 2001, 2003 and 2005, unprecedented destruction during hurricane Katrina in 2005, the worldwide financial meltdown in 2008 that reshaped and expanded the number of key constituents in global economic governance, the first declared pandemic in over 40 years in 2009, and most recently the Tohoku earthquakes, tsunami and ensuing nuclear reactor accidents at the Fukushima power plant."[5]

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2 OECD (2003: 33).
3 OECD (2011: 12).
4 The OECD was established in 1961 and is headquartered in Paris, France as a result of a multilateral treaty (OECD Convention of 14 December 1960). With an annual budget of over EUR 350 million and 2500 staff, it supports its 34 member countries with data collection, analysis and multilateral surveillance of economic and development related issues. See http://www.oecd.org/ (site last visited on 10 April 2015).
5 OECD (2011: 4).

Therefore it is not surprising that the OECD in its subsequent 2014 review of risk management and corporate governance practices would highlight the following concern:

> "It is not always clear that boards place sufficient emphasis on potentially "catastrophic" risks, even if these do not appear to very likely to materialize. More guidance may be provided on managing the risks that deserve attention, such as risks that will potentially have large negative impacts on investors, stakeholders, taxpayers, or the environment. Boards should be aware of the shortcomings of risk management models that rely on questionable probability assumptions."[6]

Despite this awareness, the OECD and similar institutions have yet to present a holistic and integrated conceptual framework for corporations to consider that differentiates between routine emergencies, disasters and global shocks (Table 1). Academic research on Enterprise Risk Management (ERM) offers sparse practical guidance on how companies could address such shortcomings in risk management at the board level. This study provides a conceptual framework for corporations and related practical guidance to their Boards of Directors (BoD) under the rubric of *uncontrollable risks*. This framework and its related practices would be a significant research contribution from an academic and industry perspective. Both would benefit from the recognition of uncontrollable risks prevalent in a globalized and inter-dependent economy.

[6] OECD (2014: 8).

Table 1: Characteristics of Routine Emergencies/Disasters/Global Shocks

Routine emergencies	Disasters	Global Shocks
Scale is modest and well-defined in space and time	Scale may be large, but defined	Scale is large and perhaps ill-defined in space and time; high impact possibly irreversible
Event recognized, but low visibility	High visibility	Very high profile, intense and long-lasting political and media interest
Interaction with familiar faces	Interaction with unfamiliar faces	Counterparts unknown
Familiar tasks and procedures	Tasks and procedures sometimes unfamiliar	Tasks and procedures outside previous experience
Intra-organizational co-ordination needed	Intra-and inter-organizational co-ordination needed	Multi-layered international co-ordination needed
Roads, telephones and facilities intact	Roads may be blocked or jammed telephones jammed or non-functional, facilities may be damaged	Transport and communication hubs blocked, ports may be damaged (airports, Internet ports, maritime ports), disrupting global supply chains
Communications frequencies adequate for radio traffic	Radio frequencies and mobile services often overload	International telecommunications overloaded or disruptive
Use of familiar terminology in communicating	Communication with persons who use different technology	Communication between persons with different language, culture, norms and geo-political perspective
Need to deal mainly with local press	Hordes of national and international reporters	Media sources incapacitated, social media unmanageable
Management structure adequate to co-ordinate the number of resources involved	Resources often exceed management capacity	Resources sometimes cannot be accessed for long periods

Source: OECD, Annex 4 A1 (2011: 98).

It is also important to acknowledge at the outset that risk management re-emerged as an important topic of research following the global financial crisis of 2008, particularly in an international business given the systemic nature of the crisis. Much of the resulting research was framed in the context of improving ERM practices. Influential ERM guidance published in 2009 alone included: the Committee of Sponsoring Organizations of the Treadway Commission (COSO) publication, Str*engthening Enterprise Risk Management for Strategic Advantage*, and the International Organization for Standardization's (ISO) publication, *ISO 31000 Risk Management—Principles and Guidelines on Implementation* and the Organization for Economic Cooperation and Development (OECD) publication, *The*

Corporate Governance Lessons from the Financial Crisis.[7] Moreover, the impetus to rethink conceptual frameworks, operational standards and governance principles related to risk management predates the global financial crisis of 2008; the catalysts a decade or more earlier included the bankruptcy of Enron Corporation in December of 2001[8] and the East Asian Financial Crisis of 1997-1998.[9] However progress is still lagging among even the largest public corporations as the OECD has cautioned in 2014:

> "Existing risk governance standards for listed companies still focus largely on internal control and audit functions, and primarily financial risks, rather than on (ex ante) identification and comprehensive management of risk. Corporate governance standards should place sufficient emphasis on ex ante identification of risks. Attention should be paid to both financial and non-financial risks, and risk management should encompass both strategic and operational risks."[10]

Today risk management remains a growing field of inter-disciplinary study for both academics and practitioners. It could be characterized as potentially a new profession itself as it "combines elements of law, accounting, human resources, business ethics, and more."[11] The research context however is shifting away from the initial regulatory and operational scrutiny of the business practices of the financial services industry in the wake of the collapse of Bear Stearns and Lehman Brothers.[12] Moreover there is broadening interest in understanding why corporations continue to fail to incorporate newly identified risks into their strategic planning or to inform better their BoD.[13] The OECD characterizes current risk governance standards as being "very high level, limiting their practical usefulness, and/or

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7 Significant global recommendations for the financial services industry would include the Basel Committee on Banking Supervision's *Basel III: International Framework of Liquidity Risk Measurement, Standard* published in 2010 and its *Principles for the Sound Management of Operational Risk* released in 2011. The Financial Market Supervisory Authority's (FINMA) publication of *Addressing Too Big Too Fail: The Swiss SIFI Policy* in 2011 is a notable example in the Swiss financial context. More recently, the Financial Stability Board (FSB) published its *Thematic Review on Risk Governance* in 2013 which in turn influenced the OECD's 2014 publication, *Risk Management and Corporate Governance*. International interest in risk management extends beyond the financial sector and industrialized economies as evidenced by the World Development Report 2014, *Risk and Opportunity: Managing Risk for Development,* published by the World Bank.

8 The collapse of Enron along with other notable corporate failures such as WorldCom spurred the passage of the Sarbanes-Oxley Act of 2002 by the Congress of the United States. The act aimed to strengthen independent auditing, transparency of financial disclosure, corporate governance, equity research and enforcement of securities laws.

9 In the wake of the East Asia financial crisis, the OECD created the Asian Roundtable on Corporate Governance in 1999 as a vehicle to promote its *OECD Principles of Corporate Governance* in the region.

10 OECD (2014:7).

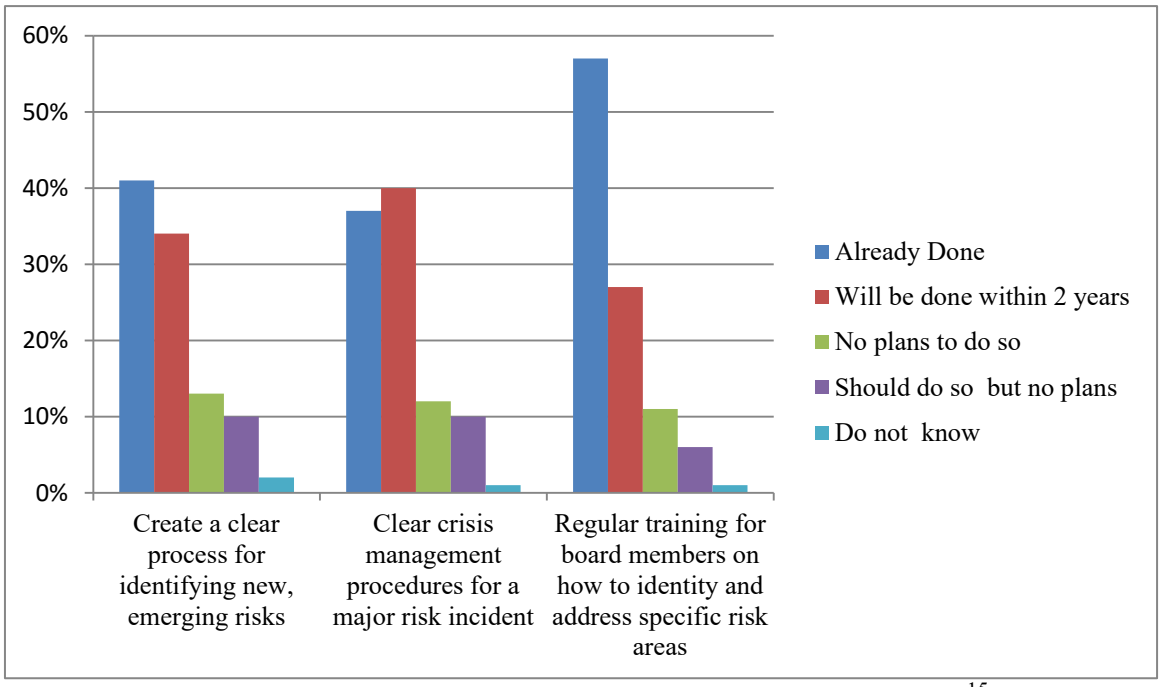
11 Miller, G. (2014:6).

12 It is also worth remembering that Lehman Brothers was once held in great esteem by the investment banking industry for its operational resiliency following the collapse of the World Trade Center in 2001 which was across the street from its New York headquarters.

13 Chasan, E. (3 July 2014), Corporate Risk Management is Going Only Half Way: Survey, *The Wall Street Journal*. Retrieved from http://blogs.wsj.com/cfo/2014/07/03/corporate-risk-management-is-only-going-half-way-survey/ (last visited on 19 October 2014).

focus largely on financial institutions."[14] That said, corporations and their BoD are claiming to be taking action at multiple levels to improve both risk management and corporate governance (Figure 2).

Figure 2: Changing Risk Management Practices at the Board Level



Source: Adapted from Clifford Chance, Figure 12 (2014: 29).[15]

Another impetus for changing risk management practices at the board level is that industries outside of financial services such as the energy sector have since experienced major corporate crises as in the case of BP and its Deepwater Horizon platform oil spill in 2010 and Tokyo Electric Power Company's (TEPCO) and its Fukushima Daiichi nuclear plant disaster in 2011. Both environmental catastrophes captured media attention internationally and introduced major uncertainty to not just the energy industry but also to the global economy, albeit in a difficult to predict manner. For example immediately in the wake Fukushima crisis, Germany took seven of its oldest nuclear reactors offline and then two months later announced that all of its nuclear power plants would be phased out by 2022.[16] That corporations, even major multinationals, fail is a normal occurrence in a competitive and healthy market but greater efforts can still be made at the corporate level to improve risk governance at the board level (Figure 3). However, what is novel is the notion that an extreme risk event involving just one corporation in a single country could dramatically

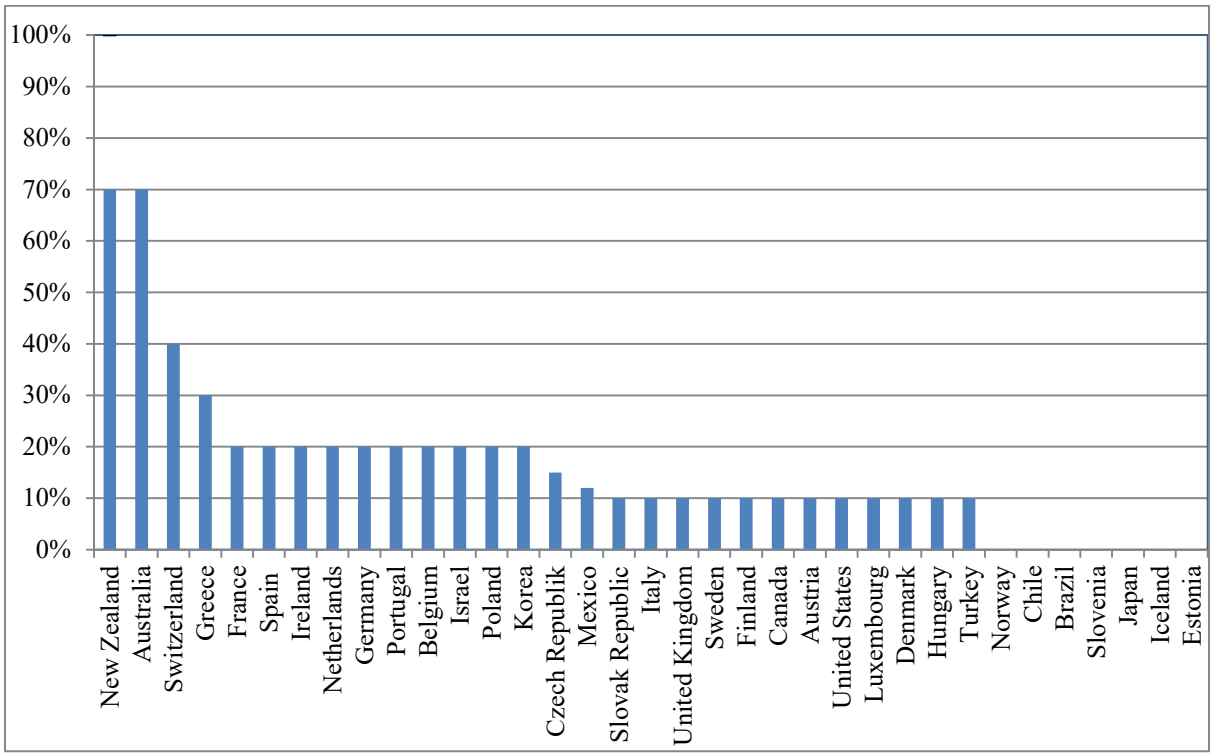
14 OECD (2014: 7).

15 Based on a 2014 global survey by the Economist Intelligence Unit (on behalf of the global law firm Clifford Chance based in London) of 320 executive and non-executive board members from organizations with annual revenues over USD 500 million.

16 BBC News Europe (30 May 2011) from http://www.bbc.com/news/world-europe-13592208 (last visited on 19 October 2014).

change the regulatory environment of industries in another country.[17] This study describes the phenomena as *uncontrollable risks* and examines them in the context of Corporate Risk Management (CRM).

Figure 3: Companies with Board Committees related to Risk (OECD Survey)



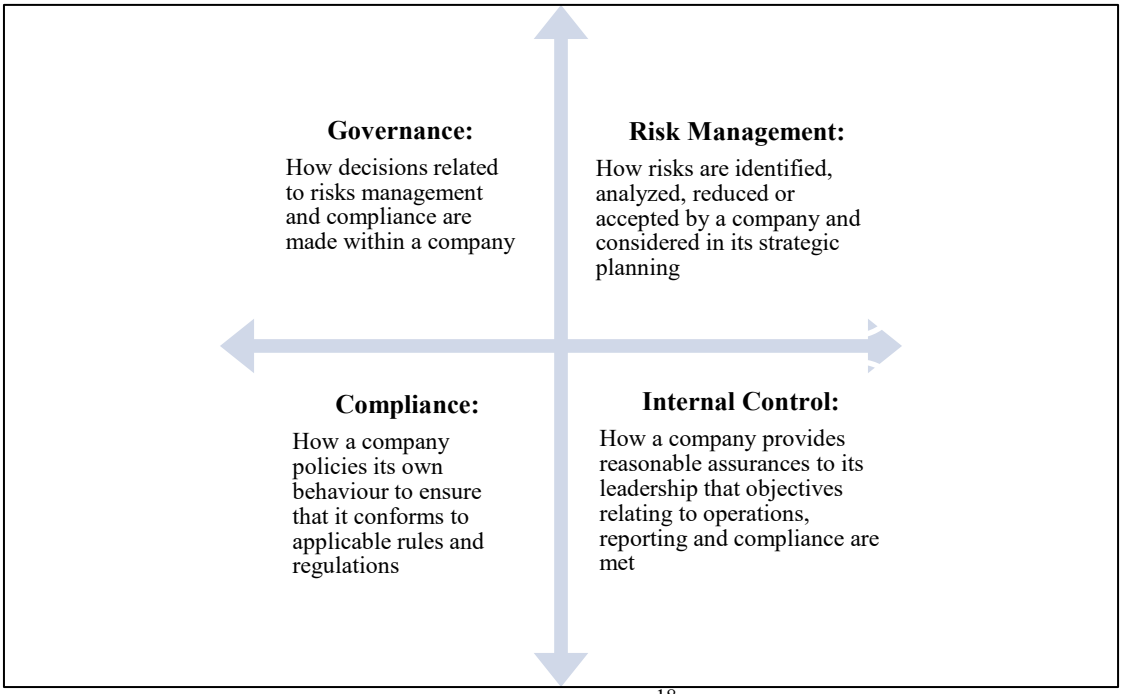
Source: Adapted from OECD, Figure 1.1 (2014: 18).

3. Corporate Risk Management (CRM)

Although the terms Enterprise Risk Management (ERM) and Corporate Risk Management (CRM) are often used interchangeably in research literature, CRM is used predominantly in this study as the term "corporate" underscores the nexus between governance, risk management, internal control and compliance (Figure 4).

[17] "Event risk is the risk of loss due to single events that are unlikely, but have serious consequences if they do occur." Lam, J. (2014: 245).

Figure 4: Corporate Risk Management (CRM) Framework



Source: Author.[18]

Moreover, governance, risk management and compliance are increasingly referred to collectively as "GRC."[19] These corporate functions are linked conceptually under the rubric of GRC because:

> "Activist shareholders, institutional investors and policymakers look to these activities as crucial means for improving business ethics, enhancing the observation of legal norms, and deterring firms from engaging in unsafe or unsound practices. Regulators encourage companies to upgrade their activities in these areas; if companies do not comply, the regulators find ways to force them to do so."[20]

The aforementioned concerns are intrinsic corporate considerations but not for all other forms of enterprise; therefore this study uses the term CRM instead of ERM in its exploration of uncontrollable risks. Moreover the term CRM also captures the notion that GRC is "inherently cross-disciplinary in nature"[21] and thereby is holistic in its approach (in contrast ERM is recognized predominantly as integrated in its approach given its origin in coordinating internal control processes). Other conceptual differences between CRM and ERM are elaborated further in the section on definitions.

18 Cf. Miller, G. (2014: 5).
19 Miller, G. (2014: 1).
20 Ibid.
21 Miller, G. (2014: 5).

4. Black Swan Event (BSE)

The concept of uncontrollable risks captures the *zeitgeist* that we seem to live in an era of the Black Swan Event (BSE). The "black swan" has been popularized in the past decade as both a conceptual framework and a fitting metaphor for a devastating but yet unforeseen risk event.[22] One of most widely read books on the topic is Nassim Taleb's "The Black Swan: The Impact of the Highly Improbable" published just before the global financial crisis of 2008 (it has sold over a million copies worldwide since its initial publication in April 2007). There are three criteria for a BSE according to its definition by Taleb:

1. Rarity: "First it is an *outlier*, as it lies outside the realm of regular expectation, because nothing in the past can convincingly point to its possibility."[23]
2. Extreme Impact: "Second it carries an extreme impact (unlike the bird)."[24]
3. Retrospective Predictability: "Third, in spite of its outlier status, human nature makes us concoct explanations for its occurrence *after* the fact, making it explainable and predictable."[25]

Table 2: Black Swan Event (BSE) Theory

Event Characteristic	**Black Swan Criteria**
Outlier (or Rarity)	YES as the event is an outlier both in historical and probabilistic terms
Massive or Systemic Impact	YES
Predictable or Knowable	YES in retrospect
Controllable	YES in theory as cause-effect relationship is knowable retrospectively

Source: Author.

The capability to imagine Black Swan Events in the context of an interdependent global economy is fundamental in addressing uncontrollable risks. The reality of uncontrollable risks requires conceptual changes from a BoD when contemplating a BSE in the context of their risk management and corporate governance responsibilities.

The first conceptual change is for a BoD to broaden the definition of a BSE (Table 2) to apply to "extreme events which are either totally unpredictable or events that *could be*

[22] However Karl Popper, the late philosopher of science and professor at the London School of Economics, is acknowledged as introducing the example of a "Black Swan" to demonstrate the problem of induction and introduce the notion of falsifiability in "The Logic of Scientific Discovery" which was translated and published in English in 1959 (the original " Logik der Forschung" was published in German in 1934).

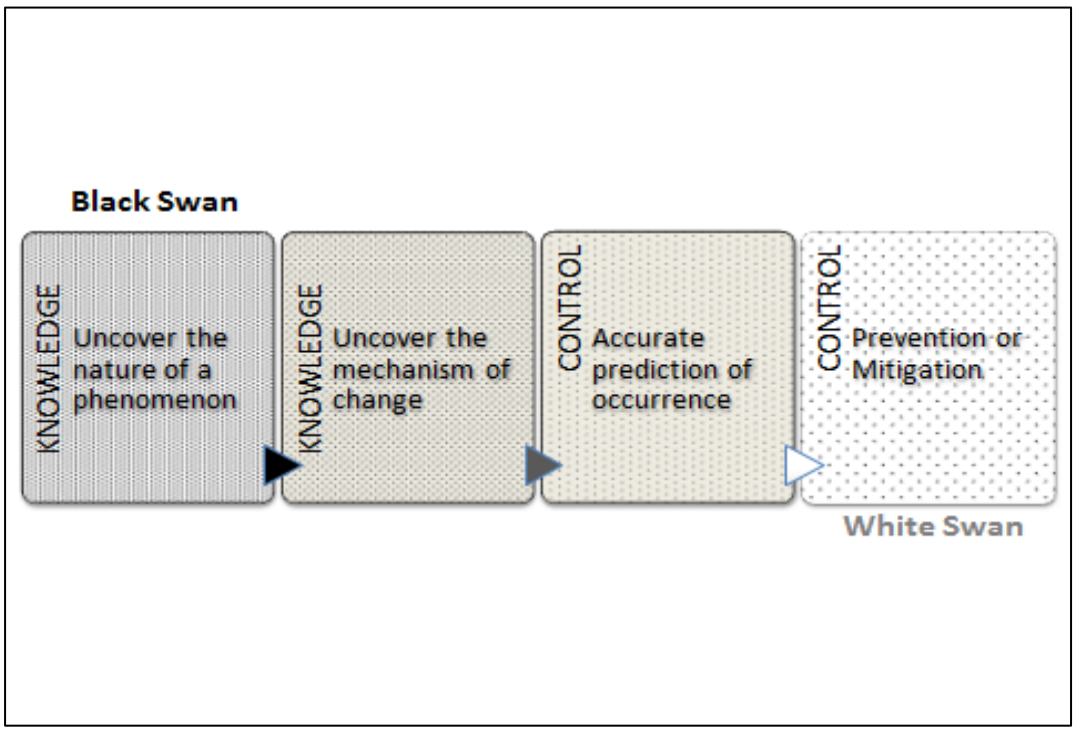
[23] Taleb, N. (2010: xxii in preface).

[24] Id.

[25] Taleb, N. (2010: xxii in preface).

foreseen but have not been considered by an observer as plausible"[26] as proposed by financial risk management expert, Evgueni Ivanstov. He argues for this wider definition because "many events today we categorise without any doubt as white swans were black swans at some point in the past."[27] However because most people could imagine "numerous outcomes from very trivial to absolutely fantastic"[28] the result is that we also characterize the vast majority of potential outcomes as unrealistic and subsequently do not take any precautionary measures should they suddenly occur. Ivanstov argues that "our level of understanding of the nature and cause-effect relationships of the phenomenon is exactly what separates black and white swan type of events."[29] If the nature of a phenomenon is unknown we ascribe to it the properties of improbability and unpredictability even though they are not (reflecting our subjective knowledge) but "as soon as we uncover the driving forces of this phenomenon, the event becomes plausible and predictable and ceases to belong to the category of extreme risk events"[30] (Figure 5).

Figure 5: Turning Black Swans into White Swans



Source: Adapted from Ivanstov, Figure 1.1 (2013: 13).

[26] Ivanstov, E. (2013: 12).
[27] Ibid. Ivanstov cites the example of a solar eclipse as having a massive impact on ancient civilizations as an unexplainable and unpredictable phenomenon but today a solar eclipse is no longer a black swan. His observation is also linked to the notion of scientific impossibility.
[28] Ivanstov, E. (2013: 12).
[29] Ivanstov, E. (2013: 13).
[30] Ibid.

Ivanstov however acknowledges the track record of turning black swans to white swans has been uneven when comparing advances in eliminating extreme risks in meteorology and agriculture versus economics and geopolitics. But one can imagine a future where "any type of 'imaginable' event is arguably foreseeable."[31] Among the practical implications would be that the difficulty in enforcing a force majeure clause in a business contract.

It is important however to acknowledge that there are in fact conceptual frameworks to study the "impossible" -- particularly in terms of the technologies that may be considered impossible now but likely in the future. Physicist Michio Kaku has elaborated a framework (three categories) of the scientifically impossible:

- **Class I Impossibilities:** "These are technologies that are impossible today that do not violate the known laws of physics. So they might be possible in this century, or perhaps the next, in modified form. They include teleportation, antimatter engines, certain forms of telepathy, psychokinesis and invisibility."[32]

- **Class II Impossibilities:** "These are technologies that sit at the very edge of our understanding of the physical world. If they are possible at all, they might be realized on a scale of millennia to millions of years into the future. They include time machines, the possibility of hyperspace travel, and travel through worm holes."[33]

- **Class III Impossibilities:** "These are technologies that violate the known laws of physics. Surprisingly, there are very few such impossible technologies. If they do turn out to be possible, they would represent a fundamental shift in our understanding of physics."[34]

We therefore need to recognize that the nature and causality of an uncontrollable risk may be known or knowable at this moment in time, but the means to predict and prevent its occurrence may become available only in the future. What is most important in the context of uncontrollable risk is to avoid hubris when discussing the impossible. The same sentiment should apply when using terms such as " unthinkable" or "unimaginable" in the context of risk management.

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31 Augenblick, M. & Rousseau, A. (2012:60).
32 Kaku, M. (2008: xvii in preface).
33 Kaku, M. (2008: xvii in preface).
34 Ibid.

5. Rethinking Human Error

The concept of *uncontrollable risks* shares with BSE theory the notion that decision-making at the individual and organizational level suffers from an overreliance on expert predications and probabilistic assumptions. A fundamental difference between a BSE and an uncontrollable risk is with the attribution of such human errors. The notion of retrospective predictability puts the individual or the organization at the center of human error. This supposition is why BSE theory is problematic because it reinforces the perception of an avoidable failure versus a normal accident.

First the notion that a future incident of systemic financial risk, environmental catastrophe and natural disaster could actually be an avoidable failure is appearing less and less plausible in an interdependent and interlinked global economy. Second many future incidents are likely to fail the "rarity" test of a BSE. Major acts of terrorism and violent extremism are sadly no longer rare in many countries and the incidence of natural disasters is increasing in the context of unabated climate change.

A key conceptual difference between a BSE and an uncontrollable risk is with the treatment of human error. This study posits that the element of retrospective predictability within a BSE represents an "old view" of human error as defined by safety expert Sidney Dekker.[35] Dekker argues that you either see "human error as the cause of a mishap"[36]or see "human "error as the symptom of deeper trouble"[37] whereby the former is outmoded and the later represents the new reality (Table 3).

[35] Dekker, S. (2006).
[36] Dekker, S. (2006: x in preface).
[37] Ibid.

Table 3: Frameworks for Studying Human Error

Old View of What Goes Wrong	New View of What Goes Wrong
Human error is the cause of trouble.	Human error is a symptom of trouble deeper in the system.
To explain failure, you must seek failures (errors, violations, incompetence, mistakes).	To explain failure, do not try to find where people went wrong.
You must find people's inaccurate assessments, wrong decisions and bad judgments.	Instead find how people's assessments and actions made sense at the time, given the circumstance that surrounded them.
Old View of How to Make It Right	**New View of How to Make It Right**
Complex systems are basically safe.	Complex systems are not basically safe.
Unreliable, erratic humans undermine defenses, rules and regulations.	Complex systems are trade-offs between multiple irreconcilable goals (e.g. safety and efficiency).
To make systems safer, restrict the human contribution by tighter procedures, automation supervision.	People have to create safety through practice at all levels of an organization.

Source: Adapted from Dekker, Table 0.1 (2006: xi).

The understanding of how to study human error is a critical governance skill. A board's supervisory responsibility includes investigating retrospectively (i.e., ex post) a major failure in risk management. In the context of uncontrollable risks, a board's past review of performance failures is likely to shape their prospective view of risk appetite and risk management policies.

6. Recent "Unthinkable" Events

We should not reflexively categorize a highly improbable but impactful risk as a Black Swan. And if such a risk event were to occur, then we should avoid the inclination to attribute cause retrospectively (and simply) to human error; real world circumstances rarely allow for either. Take for example, Malaysia Airline which experienced two highly improbable events in the span of four months in 2014. Most would agree that two tragedies would meet the common definitions of "unthinkable" or "unimaginable" in normal conversation. The challenge for a board is how to introduce a possible "nightmare scenario" into appropriate discussions about such risks (i.e., risk dialogues) in a meaningful and appropriate context.

In an interview with the risk committee chair of a multinational with a significant aviation division, the chairperson acknowledged the challenge of raising the possibility of the disappearance of a passenger aircraft. He observed that this is often the case because we associate the unthinkable with the improbable (in the context of available historical data or our own life experience). However he stressed that the problem can still be overcome by framing the "unimaginable" scenario with important ancillary data. For example, we could envisage a different reaction from a board if the scenario of a plane disappearing in mid-flight off the Indonesian coast was presented in the context of an exponential increase in air traffic in the region relative to development of the region's air traffic control coverage and its capacity for search and rescue operations.[38]

a. Malaysia Airline Tragedies

Four months after the disappearance of a Malaysia Airline flight (MH370) under shadowy circumstances, a second sinister tragedy occurred (Flight MH17); no effort at retrospective analysis can convincingly reframe what happened as either explainable or predictable or foreseeable (Table 4). Yet as Evgeni Ivanstov has suggested, our current level of understanding of a phenomena is what in reality separates black and white swan events in our minds.[39] One year after its disappearance, the "rogue pilot theory" remains the most widely accepted explanation for flight MH370.[40] What is known is that forty minutes into the flight when all communication with the aircraft was lost by air traffic control in the region, analysis of satellite "keep alive" signals sent by the aircraft show it veered off its designated course and flew by south until it ran out of fuel in the Indian Ocean. Sadly, the direct cause of both Malaysia Air tragedies remains unknown to date but a subsequent European airline tragedy a year later (Germanwings Flight 9525) has provided strong support to the rogue pilot theory of what may have led to the disappearance of MH370.

[38] Sadly on 28 December 2014 passenger flight QZ8501/AWQ850 operated by AirAsia Group and departing from Surabaya, Indonesia to Singapore crashed into the Java Sea during a storm killing all 155 passengers and 7 crew members.

[39] Ivanstov, E. (2013: 13).

[40] Forsythe, M. & Bradsher, K. (6 March 2015), To Explain Missing Malaysia Airlines Flight, 'Rogue Pilot' Seems Likeliest Theory, *The New York Times*. Retrieved from http://www.nytimes.com/2015/03/06/world/asia/malaysia-airlines-mh370-one-year-later.html (site last visited on 1 May 2015).

Table 4: Malaysia Airline Chronology of Events

8 March 2014 1st Event	Flight MH370 disappears enroute from Kuala Lumpur to Beijing. The Boeing 777 aircraft with 227 passengers plus 12 crew remains missing. The cause and nature of the disappearance are unknown.
17 July 2014 2nd Event	Flight MH17 enroute from Amsterdam to Kuala Lumpur crashes killing all 298 passengers and crew. It was allegedly shot down on the Russian-Ukraine border by a surface-to-air missile.
8 August 2014 Nationalization	Khazanah, the sovereign wealth fund of Malaysia and the biggest shareholder in Malaysia Airlines (69 per cent stake), announces intent to pay Rm1.4bn ($436m) to buy out minority shareholders and to nationalize the airline.

Source: Author.

Therefore if the BSE framework does not adequately fit the case of Malaysia Airline then what is the alternative sense-making approach to consider (beyond looking for commonalities with past or similar events)? Perhaps the more salient consideration is that such tragedies are neither low probability, high impact events nor are they "the result of a breakdown of otherwise well-functioning processes."[41] This is an important consideration as the ex ante identification of such risks is not yet possible. Therefore the BoD and the executive management team will be tasked with considering future measures to address what happened in their ex post review of a similar incident. However Stanley Dekker cautions that when investigating how to prevent major accidents:

> "Do not rely on tighter procedures because humans need the discretion to deal with complex and dynamic circumstances for which pre-specified guidance is badly suited; Do not get trapped in promises of new technology. Although it may remove a particular error potential, new technology will likely present new complexities and error traps. Try to address the kind of systemic trouble that has as its source in organizational decisions, operational conditions or technological features."[42]

This study argues that Dekker's aforementioned guidance is pertinent for a BoD as their initial exposure to an uncontrollable risk will most likely involve an ex post analysis of both the cause and impact of a such a risk event (versus its ex ante identification).

b. Germanwings Tragedy (24 March 2015)

As cited above, sadly another more recent aviation tragedy (Germanwings) possibly sheds light into what could have happened to flight MH370. It is another stark example of uncontrollable risks and the subtleties of Black versus White Swan comparisons. It is also a

41 Dekker, S. (2006: 17).
42 Dekker, S. (2006: 19).

grim reminder to heed Dekker's caution in such cases. On 24 March 2015, Germanwings Flight 9525 departing from Barcelona, Spain for Düsseldorf, Germany suddenly crashed in a remote area of the French Alps resulting in the loss of 144 passengers and 6 crew members. The aircraft was an Airbus A320-200 and operated by Germanwings, a low-cost airline owned by Lufthansa. After the cockpit voice recorder was recovered and the flight data analyzed, French and German investigators concluded that the plane was deliberately crashed by its co-pilot when he locked out the captain from the cockpit and steered the aircraft into the ground.[43] Upon learning the shocking conclusion of the prosecutors, Lufthansa CEO Carsten Spohr insisted that the co-pilot was "100% fit to fly"[44] but also acknowledged that "in our worst nightmares we could not have imagined that such a tragedy could happen in our company."[45] Subsequently it was revealed that the co-pilot suffered from severe depression but the airline was unaware of his current and prior mental health problems.[46] Further investigation found that prior to the event the co-pilot was conducting research online on how to commit suicide and on security measures for cockpit doors. [47]

The Germanwings tragedy was clearly a Black Swan Event (BSE) for the two airlines -- i.e. it was an unthinkable risk event for both Germanwings and Lufthansa yet clearly plausible in hindsight. Moreover it cannot be attributed entirely as a rogue pilot incident – for example, the Federal Aviation Administration (FAA) of the United States requires at least two crew members to be in the cockpit throughout the entire flight as a result of the terrorist attacks of 11 September 2001.[48] Indeed there are multiple systems to consider in this case - cockpit policy, door lock mechanism and its electronic override code as well as medical privacy rules and mental health evaluations. Among the conceptual changes required in the context of uncontrollable risks is to avoid breaking things down into component parts to find error as this results in misdiagnosing a complex system as a complicated one.

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43 BBC News Europe (3 April 2015), Germanwings crash: Co-pilot Lubitz 'accelerated descent.' Retrieved from http://www.bbc.com/news/world-europe-32173632 (last visited on 6 April 2015).

44 Bloom, D. (26 March 2015), Germanwings co-pilot Andreas Lubitz was '100% fit to fly' says Lufthansa CEO, *Daily Mirror*. Retrieved from http://www.mirror.co.uk/news/world-news/germanwings-co-pilot-andreas-lubitz-100-5405141 (last visited on 6 April 2015).

45 Bryant, C. & Shotter, J. (26 March 2015), Lufthansa Chief Shaken by Findings on Germanwings Crash, *Financial Times*. Retrieved from http://www.ft.com/intl/cms/s/0/1fc3df8c-d3c9-11e4-99bd-00144feab7de.html (last visited on 2 May 2015).

46 Michaels, D. & Walls, M. (4 April 2015), EU Rebukes Germany for Airlines Oversight Before Germanwings Crash, *The Wall Street Journal.* Retrieved from http://www.wsj.com/articles/eu-rebuked-germany-for-lax-airline-oversight-1428094581 (last visited on 6 April 2015).

47 Kulish, E., Eddy, M. & Clark, N. (2 April 2015), Germanwings Co-pilot Searched Web about Suicide and Cockpit Doors, Officials Say, *The New York Times*. Retrieved from http://www.nytimes.com/2015/04/03/world/europe/germanwings-lufthansa-andreas-lubitz-black-box.html (last visited on 7 April 2014).

48 Johnson, M.A. (27 March 2015), Airlines Adopt Two-in-the-Cockpit Rule After Germanwings Crash, *NBC News.* Retrieved from http://www.nbcnews.com/storyline/german-plane-crash/airlines-worldwide-adopt-two-cockpit-rule-after-germanwings-crash-n331041 (last visited on 6 April 2015).

7. Complicated versus Complex Systems

International economists Ian Goldin and Mike Mariathasan contend that increased connectivity both enables and creates systems that are globally integrated but also inherently complex.[49] They state that "as a result of globalization, the world today should be defined as a complex system"[50] and therefore argue for "reforms to promote a more *transparent* and a more *resilient globalization*."[51] In the context of uncontrollable risks, distinguishing between a complicated and complex system is essential when examining risk management and corporate governance responses to globalization:

> **Complicated Systems** "are composed of many different interacting parts whose behavior follows a precise logic and repeats itself in a patterned way. They are therefore predictable. Automatic watches with mechanical movements composed of hundreds of coordinated elements are examples of complicated systems."[52]
>
> **Complex Systems** "are dominated by dynamics that are often beyond our control. These dynamics are the result of multiple interactions between variables that do not follow a regular pattern. However, their dynamic interplay can lead to unexpected consequences. Society is a complex system driven by emotions (the human component), infrastructure and our environment."[53]

Knowledge management experts Gilbert Probst and Andrea Bassi contend that such differentiation is critical and that complexity is relevant for the private sector as "the patterns of demand and supply from emerging countries are evolving, technology is developing rapidly, and energy and natural resource prices are highly volatile." [54] Goldin and Mariathasan reframe the consequences of complex linkages in a manner that is particularly challenging in the context of corporate governance whereupon an erosion of responsibility occurs "because our actions so indirectly lead to their effects." To clarify this important point,

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49 Goldin, I. & Mariathasan, M. (2014: 13).

50 Ibid at 21.

51 Goldin, I. & Mariathasan, M. (2014: 10).

52 Probst, G. & Bassi, A (2014: 3).

53 Ibid. Probst and Bassi suggest that the drive home from work is a mundane but accurate example of a complex system at work:

> "The choice of road depends on personal needs (do we have time?), the information we receive and pay attention to (has there been an accident on the road?), the transportation mode utilized (car, bus or metro) and our interest in the environment (e.g. CO2 emissions). All these factors never work in exactly the same way every day, but there is always a specific rationale behind every decision. The system is therefore complex, not chaotic or complicated." Ibid at 4.

54 Probst, G. & Bassi, A (2014: 5).

Goldin and Mariathasan put forth an example of a natural disaster that disrupts a tightly linked global supply chain and ask the following pertinent questions:

> "Who is to blame for the resulting shortage of cars, computers or customized machinery? Is the owner responsible for not taking sufficient precautions? Is the manufacture to be held accountable for operating in a risky location? Is the distributor at fault for using the supply chain without backups? Did the local government fail in its urban management duties by licensing an exposed area for industrial use? Is climate change the reason the disaster occurred in the first place?" [55]

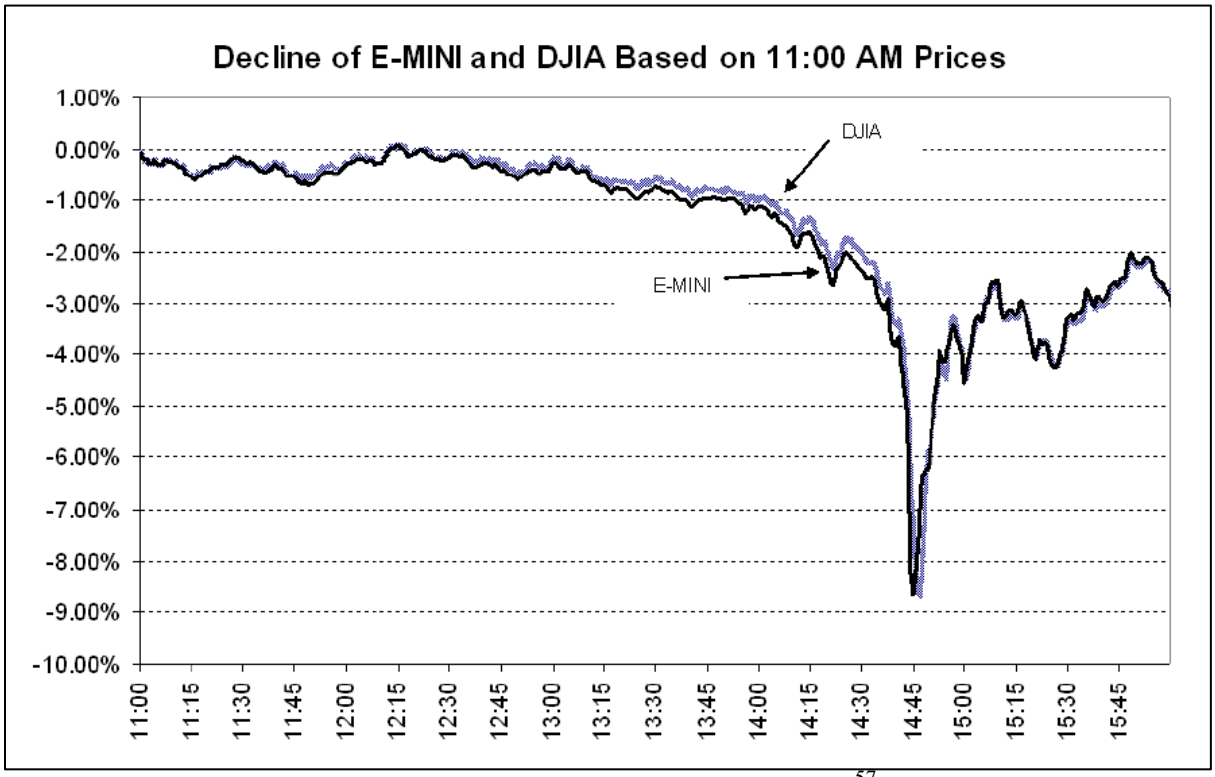
Probst and Bassi therefore warn that such a spiral of complexity "may frighten decision makers, or they may be unable to appreciate and understand it."[56] Increasing connectivity also challenges a BoD by introducing greater uncertainty and complexity into what were considered familiar risk domains.

a. DJIA Flash Crash (6 May 2010)

A prime example of the complexity facing both business and government is the mysterious stock market "Flash Crash" that occurred on 6 May 2010 when the Dow Jones Industrial Average (DJIA) index lost 9% of its value (998.5 index points or nearly one trillion USD) within minutes (Figure 6). It then quickly recovered much of the loss by the end of the trading day. This sudden drop was the biggest one day decline on an intraday basis in the history of the DJIA. With public concern over systemic financial risks still running high, American regulators were quick to launch an investigation into what led to such massive volatility in a single day.

[55] Goldin, I. & Mariathasan, M. (2014:23).
[56] Probst, G. & Bassi, A. (2014:5).

Figure 6: DJIA Flash Crash of 6 May 2010



Source: SEC, Appendix (11 May 2010). [57]

An investigative report conducted jointly by the U.S. Securities and Exchange Commission (SEC) and the Commodities Futures Trading Commission (CFTC) was issued on 30 September 2010 that outlined the sequence of events that led to the flash crash incident on 6 May.[58] The joint report concluded that among the key lessons learned was:

> "One key lesson is that under stressed market conditions, the automated execution of a large sell order can trigger extreme price movements, especially if the automated execution algorithm does not take prices into account. Moreover, the interaction between automated execution programs and algorithmic trading strategies can quickly erode liquidity and result in disorderly markets. As the events of May 6 demonstrate, especially in times of significant volatility high trading volume is not necessarily a reliable indicator of market liquidity… May 6 was also an important reminder of the inter connectedness of our derivatives and securities markets, particularly with respect to index products."[59]

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57 SEC (11 May 2010). Testimony of Concerning the Severe Market Disruption on May 6, 2010 (by Margaret Shapiro, Chairman, US Securities and Exchange Commission). Retrieved from https://www.sec.gov/news/testimony/2010/ts051110mls.htm (last visited on 25 April 2015).

58 CFTC & SEC (2010). *Findings Regarding the Market Events of May 6, 2010*: *Report of the Staffs of the CFTC and SEC to the Joint Advisory Committee on Emerging Advisory Issues*. See https://www.sec.gov/news/studies/2010/marketevents-report.pdf (site last visited on 25 April 2015).

59 CFTC & SEC (2010: 9).

The nearly five months of investigative study did not consider whether the flash crash incident could have been caused by an individual trader manipulating the DJIA with fake orders. Yet five years after their report, it appears that such a scenario was the likely trigger for the event. On 22 April 2015, Navinder Singh Sarao was arrested in London as a result of a request by the Department of Justice (DOJ) of the United States extradite him to stand trial in Illinois for charges of "one count of wire fraud, 10 counts of commodities fraud, 10 counts of commodities manipulation and one count of spoofing, a form of market manipulation that involves putting on an order and swiftly withdrawing it before a trade can take place."[60]

The 2015 arrest of a single financial trader has completely upended the conclusions of the CFTC and SEC from five years ago as the DOJ's charges that Sarao's actions on 6 May 2010 led to the flash crash by his use of:

> "[l]ayering and spoofing algorithms to enter orders for thousands of futures on the Standard & Poor's 500 Index. The orders amounted to about $200 million worth of bets that the market would fall, a trade that represented between 20 percent and 29 percent of all sell orders at the time. The orders were then replaced or modified 19,000 times before being canceled in the afternoon. None were filled, according to the affidavit."[61]

The flash case incident is a stark "real world" example of why Goldin and Mariathasan argue that because of connectivity it is "increasingly difficult to identify the root cause of a hazard or even the channels of its transmissions"[62] as globally accessible systems are increasing in their complexity. Put in another way, although it may soon be proven in a criminal court that the actions of lone English trader led to the single greatest single day decline in intra-day trading in the US stock market, it nonetheless took nearly five years to discover him. Moreover the arrest was spurred not by regulatory expert analysis but by that of a whistle-blower who studied the crash independently."[63]

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60 Stafford, P. & Chon, G. (22 April 2015). UK Trader Arrested Over 2010 Flash Crash, *Financial Times*. Retrieved from http://www.ft.com/intl/cms/s/0/fc3a66a8-e84a-11e4-baf0-00144feab7de.html (last visited on 25 April 2015).

61 Micheals, D., Leising, M. & Mamudi, S. (22 April 2015), Flash Crash Arrests Lays Bare Regulatory Lapses at All Levels, *Bloomberg Business*. Retrieved from http://www.bloomberg.com/news/articles/2015-04- 22/flash-crash-arrest-lays-bare-regulatory-lapses-at-all-levels (last visited on 25 April 2015).

62 Ibid.

63 Micheals, D., Leising, M. & Mamudi, S. (22 April 2015).

8. Evolving Corporate Norms

a. Corporate Global Citizenship

There are also normative considerations that warrant boards to consider rethinking their supervisory roles. As their firms navigate an interlinked global economy and encounter uncontrollable risks, stakeholders are increasingly evaluating their corporate behavior in terms why certain decisions are taken by a board as well as how they are executed by the firm's management.

Klaus Schwab, the Founder and Executive Chairman of the World Economic Forum (WEF)[64], posited prior to the 2008 financial crisis that companies would depend on global development for their future growth as existing markets mature and therefore it was in their strategic business interest to help improve the state of the world. By combining such enlightened self-interest with good corporate governance, a company could mitigate the regulatory uncertainty often linked to national political responses to macro global issues such as climate change. Schwab framed this new imperative for business as "Corporate Global Citizenship"[65] as below:

> "[Corporate Global Citizenship] expresses the conviction that companies not only must be engaged with their stakeholders but are themselves stakeholders alongside governments and civil society. International business leaders must fully commit to sustainable development and address paramount global challenges, including climate change, the provision of public health care, energy conservation, and the management of resources, particularly water. Because these global issues increasingly impact business, not to engage with them can hurt the bottom line. Because global citizenship is in a corporation's enlightened self-interest, it is sustainable. Addressing global issues can be good both for the corporation and for society at a time of increasing globalization and diminishing state influence."[66]

Seven years later Schwab argued further for "new models of engagement among business, government and civil society to address the shortcomings of our existing multilateral governance system"[67]and that business by "serving as responsible and responsive stakeholder

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64 The World Economic Forum was established in January 1971 when a group of European business leaders met under the patronage of the European Commission and European industrial associations in Davos, Switzerland at a seminar organized by Professor Klaus Schwab of the University of Geneva. Its current status as an international institution was formalized by an agreement with the Swiss Federal Council on 23 January 2015 under the country's Host-State Act. See http://www.weforum.org/ (last visited on 10 April 2015).

65 Schwab, K. (2008).

66 Schwab, K. (2008: 108).

67 Schwab, K. (2015).

in the global community"[68] has a unique role to play. At the micro-level, Corporate Social Responsibility (CSR) had become increasingly broad in both its application and its scope. Therefore in Schwab's view CSR alone is "not sufficient to help optimize corporate behavior and decision-making"[69] in considering macro global issues. In the context of a company's engagement with its various stakeholders, Schwab argues for CSR to be supplemented by corporate governance, corporate philanthropy, social entrepreneurship, corporate global citizenship and professional accountability.

Schwab's prescription in this context also supports the "glocal" orientation of boards and executive management endorsed by Martin Hilb's New Corporate Governance (NCG) framework; NCG is elaborated further in the theoretical section of this study.[70] The term "glocal" refers to something that is "characterized by both local and global considerations"[71] and the use of this term has exponentially increased along with the growth of the Internet.[72] Both Schwab and Hilb imply in their respective frameworks that there is a strong likelihood that if a corporation approaches CSR in such a holistic and integrated manner, then its reputation among its stakeholders would stand to benefit. Reputation is salient in the context of uncontrollable risks as reputational risks are of increasing concern for companies worldwide.

b. Social Media Technology

A strategic risk management survey of 300 companies globally published in 2013 by Deloitte Touche Tohmatsu Ltd., underscored the importance of reputation[73] (Table 5). The study highlighted that "[r]eputation risk is now the biggest risk concern, due in large measure to the rise of social media, which enables instantaneous global communications that make it harder for companies to control how they are perceived in the marketplace." [74]

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68 Ibid.

69 Micheals, D., Leising, M. & Mamudi, S. (22 April 2015), Flash Crash Arrests Lays Bare Regulatory Lapses at All Levels, *Bloomberg Business*.

70 Hilb, M. (2008: 22).

71 See http://www.oxforddictionaries.com/definition/english/glocal (site last visited on 10 April 2015).

72 The exponential growth of the use of the term 'glocal' over the last fifteen years can be visualized graphically online at the website https://books.google.com/ngrams (site last visited on 10 April 2015).

73 Deloitte (2013: 9). The survey question asked was "which of the following risk areas have the most impact on your business strategy (three years ago, today and three years from now)?" Respondents could chose more than one answer and the top three are shown in Table 5.

74 Deloitte (2013: 4).

Table 5: Risk Areas with Greatest Impact on Business Strategy

3 Years Ago (2010)	Today (2013)	3 Years from Now (2016)
41% Brand	40% Reputation	29% Economic Trends
28% Economic Trends	32% Business Model	26% Business Model
26% Reputation	27% Economic Trends	24% Reputation

Source: Adapted from Deloitte (2013:9).[75]

Today the potential impact of social media seems obvious in the context reputational risk but the technologies that have enabled it globally are less than ten years old. Therefore a BoD that has multiple decades of experience in addressing reputation risk issues may nonetheless be vulnerable as a result of this increasing interconnectivity. For example United Airlines experienced a major threat to its business reputation in 2009 when one angry passenger performed a song called "United Breaks Guitars" that went viral on YouTube and has since been viewed over 14 million times[76] (Table 6).

Table 6: United Airlines Chronology of Events

6 July 2009	A Canadian band, Sons of Maxwell, posts a protest music video on YouTube recounting the prolonged customer-service dispute of one of its band members with United Airlines over the company's refusal to provide compensation for a guitar that was damaged on one of its flights.
8 July 2009	The YouTube video is seen 137,896 times: this is considered a large number of viewers after being online for just two days.
10 July 2009	The viral momentum of the "United Break Guitars" music video leads to coverage in mainstream media outlets and results in 1,706,988 views by the end of the day. Passing a million views in such a short time becomes a story in itself and attracts major media coverage across North America.
8-10 July 2009	The story about the dispute with United Airlines and the resulting music video was also published in 339 mainstream online news sites and 777 online blogs. On Twitter, the story was shared ("tweeted") 2,000 times.

Source: Adapted from MediaMiser (a media-monitoring consultancy).[77]

With regard to corporate reputation, the illusion of control remains a persistent one given the human and financial resources that companies devote to marketing and public affairs along with their retention of professional service firms. However the rapid rise of social media with

[75] The table represents the top three selections based on 300 survey respondents worldwide where among them were 263 C-level executives. Deloitte categorizes strategic risks as those that affect or are created by business strategy decisions. Retrieved from http://www2.deloitte.com/content/dam/Deloitte/global/Documents/Governance-Risk-Compliance/dttl-grc-exploring-strategic-risk.pdf (site last visited on 15 May 2015).

[76] WEF (2013: 25). The music video can be seen at http://www.youtube.com/watch?y=5YGc4zOqozo (site last visited on 20 October 2014).

[77] MediaMiser (2009). Retrieved from http://www.mediamiser.com/blog/reports/united-breaks-guitars-viral-analysis/ (site last visited on 15 May 2015).

its variety of mobile platforms is eroding this illusion of control. Therefore conceptual frameworks (e.g. corporate global citizenship and corporate social responsibility) that help align corporate behavior and board decision-making with ethical norms at the local and global levels are essential to preserve and to protect a corporation's reputation in the context of uncontrollable risks.

9. Emergence of Global Risks

a. OECD Global Risks (2003)

In 2003 the Organization for Economic Co-operation and Development (OECD) published a prescient report entitled "Emerging Global Risks in the 21st Century: An Agenda for Action."[78] Released two years after the tragic events of September 11th and four years before the global financial crisis, the report focused on risks that could have a large scale impact on society as well as on the key systems on which society depends (e.g. health, transportation, energy, and information technology).[79] It narrowed its focus to five categories of risk with systemic or global characteristics[80]:

- Natural Disasters
- Industrial Accidents
- Infectious Diseases
- Terrorism
- Food Safety

The report also stressed that managing these four categories of risk would be challenging and complex as each would occur within four changing contexts:

- **Demographic**: The most salient demographic concern highlighted by the OECD was that the world's population will increase to 9 billion in 2050 (from 6 billion in 2003).[81]

It is obvious in hindsight that the OECD, the world's foremost economic think-tank, should have integrated systemic financial risks into its otherwise prescient study yet it did not. "The report does not deal with systemic risks to markets, notably to financial markets, although some aspects of financial systems are considered in the analysis." OECD (2003: 9).

79 OECD (2003: 5). The report highlighted health services, transport, energy, food and water supplies, information and telecommunications as "examples of sectors with vital systems that can be severely damaged by a single catastrophic event or chain of events." Ibid.

80 OECD (2003: 5). The report acknowledged that threats to vital systems could originate from a range of sources but chose to focus on these five clusters of risk. And indeed each of the clusters presents clear and obvious threats to business operations worldwide.

81 OECD (2003: 10). In 2013 the world's population was estimated to be 7 billion and counting (see http://www.census.gov/popclock/).

- **Environmental:** Two environmental concerns linked to population cited are: 1) CO2 emissions are projected to increase by one-third in OECD economies and to double in the rest of the world from the period from 1995 to 2020; and 2) with current consumption trends, ninety percent of the fresh water available for human use will be used in 2030 – therefore two-thirds of the world's population is expected to face a water shortage by 2025.[82]

- **Technological:** Three elements of emerging technologies were perceived as changing the future risk environment. First was connectedness as "[r]egulatory change and the development of transport, trade and information systems mean that many activities depend on the interaction of a variety of actors within networks, often at a global scale."[83] Second was the velocity of technological change as "[s]uccessful new technologies may quickly replace those existing, and the need to conquer markets may supersede thorough consideration of all the implications." [84] Third was concern regarding advances in life sciences as "[s]ome emerging technologies change living matter, and represent an unprecedented potential to change the environment."[85]

- **Socioeconomic:** The more immediate concern for enterprise relates to the concentration of industry activity in a particular geography or with a single company that has achieved massive scale – both are enabled as a result of globalization as enterprises are more easily able to expand their operations, extend their supply chains and increase their balance sheets. The OECD warned that "[t]his can increase vulnerability to shocks if a vital component is damaged and no alternative is readily available."[86]

The OECD cautioned that the four contexts would not only "[r]eshape conventional hazards and create new ones, modify vulnerability to risks, transform the channels through which accidents spread, and alter society's response" but also result in "[d]ifferent forces acting on the same risk [that] can neutralise each other's effects, or reinforce each other for a compound effect."[87] In the framework of uncontrollable risks, it is the aggregation and interplay of the four contexts that is material conceptually relative to the five risk categories highlighted by the OECD. The OECD also identified five phenomena that could challenge risk management because of their complex dynamics:

82 OECD (2003:11).
83 OECD (2003:12).
84 OECD (2003:12).
85 OECD (2003:12).
86 OECD (2003:13).
87 OECD (2003:10).

- **Heightened Mobility and Complexity:** The notion that an interdependent and interconnected world is a more complex one is simple to grasp, but that there is a corresponding increase in the complexity of the risks we face that is not. The point for consideration in the report is that "complexity is understood as the number of potential interactions that might influence the occurrence and the consequences of a given hazard"[88] and the result therefore is a manifold increase in the number of possible disruptive events.

- **Increasing Scale and Concentration:** The salient point to consider in an risk management context is that that the relationship between population growth and urbanization (as both levels are increasing) is such that the resulting concentration of growing populations in fewer urban areas is aggregating risks, particularly with respect to critical infrastructure. "Surveillance, protection and resilience of systems also need to be enhanced to compensate for reduced diversity."[89]

- **Changing Context and Major Uncertainties:** The significant point to consider is that material advances in ERM may have reached its limits if based entirely on past experience and available data. For example, scientific knowledge is limited with regard to known but complex phenomena such adapting to climate change or creating genetically modified organisms. "The traditional retrospective approach to the handling of risk needs to be complemented with a more prospective and pro-active approach."[90]

- **Shifting Responsibilities:** The salient argument to consider is that although ERM is constantly evolving a centralized, command and control approach to risk management will be problematic in the future contexts hence the need to consider a holistic framework such as CRM. Moreover the OECD notes that "while a range of risks are emerging that are unmistakably global, the international co-ordination of risk management policies is at best in its infancy." [91]

88 OECD (2003:49).
89 OECD (2003:52).
90 OECD (2003:53).
91 OECD (2003:54).

- **Importance of Risk Perception:** The key realization is that the nature of how risks are perceived and communicated have substantial impact on risk management (this a major element in the empirical portion of this study). Therefore media coverage and public reaction are important considerations in CRM. The OECD report in 2003 predates the mass adoption of social media technology which has since changed entirely our notion of reputational risk.[92]

These dynamics create feedback loops with the others in the context of uncontrollable risks. The 2003 OECD report also warned that in an increasingly interconnected and interdependent global economy, no enterprise could expect to operate in a predominantly endogenous risk environment. Subsequent events have shown that modern business enterprise with extensive supply chains and customers worldwide are already dependent on critical systems or international networks (e.g. Internet[93], SWIFT[94], and GPS[95]) and still remain exposed to exogenous events (e.g. natural disasters, regional pandemics, terrorism) outside their control or influence (Figure 7).

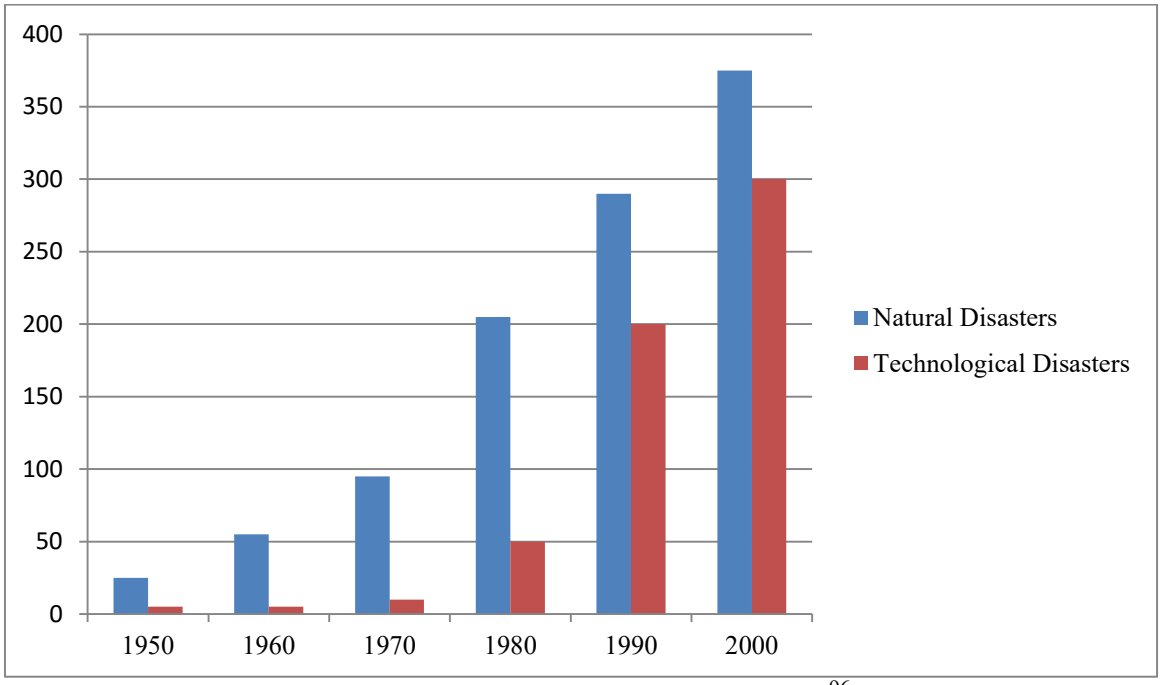
[92] OECD (2003:54). Therefore the implications are likely to be even greater given that Facebook (founded in February 2004) reached over 1 billion users in 10 years (see http://www.statisticbrain.com/facebook-statistics/).

[93] Internet refers to the publicly accessible computer network that connects many smaller networks from around the world (on its governance see http://www.ietf.org or http://www.icann.org).

[94] SWIFT stands for the Society for Worldwide Interbank Financial Telecommunication (see http://www.swift.com).

[95] GPS stands for Global Positioning System (see http://www.gps.gov).

Figure 7: Natural Disasters & Technological Disasters Events



Source: Adapted from OECD (2003:35)[96]

b. World Economic Forum Global Risks (2006)

In 2006 the WEF published the first edition of its annual report on global risks. The publication developed from an initiative that began in 2004[97] with the aim to "identify and assess key current and emerging systemic risks to global business, to study the links between them to assess their likely effect on different markets and industries, and to advance the thinking around more effective mitigation."[98] In developing its initial list of global risks for publication the WEF applied six selection criteria to filter a much broader list of risks that were identified from various workshops organized in 2004[99] and in 2005.[100]

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96 OECD (2003:35) Figures 1 & 2 citing OFDA-CRED International Disaster Database. The database considers an event a disaster if one of these conditions are met: 10 people are reported killed; 100 people are reported affected; international assistance is officially requested; or a state of emergency is declared.

97 "The programme was launched in 2004 by the World Economic Forum in collaboration with Merrill Lynch. In 2005, two more Strategic Partners joined the Programme: Swiss Re and MMC (Marsh & McLennan Companies, Inc.), each contributing to the programme different skills and expertise and helping to provide improved focus and rigour to the selection of global risks and to the construction of scenarios surrounding these risks." WEF (2006: 2). Retrieved from http://www.weforum.org/pdf/CSI/Davosrisk.pdf (site last visited on 15 May 2015).

98 Ibid.

99 "In 2004, the World Economic Forum, working with Merrill Lynch, developed a preliminary group of global risks within selected issue areas, covering most of the global risks that were then seen to be of concern to the global business community. The first list of risks emerged from expert workshops in

The global risks selected in 2006 (Table 7) were to be considered over a time horizon of ten years and based on the following criteria:

- Scale and scope of impact[101]
- Nature of impact – economic or social, or both[102]
- Uncertainty[103]
- Need for multi-stakeholder response[104]

The WEF's inaugural report attempted to avoid extrapolating the current trends at the time recognizing the inherent uncertainty of how such global risks might manifest themselves. Instead it developed brief scenarios for each global risk that projected a short-term view (12 months into the future) and a long-term view (over 10 years into the future).

2004 arranged by the Forum and hosted by Merrill Lynch, and were presented at the Annual Meeting in Davos in January 2005." WEF (2006: 2).

100 "The risks identified as *global risks* were assessed for likelihood and severity at a meeting of partners hosted by Swiss Re at Rueschlikon in September 2005, and refined further in consultation with faculty at the Wharton Risk Management and Decision Processes Center in October 2005. Workshops hosted by Merrill Lynch and MMC (Marsh & McLennan Companies, Inc.) in November and December 2005 in New York and London addressed the issues of risk conflation and strategies for mitigation." World Economic Forum (2006: 3). Retrieved from http://www.weforum.org/pdf/CSI/Davosrisk.pdf (site last visited on 15 May 2015).

101 "A global risk has global scope, with the potential (including both primary and secondary impacts) to affect at least three world regions on at least two continents. A global risk has cross-industry impact, potentially affecting three or more industries. Each global risk must satisfy both of these criteria." WEF (2006: 4). Retrieved from http://www.weforum.org/pdf/CSI/Davosrisk.pdf.

102 "A global risk has an economic impact exceeding $10 billion and/or a major social impact in terms of human suffering and loss of life, triggering public pressure to respond. Each global risk must satisfy one of these two criteria." WEF (2006: 4).

103 "To warrant inclusion in the list of global risks, there must be uncertainty as to how the risk will manifest itself over ten years, or at least as to the severity of its impact. A trend whose path is already clear and has been discounted or otherwise fully accommodated in forward planning, does not constitute a global risk in the context of the Programme." WEF (2006: 4).

104 "[A] global risk was defined as one demanding a multistakeholder approach to respond to it. This might be because cooperation between the public and private sectors is required to understand the drivers of the risk, to assess its inter-linkages with other risks, or its impacts on different industries or countries; or because concerted endeavours by governments, multilateral organisations, businesses and civil society institutions are needed to address the causes or mitigate the effects." World Economic Forum (2006: 04).

Table 7: World Economic Forum Global Risks (2006)

Economic	Societal	Environmental	Technological	Geopolitical
Oil prices/energy supply Asset prices/indebtedness US current account deficit and US dollar Coming fiscal crises China Critical infrastructure	Regulation Corporate governance Intellectual property rights Organised crime Global pandemics Slow and chronic diseases (industrialised world) Epidemic disease (developing world) Liability regimes	Tropical cyclones Earthquakes Climate change Loss of ecosystem services	Convergence of technologies Nanotechnology Electromagnetic fields Ubiquitous computing	Terrorism European dislocation Current and future hotspots

Source: Adapted from WEF (2006: 7).

The third part of this study (Empirical Analysis) focuses on the redesign of the WEF's risk related survey methodology that was designed and instituted by the author in 2011 and 2012 as part of the quantitative research required for this study.

c. Global Risk in Risk Management

In their 2008 edition of *Corporate Risk Management*, Tony Merna and Faisal Al-Thani provide a definition of global risks in the context of project planning:

> "Global risks originate from sources external to the project environment and although they are usually predictable their effect on the outcome may not always be controllable with the elements of the project. The four major global risks are political, legal, commercial and environmental risks."[105]

Their definition is one of the earliest in the research literature to reference global risks specifically as uncontrollable risks (again in the context of project risk management):

[105] Merna. T. & Al-Thani, F. (2008: 20).

> "These types of risks are often referred to as ***uncontrollable risks*** since the corporate entity cannot control such risks even though there is a high probability of occurrence."[106]

They also identified the board and executive team broadly as the locus of decision-making for global risks as a result of their uncontrollable nature because: "[n]ormally these risks are dealt with at corporate level and often determine whether a project will be sanctioned."[107] Their observations in this regard have contributed to the problem definition of this study.

B. Problem Definition

The aim of this study is to assist boards in identifying and addressing critical uncertainties; understand their interconnectivity; and to recognize their potential compounding effects should such unfavorable events occur simultaneously. It attempts all three under the new rubric of "uncontrollable risks." It examines three dimensions of risk management that will require further innovation in the context of corporate governance.

- The first dimension is that Enterprise Risk Management (ERM) does not have a robust conceptual framework to address uncontrollable risks in the context of a highly interconnected and interdependent global economy. Black Swan Events (BSE) and global shocks are particularly vexing challenges for a Board of Directors (BoD) as their nature and causality may be known or knowable but the means to predict or prevent their occurrence are not yet available.

- The second dimension is that uncontrollable risks are relevant corporate governance concerns given their massive financial, operational and strategic impact that extend across stakeholders. In this context, the term Corporate Risk Management (CRM) is more appropriate as means to signal the evolution towards a more holistic approach to corporate activities such as Governance, Risk management and Compliance (GCR) at the board level.

- The third dimension is that the ex ante identification of uncontrollable risk requires not only innovations in the mapping of known risks but also an exploration of not only "known unknowns" but also the "unthinkable" or "unknowable." Putting higher emphasis on such potentially catastrophic risks, even if they are unlikely to materialize, requires greater diversity of thinking and more risk dialogue at the board

[106] Merna. T. & Al-Thani, F. (2008: 20).
[107] Merna. T. & Al-Thani, F. (2008: 20).

level. It also requires a BoD to overcome various cognitive biases and heuristic tendencies.

C. Practical Background

Economic research on the complexity and uncertainty inherent in an interlinked global economy is arguably more advanced than management research on how best a company should address them at the board and management levels. This study of uncontrollable risks attempts to bridge this critical knowledge gap. In this regard, the OECD is unique as it has promoted research on both fronts for over a decade. However its diagnostic efforts related to risk management are arguably more developed than its prescriptive efforts related to corporate governance (Table 8).

Table 8: Selected OECD Publications on Global Risks and Corporate Governance

Year	Title	Observations
2003	*Emerging Global Risks in the 21st Century*	Introduces 5 major risks but fails to include systemic financial risk among them
2009	*The Corporate Governance Lessons from the Financial Crisis*	Focuses on lack of board oversight of excessive risk-taking and remuneration in financial companies
2011	*Future Global Shocks: Improving Risk Governance*	Warns of possible global shocks with major systemic implications
2014	*Risk Management and Corporate Governance*	Warns that boards may not be focusing enough on "potentially catastrophic" risks

Source: Author.

The OECD has only recently integrated its own foresight regarding global risks into its latest recommendations on risk management and corporate governance as evidenced by the main conclusions of its report published in April 2014.[108] Among the key points to consider in the context of increased connectivity and complexity are:

> "Currently risk governance standards tend to be very high-level, limiting their practical usefulness, and/or focusing largely on financial institutions. There is scope to make risk governance standards more operational, without narrowing their flexibility to apply them to different companies and situation. Experiences from the financial sector can be valuable, even if not transferable to the non-financial sector. Outsourcing and supplier-related risks, for example, deserve attention in both the financial and non-financial sector."[109]

Despite its increasing public prominence over the past decade, ERM remains in principal relatively straight forward enough to be understood by all: "[i]f the enterprise collects and systemically analyses its risk and takes adequate actions to mitigate them, this is the process of risk management."[110] It is also clear that risk management in practice is contextual as each enterprise "[h]as to decide which risks must be accepted, avoided or managed on the basis of their consequences and suitable measures."[111] Yet this century has already shown that sophisticated companies regularly experience major failures and in many cases share the same or similar risk management weaknesses of their competitors and partners. The inference to draw is that there are common cultural, organizational and regulatory shortcomings that require closer examination. It therefore comes as no surprise that the past decade has seen major research efforts to establish conceptual frameworks of risk management that are not only integrated and comprehensive but also universal and flexible in their applicability.

1. Influence of Regulatory and Legal Requirements on Practice

The board has the ultimate responsibility for governing a corporation.[112] Among those responsibilities is risk governance and the importance of which was highlighted by the experience of the global financial crisis of 2008 as the OECD observed that "boards were in a number of cases ignorant of the risk facing the company."[113] Therefore in many countries, the

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108 OECD (2014). The report reviews the corporate governance framework and risk management practices for both private sector and state owned enterprises in the twenty seven members of the OECD Corporate Governance Committee.

109 OECD (2014:7).

110 Kalia, V. & Müller, R. (2007:11).

111 Kalia, V. & Müller, R. (2007:24).

112 See Delaware Corporation Law §141(a) for the United States and article 716a of the Swiss Code of Obligations (CO) for Switzerland.

113 OECD (2014: 12). Summarizing the key findings of its earlier 2010 study on corporate governance and

BoD in listed companies can be mandated by law to adopt risk management practices (e.g. creation of a risk or audit committee) or to provide risk related information (e.g. internal control report). For example in the United States, the compliance requirements contained in §404(a) of the Sarbanes-Oxley Act (SOX) requires that a publicly traded firm's annual report contain an internal control report which states the responsibility of management for establishing and maintaining a proper structure and process for financial reporting.[114] SOX was enacted to improve corporate governance standards after the collapse of Enron Corporation along with other governance scandals resulted in some of the largest corporate failures in modern history involving firms listed on the New York Stock Exchange (NYSE).

The Sarbanes-Oxley Act (SOX) has clearly influenced the creation of board committees and their control responsibilities in other jurisdictions (Table 9). It also has had a significant normative impact, particularly with regard to notions of board independence. The SOX not only requires that a majority of board members be independent but that specific committees (e.g., audit and compensation) are composed entirely by independent directors. The changes in American securities law and securities that resulted from the scandals resulted in similar reforms in other jurisdictions that also experienced corporate scandal. In private discussions on corporate governance organized by the WEF, a board chairman cited the example of the corporate accounting scandal of Satyam Computer Services in 2009 as having nearly the same legal and regulatory impact in India that the demise of the Enron Corporation in 2001 had in producing the Sarbanes-Oxley Act. The revision of India's Companies Act of 1956 is expected to bring about considerable corporate governance reforms, particularly related to board independence issues stemming from the SOX.[115] The problem with such efforts as noted by the chairman from India is that many enterprises are family owned (often via majority shareholdings) including their largest multinationals.

Table 9: Overseas Influence of the Sarbanes-Oxley Act

United States of America	Switzerland
§301 of the Sarbanes-Oxley Act (Form of Audit Committee)	Swiss Code of Best Practice for Corporate Governance, par. 23 (Audit Committee)
§404 of the Sarbanes-Oxley Act (Assessment of Internal Controls)	Article 716a of the Swiss Code of Obligation (CO) (Determining Management Systems)

Source: Author.

As the table below outlines, risk government requirements for listed companies varies significantly around the world and often targets different layers and functions of the

the financial crisis.

114 Miller, G. (2014: 104).

115 Afsharipour, A. (December 2010). A Brief Overiview of Corporate Governance Reform in India. *Director Notes*. The Conference Board.

organization (Table 10). There are board level responsibilities outlining specific risk management responsibilities for the BoD that may take the form of a law, regulation, code or principle. There also may be requirements to establish a board level committee charged with risk management (separated or integrated with other committees such as audit). There may be requirements related to the implementation of an internal control or risk management system or process including the need to designate a chief risk officer (CRO). Obviously such a range of possible risk governance requirements will have a major influence singularly as well as collectively on the behavior and practices of a BoD.

Table 10: Requirements/recommendations for listed companies (Abridged)

Board responsibilities L denotes mandated by Laws R denotes mandated by Regulations C denotes mandated by Codes/Principles - denotes no requirement		Board level committee		Internal control/ risk management system	Chief Risk Officers
		Audit	Risk		
Argentina	C	L/R	C	C	C
Australia					
Austria	L/C	L*/C*	-	L	-
Belgium					
Brazil					
Canada					
Chile	-	R	R	R	-
Czech Republic	-	-	-	-	-
Finland	-	C*	-	C	-
France					
Germany	L/C	L/C	-	L/C	-
Greece					
HongKong, China	R/C	C*	-	C	-
India	L/C	L*C*	-	L/C	-
Indonesia					
Ireland					
Israel	-	L*	-	R	L*
Italy	C	L	C	C	C*
Japan	L	-	-	L	-
Korea	C	-	-	-	-
Mexico	L	L	-	-	-
Netherlands	C	C*	-	C	-
New Zealand	-	-	-	-	-
Norway	C	L*	-	L/C	-
Poland	-	L*	-	L	-
Portugal	-	-	-	-	-
Saudi Arabia					
Singapore	C	C	C	C	C
Spain	-	L*/C*	-	L/C	-
Sweden	C	-	-	C	-
Switzerland	L	C*	-	C	-
Turkey	R	L	L	L	-
United Kingdom	C	C*	-	C	-
United States	R*	L*/R*	-	L/R	-

Source: Adapted from OECD, Table 1.1 (2014: 19).[116]

[116] **"Board responsibilities:** Specific provisions describing the board responsibilities for risk management. * In the US, the SEC rules require a company to disclose the board's role in the oversight of risk. **Board-level committee:** Requirement or recommendation regarding the establishment of a board-level committee charged with risk management. ***** denotes that risk management is explicitly included in the role of audit committee. **Internal control/risk management system**: Requirement or recommendation regarding the implementation of the internal control and risk management system. **Chief risk officers:** Requirement or recommendation regarding a chief risk officer. *denotes that internal auditors are in charge of risk management." OECD (2014: 19).

2. Influence of Frameworks and Standards on Practice

The two most prominent efforts have been the 2004 report of the Committee of Sponsoring Organizations of the Treadway Commission (COSO), "Enterprise Risk Management-Integrated Framework" and the International Organization for Standardization's (ISO) 2009 publication, ISO 31000 ("Risk Management—Principles and Guidelines on Implementation").[117] A succinct comparison would be that the COSO framework is acknowledged for providing a flexible standard against which to evaluate Enterprise Risk Management (ERM) processes (particularly in the context of existing internal controls) whereas ISO 31000 is acknowledged for providing practical guidance on how to implement appropriate ERM processes (particularly in an international and cross-industry context).

Both efforts reflect the contemporary (i.e. 21st century) historical context of ERM, which featured cases of massive corporate failures as mentioned earlier. Those failures also influenced the evolution of internal control frameworks (originally for auditing, financial reporting as well as regulatory and legal compliance purposes) towards integrating critical operational as well as strategic concerns of an enterprise. Although risk management as an emerging discipline continues to attract significant research, much of it has been directed towards executive management concerns as compared those of the BoD. Invariably most research today will highlight the importance of the board in terms a strategic and integrated approach to risk management.

For example, a 2010 benchmark risk management survey of the energy and resources industry revealed that the BoD (and its audit committee) was the primary driver of risk management within their organizations. In contrast, executive management was seen as mostly concerned with aligning strategic risk management and operational performance.[118] The study's authors saw this as consistent with the emergence of strategy as a driver of ERM but also suggested that a board's tendency to focus mostly on asset protection and executive management's tendency to focus more on growth set the stage for mismatched expectations between the two with regard to risk management and value creation.[119] The latter is problematic because if ERM is driven primarily by the board (or its key committees), then senior management may perceive this risk management imperative as yet another top-down compliance requirement that from their perspective is unrelated to improving value creation or operational performance.[120] Therein rests one of the basic challenges for corporate boards

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117 Retrieved from http://www.coso.org/-erm.htm (last visited on 15 May 2015) and retrieved from http://www.iso.org/iso/home/standards/iso31000.htm (last visited on 15 May 2015).

118 Deloitte (2010 :7)

119 Ibid.

120 Kalia, V. & Müller, R (2007:17). The authors recommend that to avoid this situation, "the Board of Directors (BoD) can be pro-active in demanding information regarding risks, sticking to guidelines and policies (preferably championed at a senior level), and analyzing the quality of risk management initiatives and their impact on the performance of the company." Ibid.

as risk management is in fact an "untransferable and inalienable task of the Board of Directors (BoD)."[121] Initially the practical ERM concern of the BoD is how to "ascertain the categories into which risks will fall, and the level at which these risks will be dealt with in the organization."[122] But the greater governance challenge is "to achieve effective supervision without interfering excessively in the work of top managers."[123]

Historically, a common reason for an enterprise failing in the prior century was that "often the BoD did not (or decided not to) recognize threatening risks and therefore did not initiate any measures to mitigate these risks."[124] Therefore BoD today are advised to focus not only on financial and operational risks but to consider strategic ones as well.[125] But as new or revised principles and standards continue to evolve, it is clear that risk management remains a developing discipline that requires the BoD to engage in continuous learning at both the conceptual and organizational levels. That reality is reflected in COSO's 2009 publication, "Effective Risk Oversight: The Role of the Board of Directors," which stated:

> "With the benefit of hindsight, the global financial crisis and swooning economy of 2008 and the aftermath thereof have shown us that boards have a difficult task in overseeing the management of increasingly complex and interconnected risks that have the potential to devastate organizations overnight."[126]

Thus the practical challenges for the BoD today go beyond evaluating, adopting or supervising the most relevant risk management framework for their firm but also involve defining and developing its corporate governance role with regard to new forms or categories of risks. In a highly interconnected and interdependent global economy, the BoD cannot avoid the difficult issue of how their company should prepare for exogenous shocks that are seemingly beyond its control or influence. This stark realization has led to increasing interest in risk envisioning innovations such as creating risks-maps and participating in scenario planning or stress-testing exercises but the primary prescription for a BoD remains engaging in deeper risk dialogues. This study will show that such innovations and dialogues are far from being the corporate norm and this paper will also argue need additional changes in board culture, composition and behavior if they are to be effective in the context of uncontrollable risks.

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121 Kalia, V. & Müller, R. (2007:12).
122 Kalia, V. & Müller, R. (2007:18).
123 Kalia, V. & Müller, R. (2007:19).
124 Kalia, V. & Müller, R. (2007:16).
125 Ibid.
126 COSO (2009: 2).

3. Influence of Behavioral Science on Practice

Most approaches to risk management typically fail to integrate research on human behavior that can explain how risks are distorted by distinct heuristics and biases -- this is arguably a pervasive and persistent shortcoming of the discipline given the importance of sound judgment skills in evaluating uncontrollable risks (Table 11). As early as 1979, Daniel Kahneman and Amos Tversky published their "prospect theory"[127] that shows the irrational nature of human judgement in economic decision-making. Their human experiments demonstrated that an innate fear of loss overrode the hope of gain in the context of risk-taking – i.e. people use heuristics to make decisions based on the potential value of losses and gains rather than the final probabilistic outcome. In recognition of their influential findings, Kahneman's was awarded the Nobel Prize in Economics in 2002 (Tversky had passed away in 1996). It was only in 2012 that COSO published its thought paper, *Enhancing Board Oversight: Avoiding Judgement Traps and Biases*, which highlights the importance of improving board oversight in effectively challenging the judgment of corporate officers as well as enhancing their own professional judgment skills.[128] It noted (with irony) that:

> "[D]espite the fact that we constantly make judgments and decisions and that the demand for good judgment is high, most people receive very little formal training in what good judgment looks like or in the human tendencies that threaten good judgment."[129]

In the context of uncontrollable risks, cognitive biases are particularly challenging. In an interview with the risk committee chair of a European bank, the chairperson observed that most people will think quite differently (from a creative context) when asked to imagine experiencing a massive earthquake versus winning the national lottery – yet both are basically "high impact, low probability" events. Indeed scientific research has shown that daydreams are typically more pleasant than dreams that enter our minds during sleep as those are often threat related.[130] In addition, uncontrollable risks resurface the particular problem of "ambiguity aversion"[131] whereby individuals prefer a known risk over an unknown risk.

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127 Kahneman, D. & Tversky, A. (1979).

128 COSO (March 2012).

129 COSO (March 2012:2).

130 Revonsuo, A. (2000: 897). "Thus, daydreaming appears to deal with the evaluation and setting of particular future goals, and charting the ways in which we might achieve such goals. Daydreaming is at least partly controlled voluntarily. By contrast, dreaming is a fully developed involuntary simulation of the perceptual world, tuned especially to simulate and rehearse the perception of, and immediate defensive reactions to, possible threatening events." Ibid.

131 See Ellsberg, D. (1961), "Risk, Ambiguity, and the Savage Axioms,"*The Quarterly Journal of Economics,* vol. 75 no.4 (November 1961). In his widely cited article, Daniel Ellsberg presented two thought experiments to demonstrate a paradox in decision theory (the so-called Ellsberg paradox) whereby a person would make a choice that violated postulates of subjective expected utility – i.e.

When presented with a choice, someone that is averse to ambiguity will prefer a probabilistic outcome over an outcome where the probabilities are unknown or unknowable. Ambiguity aversion partly explains why boards often ignore the deficiencies of risk management models that are built upon inexact probability assumptions.

Table 11: Heuristics as Cognitive Distortions

Availability	We tend to interpret any story through the lens of superficially similar account
Confirmation Bias	We glibly underpin an assumption by focusing on instances that confirm it, while ignoring those that didn't
Overconfidence	We see ourselves as always being right – or at least more often than other people
Anchoring	We tend to cling mentally to any number we hear in a particular context, even if it is factually far off the mark
Representativeness	We judge the substantially similarity of things based on their superficial resemblances

Source: Adapted from Cleary & Malleret (2006: 62).

Cognitive biases will be explored further in part two of this study (Theoretical Review) in the section focusing on challenges to risk management. Differences in risk perception will be examined in part three (Empirical Analysis) based on survey data collected on perceptions of global risks.

D. Theoretical Background

This study asserts that the discipline of risk management as has not developed a conceptual framework (across all levels of an organization) to address uncontrollable risks inherent in a highly interconnected and interdependent global economy. The core suppositions for this assertion are three-fold:

1) The definition of risk as well as the categorization of risk types continues to be refined and expanded by academic researchers and risk management professionals. Terms such as Black Swan Events (BSE), systemic risk and "known unknowns" have entered risk parlance. However many of the new risks are essentially uncertainties as nature and causality may not be known or knowable and the means

make a choice based on a known probability of an outcome over a choice based on an unknown probability of an outcome even if the unknown probability could guarantee the desired outcome (and the known probability is quite low).

to predict and prevent their occurrence are also not available. As they are often perceived as exogenous and therefore beyond the "control" of any signal institution, such risks are typically outside the enterprise risk management remit of most corporations. Under the rubric of "uncontrollable risk," this study examines the conceptual and practical challenges that a BoD faces from such critical uncertainties.

2) Risk management as an emerging discipline faces increasing scrutiny in theoretical and practical terms after the global financial crisis of 2008 and subsequent global shocks such as the H1N1 influenza pandemic in 2009 and the Great East Japan Earthquake in 2011. The OECD has criticized boards for failing to put sufficient emphasis on catastrophic risks as well performing poorly in the ex ante identification of risks. Other board shortcomings include an over-reliance on questionable probability assumptions, neglecting to study intersecting vulnerabilities across risks and risk categories as well as their cascading consequences across stakeholders. This study examines such weaknesses in corporate governance and risk management by considering research from other emerging disciplines, most notably from complexity science and behavioral science. Moreover, examining such shortcomings from a CRM perspective should improve the capabilities of boards to address uncontrollable risk in both an ex ante and ex post context.

3) International institutions, most notably the Organization for Economic Co-operation and Development (OECD) and the World Economic Forum (WEF), have been the vanguard research centers with regard to developing a conceptual framework for identifying and monitoring global risks that could be utilized by public and private sector organizations. This study examines their methods in the context of uncontrollable risks and their potential utility for a BoD.

Second this paper acknowledges that risk management is a new discipline. It is one that consistently recognizes the importance of corporate governance in relationship to the risk management and compliance responsibilities of a firm. Moreover research literature and international standards on practice highlight the necessity of adopting an integrated risk management approach across an organization that is supervised by the BoD and implemented by the executive management team. However this paper asserts that CRM is the more relevant framework in this study than ERM. The term "corporate" underscores the nexus between governance, risk management and compliance (GRC) and the importance of the BoD given their strategic and holistic framing of uncontrollable risks. The core suppositions for this assertion are three-fold:

1) The ex ante identification of risks remains a vexing challenge for a board and will be even more so in terms of uncontrollable risks. Diversity of thinking within a board is therefore an essential attribute to address this challenge.

2) Uncontrollable risks sit on the dividing line of responsibility between the BoD and the executive management team particularly with respect to their glocal[132] nature in times of crisis management.

3) Uncontrollable risks require further innovation of routine or traditional risk management methods as insurance protection, risk avoidance and hedging strategies are of limited use and instead requires greater board attention on Business Continuity Management (BCM) and organizational resilience building.

Third this paper asserts that an uncontrollable risk event is likely to fall in a "grey" zone that touches on both Business Continuity Management (BCM) and organizational resilience. The core suppositions for this assertion are three-fold:

1) Uncontrollable risks are similar to "known unknowns" but also encompass "unknown unknowns" because their probability and mode of occurrence are indeterminable in many instances. Risk envisioning dialogues therefore can be helpful in their ex ante identification if adequate consideration is given to the nature of such risks (e.g., risk interconnectivity, intersecting vulnerabilities and cascading consequences) and to the environment needed for such a strategic thinking exercise (e.g., informal, collegial and creative atmosphere embracing a diversity of discussion formats and thinking styles).

2) Uncontrollable risks can be exogenous, systemic or both but such a risk event will manifest itself in a national context and are therefore are a "glocal" phenomena. Therefore addressing uncontrollable risks in an ex post context requires strengthening organizational resilience as wells implementing business continuity plans which are at the core of risk management.[133]

3) Resilience building necessitates stronger relationships between public and private sector stakeholders in the context of uncontrollable risk. The intersecting vulnerabilities likely to emerge across multiple risks and the cascading

[132] The term 'glocal' refers to characterizing something as possessing both local and global considerations. See http://www.oxforddictionaries.com/definition/english/glocal (site last visited on 10 April 2015).

[133] Kalia, V. & Müller, R. (2007:29) "BCM is considered a "business-owned and business-driven process that unifies a broad spectrum of management disciplines." Ibid.

consequences likely to impact across various stakeholder groups upon their occurrence require a global approach.

To support the above-mentioned assertions and to explain each supposition, this paper relies on the conceptual insights and practical methods primarily associated with the following institutions and individuals:

- The International Centre for Corporate Governance (ICCG) [134] affiliated with the University of St. Gallen and the research of Professor Martin Hilb on New Corporate Governance[135] and Professor Roland Müller and Vinay Kalia on risk management at the board level.[136]

- The World Economic Forum (WEF) and the action research of the author conducted partly in his professional capacity as a member of its Managing Board but primarily in his adjunct role as the Editor-in-Chief of the 7th and 8th editions of its annual report on global risks as well as leading its Risk Response Network (RRN) initiative[137] during the same period.

II. Research Objectives

The primary objective of this research is to contribute to the understanding of uncontrollable risks, both in academic and practical terms. This in turn will enable BoD to fulfill their expected and desired risk management role. The salient observation for this study is that Black Swan Events (BSE), systemic risk and global shocks have each entered the lexicon of risk management in the absence of a robust framework for their identification, mitigation and management. Therefore the following principal research question will be addressed:

What are uncontrollable risks and how do they affect the role of the Board of Directors (BoD) and what can be done to address those effects?

Research on this comprehensive question will build upon prior studies by clarifying working definitions and categories of risk in order to introduce the concept of uncontrollable risks in the framework of CRM. It will also build upon existing risk management frameworks, leading corporate practices and related new disciplines (e.g. complexity and behavioral sciences) to explore their applicability addressing uncontrollable risks at the board level.

134 See http://www.icfcg.org/en/home.htm (last visited on 12 April 2015).
135 Hilb, M. (2008).
136 Kalia, V. & Müller, R. (2007).
137 WEF (2012) & WEF (2013).

Therefore the study of this question should contribute to research, teaching and practice related to uncontrollable risks by:

- Improving the ex ante identification and categorization of the types of uncontrollable risks that are prevalent in an interconnected and interdependent global economy but still unfamiliar to most corporations.

- Bridging conceptual frameworks to develop a holistic approach for boards to examine uncontrollable risks under the rubric of CRM.

- Introducing new approaches to risk mapping and scenario planning that puts greater emphasis on risk interconnectivity and on potentially catastrophic risks even if their occurrence is considered very unlikely to materialize.

- Demonstrating that diversity of thinking is a critical attribute for a BoD in order to mitigate cognitive biases and other common judgement errors.

III. Approach

A. Scientific Approach

A new empirical study is often considered to be exploratory in the absence of conceptual frameworks or clear proposals related to the phenomena that are available and accessible from academic research and existing knowledge. [138] This study asserts that an uncontrollable risk is a critical uncertainty whose nature and causality may be known or knowable but the means to predict or prevent its occurrence are not yet available. It is partly an exercise in descriptive theory building as it examines how a board currently makes decisions about uncontrollable risks. However it also an effort at normative theory building as the study is also concerned about how a BoD should behave when confronted by an uncontrollable risk. Therefore this study is best characterized as research based on intermediate theory as it aims to integrate a new construct (uncontrollable risks) into an existing conceptual model (corporate risk management).[139]

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138 Yin, R. (1998), "The Abridged Version of Case Study Research", in: Bickman, L. and Rog, D.J., Handbook of Applied Social Research, Thousand Oaks, CA: Sage: 229-259.

139 Edmondson, A.C. & McManus, S.E. (2005: 19).

As uncontrollable risk is a new construct, this study draws upon the theory building approach developed by Carlile and Christenson.[140] Their development of descriptive theory entails three research steps:

First, observation of the phenomena and its careful description and measurement in a manner that allows subsequent researchers to improve upon the theory.[141] The result is the creation of constructs that "are abstractions that help us rise above the messy detail to understand the essence of what the phenomena are and how they operate."[142] This action research step was conducted by the author in the analysis of prior classifications of global risks conducted by the OECD and the WEF as well as scouting for new ones.

Second, categorization (or classification) of the phenomena into categories (based on their attributes) follows observation.[143] The result is the creation of frameworks or typologies. This research step was conducted by the author by redesigning the World Economic Forum Global Risk Perceptions Survey (GRPS) and expanding the category of global risks surveyed. In addition, in-depth interviews were conducted with board members to assess their familiarity with the construct of uncontrollable risks and its usefulness conceptually and practically with regard to their supervisory responsibilities.

Third, association of the phenomena with various outcomes based on differences in the attributes identified through the categorization process is the last step.[144] The search for how attributes correlate to outcomes often relies on regression analysis techniques. The ex ante identification of risks is a particularly vexing challenge for a BoD and is even more so in terms of uncontrollable risks. Insights from behavioural science and complexity science indicate that diversity of thinking within a board would be an essential and constructive attribute to address this challenge. Therefore a quantitative research approach was taken to test this assumption with regard to diversity and risk perception. Action research was conducted by the author by expanding the survey population of the GRPS (in terms of the gender, geographic representation and age group of respondents) in the second year of the revamped survey.

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140 Carlile, P.R. & Christensen, C.M. (2005:1). "The building of theory occurs in two major stages – the descriptive stage and the normative stage. Within each of these stages, theory builders proceed through three steps. The theory building process iterates through these three steps again and again. In the past, management researchers have quite carelessly applied the term *theory* to research activities that pertain to only one of these steps." Ibid.

141 Carlile, P.R. & Christensen, C.M (2005: 2). "The phenomena being explored in this stage include not just things such as people, organizations and technologies, but processes as well. These observations can be done anywhere along the continuum from analysis of huge databases on the one end, to field-based, ethnographic observation on the other." Ibid.

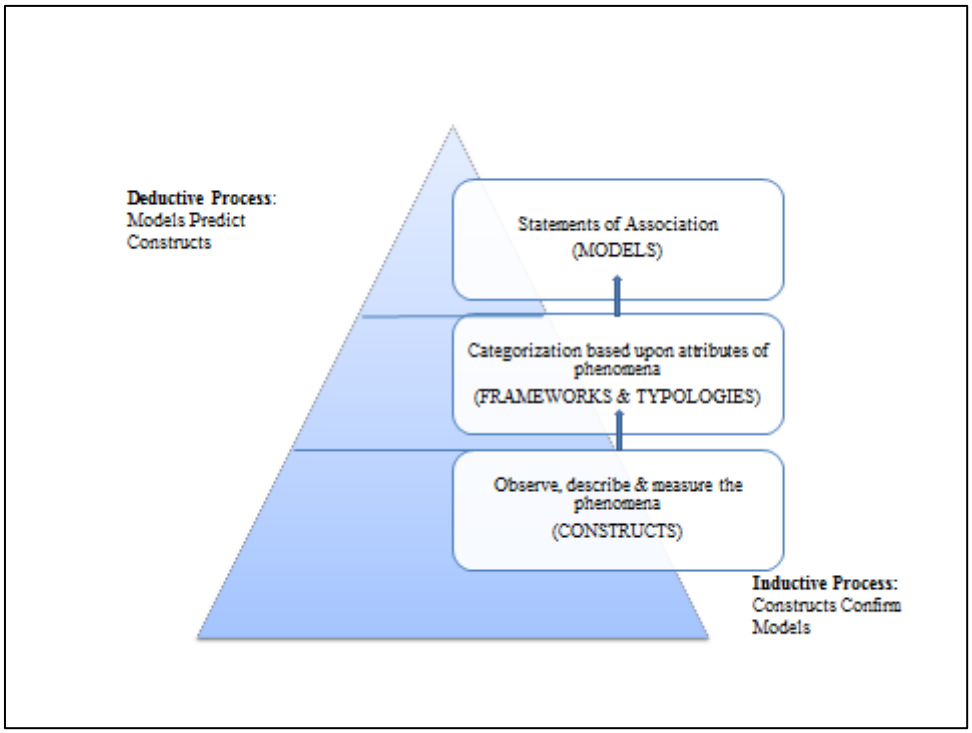
142 Carlile, P.R. & Christensen, C.M. (2005:3).

143 Ibid.

144 Carlile, P.R. & Christensen, C.M. (2005:3).

The inductive portion of the theory building process follows the sequence of first observation then categorization and finally association (Figure 8).[145] Theory development, however, is expected neither to be orderly or consistent as the observation of nascent phenomena may reveal multiple attributes that can generate a range of categorization schemes. Moreover no single association can be considered conclusively as being superior from another at such an early stage of theory building.[146] The qualitative research conducted was an attempt in consideration of such attributes of theory building (e.g. consultations with working groups of risks experts and confidential interviews of board directors). When considering uncontrollable risks and their implications for a BoD, it is worth reminding that Carlile and Christensen characterize a model building process where "[e]ach seems able to explain anomalies to other models, but suffers from anomalies to its own."[147]

Figure 8: Descriptive Theory Development Process



Source: Adapted from Carlile & Christensen (2005:5).

Testing the hypothesis involves the deduction phase by working in the opposite direction to see if the same association (correlation) exists between attributes and outcomes in various sets of data.[148] This deductive process begins the future development of normative theory that is based on the initial descriptive theory. This method is particularly relevant in this

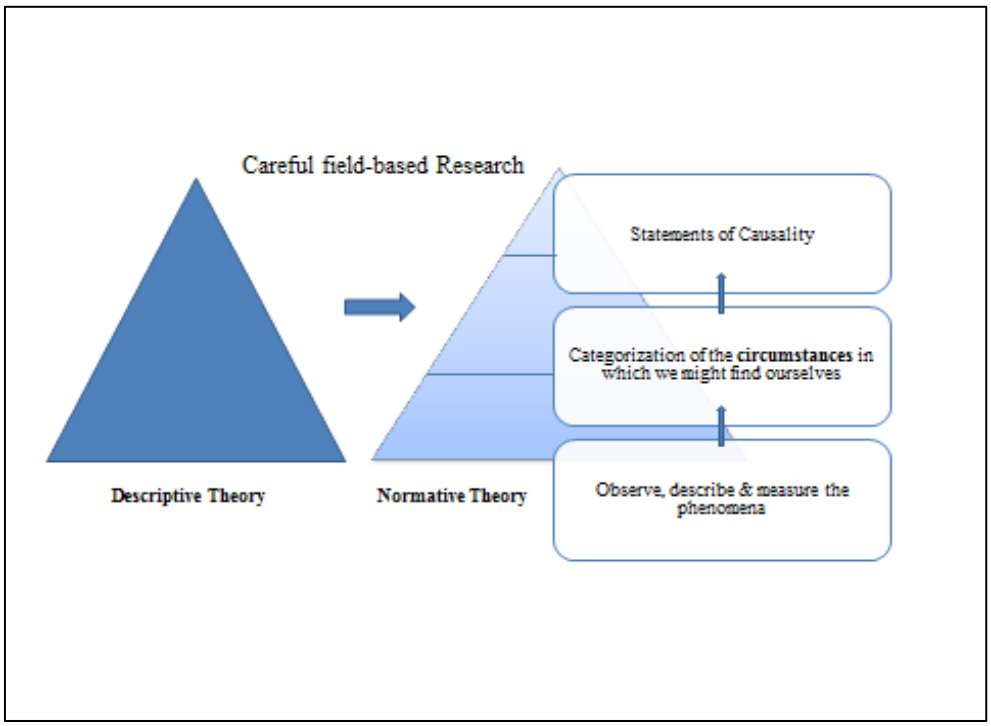
145 Carlile, P.R. & Christensen, C.M. (2005:4).
146 Carlile, P.R. & Christensen, C.M. (2005:5).
147 Ibid.
148 Carlile, P.R. & Christensen, C.M. (2005:6).

study's analysis of differing perceptions of global risks in part three (Empirical Analysis) and the implications for board composition highlighted in part four (Summary and Recommendations). The relationship between descriptive and normative theory can be summarized as:

- Descriptive theory does not define what causes the outcome of interest but does provide preliminary statements of correlation.

- Normative theory flows from descriptive theory by carrying on further research on causality in order to discern what a specific company in a specific situation can do which will lead to a desired result (Figure 9).

Figure 9: Normative Theory Building Process



Source: Adapted from Carlile & Christensen (2005:6).

This study of uncontrollable risks and their impact on a BoD can be further characterized as moving from nascent to intermediate theory research per the 'methodological fit' framework developed by Edmondson and McManus.[149] Intermediate theory research proposes "new constructs and/or provisional theoretical relationships" [150] that rely on the integration of qualitative and quantitative data in a hybrid approach (Table 12). A hybrid research strategy "may either supplement qualitative work with quantitative data or the other way around."[151]

149 Edmondson, A.C. & McManus, S.E. (2007:1165).
150 Ibid.
151 Edmondson, A.C. & McManus, S.E. (2005 : 18).

Table 12: Intermediate Theory & Hybrid Research Strategy

Intermediate Theory Development	***via Hybrid Research Strategy***
Is positioned between nascent and mature theories as it often challenges or integrates prior work	*Relies upon qualitative data to elaborate a phenomenon*
Has both descriptive and normative theory building elements by introducing new hypothesis or constructs	*Relies upon quantitative data to test relationships between constructs*

Source: Author.

Intermediate theory development for this study is done via a hybrid research strategy. That strategy in turn is enabled by an action research approach given its efficacy "for linking theory with practice makes the outcome of action research potentially relevant, readable and persuasive to a practitioner as well as an academic audience."[152]

More importantly, action research allows for seeking out triangulation between 1) observation of events and processes, 2) personal accounts of such by participants and 3) changes in the accounts (and its interpretation) as time passes.[153] Therefore this study of uncontrollable risk relies upon an action research approach to address the exploratory questions presented in the prior sections on problem definition and research objectives. The three hybrid elements of the research strategy used in this study are summarized below:

1. There is no commonly accepted categorization in risk management of global shocks such as the financial crisis in 2008, the global H1N1 influenza pandemic in 2009 and the Great East Japan Earthquake in 2011. The common characteristic is that they are uncontrollable as their nature and causality may be known or knowable but the means to predict or prevent its occurrence are not yet available. An action research approach was taken to test this assumption in developing a theory of uncontrollable risk. The action research was carried out in the WEF during the author's two year adjunct assignment (2012-2013) as Editor-in-Chief of its annual global risks report (7th & 8th editions) and head of its Risk Response Network (RRN) initiative.

152 Eden, C. & Huxham, C. (1996: 83).
153 Ibid.

2. The ex ante identification of risks remains problematic for a BoD and is even more so in terms of uncontrollable risks. Insights from behavioral science and complexity science indicate that diversity of thinking within a board would be an essential and constructive attribute to address this challenge. A quantitative research approach was taken to test this assumption with regard to diversity of risk perception.

3. An important related challenge, conceptually as well as in practice, for a BoD is in the identification and analysis of interconnected risks, particularly with exogenous risks considered unlikely to materialize in terms of their probability. Criticism of current corporate governance of risk management suggests that significant performance improvements are possible in this regard despite the dearth of practical guidance available to a BoD on this problem. A qualitative research approach was taken to test this performance assumption by interviewing board members from multinational corporations confronted by both the problem and the criticism.

As stated earlier, intermediate theory research proposes "new constructs and/or provisional theoretical relationships" [154] that rely on the integration of qualitative and quantitative data in a hybrid approach. With regard to uncontrollable risks, quantitative data allows for the testing of associations with various attributes and qualitative data allows for the illumination of novel constructs.[155] Moreover, to justify the use of action research "the reflection and data collection process – and hence the emergent theories –should focus on the aspects that cannot be easily captured by another approach."[156] Therefore the empirical method for this study entails a hybrid approach whereby:

Two international surveys were conducted to collect quantitative data from which to test associations with various attributes for the purpose of making inferences related to private and public sector perceptions of uncontrollable risks. With this action research purpose in mind, the WEF global risk perception surveys (GRPS) were redesigned by the author and administered in 2011 and 2012.[157] The first survey was conducted in the autumn of 2011 yielded 469 responses from experts. The second survey conducted in the summer of 2012 yielded 1234 responses globally.

154 Edmondson, A.C.& McManus, S.E. (2007: 1166).
155 Ibid.
156 Eden, C. & Huxham, C. (1996: 83).
157 The author is a Managing Director and Member of the Managing Board of the World Economic Forum (WEF). His primary responsibility at the WEF is the editorial and operational oversight of its flagship Annual Meeting held in Davos, Switzerland. The WEF encouraged and sponsored the author's PhD studies at the University of St. Gallen in the context of his professional development. In this regard in June of 2011, he was offered the opportunity to revamp the WEF's risk program in the context of his doctoral research which permitted the action research conducted in this study.

- Qualitative research was conducted via initial consultations and workshops with members of the WEF's Risk Response Network (RRN)[158] in 2013 and subsequent structured interviews of board members from large multinational corporations (MNCs) as well as members of the WEF's Community of Chairmen in 2015.[159] Both were enabled by the author's action research activities at the WEF related to uncontrollable risks.

B. Structural Approach

To address the primary question of how uncontrollable risks change the role of the board in risk management, this research is structured in four parts.

Part one (Introduction) presents the research question by analyzing its contemporary relevance and by presenting the practical and theoretical implications of uncontrollable risks for a BoD. It also introduces the structure of the research, definitions of key concepts and the limits of the research effort.

Part two (Theoretical Review) presents the general theoretical review of risk management including the historical evolution of risk management in theory and in practice as well as contemporary criticism of the emerging discipline and related challenges such as the ex ante identification of risks and common cognitive biases. It then examines the importance of risk interconnectivity and interdependence and its relationship to the emerging discipline of complexity science in the context of uncontrollable risk. The New Corporate Governance (NCG) framework is introduced and is examined along with other novel concepts such as 'resilience management' and its variant "national resilience" as developed by the author. The general theoretical part concludes with a summary of the literature review and the key concepts applicable to uncontrollable risk.

Part three (Empirical Analysis) presents the quantitative and qualitative research objectives related to uncontrollable risks as well as describing the hybrid research methodology to attain them. The context and the aim of the action research conducted are presented in detail as outlined in the prior section on scientific approach. It then presents quantitative data and

158 The launch of the WEF's Risk Response Network was publicly announced on 26 January 2011 at its Annual Meeting in Davos, Switzerland. See http://www.weforum.org/news/risk-response-network-proactively-preparing-threat-global-risks (site last visited on 12 April 2015). It was subsequently disbanded as a formal initiative in September 2013 as part of a broader reorganization at the WEF.

159 The WEF is funded principally by its 1000 members and partners that comprise mainly of large multinational corporations and represented mainly at WEF activities at the executive management and supervisory board levels.

analysis from two large surveys on global risk perception and interconnectivity designed by the author. It then introduces the qualitative research findings based primarily on individual interviews and surveys of board members from major multinational corporations (MNCs). The empirical section concludes with summary of the key quantitative and qualitative findings related to the phenomena of uncontrollable risk and the impact on a board.

Part four (Summary and Recommendations) appropriately summarizes the quantitative and qualitative findings in the context of their implications for both practice and theory. It then develops a list of recommendations including conceptual changes and board practices assist a board with uncontrollable risk. It also highlights relevant issues for further and future research based on both the limitations of this study and its preliminary or ancillary findings.

IV. Definitions

This section provides a working definition of key terms and concepts that are at the core of this study. The general theoretical part that follows this section explores some of these terms and concepts as well as others in greater depth and in the context of the research question.

A. Risk and Uncertainty

Risk is a term that is intuitive yet at the same time difficult to define. Its etymological origin in the English language dates to 1661 and was defined then as "hazard, danger: exposure to mischance or peril."[160] Advances in mathematics in the 17th and 18th centuries, particularly in the area of probability, changed how risk was perceived and defined by showing that "what appears to be mere chance is the measure of our ignorance" given the emergence of statistical science.[161] However, this newfound confidence in the mathematical measurement of risk was tested in the early in the 20th century by the First World War and the Great Depression.

Often risk is expressed by the following equation as the probability of harmful consequences or expected loss: Risk = Hazard x Vulnerability.[162] A hazard is something that is potentially damaging to people and their welfare and can take the form of a physical event, latent condition or phenomenon.[163] Vulnerability is the susceptibility to (and inability to withstand) the impact of such hazards.[164] For purposes of economic assessment, the following equation is used to quantify it in monetary terms: Risk (economic cost per year) = Probability (once in *n* years) x Vulnerability (economic costs/event).[165]

A fundamental distinction between risk and uncertainty emerged in the 1920s; a risk is a measurable uncertainty whereas a true uncertainty cannot be measured and therefore cannot be characterized as a risk.[166] The work of Frank Knight is frequently cited at the origin of the notion that risk and uncertainty are separate concepts. The two concepts have been further refined as Larry Epstein and Tan Wang make the further distinction that risk entails decision-making where "probabilities are available to guide choice"[167] and uncertainty is when "information is too imprecise to be summarized by probabilities."[168] There are also two types

160 Cleary, S. & Malleret, T. (2006:11).
161 Cleary, S. & Malleret, T. (2006:25).
162 Goldin, I. & Mariathasan, M. (2014: 26).
163 Ibid.
164 Goldin, I. & Mariathasan, M. (2014: 26).
165 Goldin, I. & Mariathasan, M. (2014: 26).
166 Ibid. Summarizing the work of Frank H. Knight "Risk, Uncertainty and Profit" pg. 19, Hart, Schaffner, and Marx Prize Essays, no. 31. Boston and New York: Houghton Mifflin. 1921.
167 Goldin, I. & Mariathasan, M. (2014: 25). Citing the work of Larry G. Epstein and Tan Wang, "Intertemporal Asset Pricing under Knightian Uncertainty, *Econometrica* 62 (3): 283-322, quote on 283.
168 Ibid.

of uncertainties: aleatory uncertainty and epistemic uncertainty.[169] Aleatory uncertainty arises from a situation of pure chance. Epistemic uncertainty arises from a problem situation where judgment is required for its resolution.

The recognition of measureable and an unmeasurable uncertainty influenced the meaning and use of the term risk (particularly in a quantitative risk management context). This study posits that BoD will increasingly have to develop a risk management framework for unmeasurable uncertainties along with those for measurable risks. The ISO 31000 (2009) therefore appropriately defines risk succinctly as the "effect of uncertainty on objectives." Indeed the appraisal of the most significant risks and the evaluation of management's response to them are among the basic tasks a BoD undertakes in their supervision of risk management. In undertaking this supervisory task, the BoD assumes that either the mode of occurrence or the probability of occurrence of a particular risk is known or thought to be knowable along with the expected measure of damages.[170] If however any one of the aforementioned conditions is not met then the BoD is in reality assessing an uncertainty. And assessing uncertainty requires corresponding changes in the behavior and mental models of a BoD. [171] It also raises a question of whether a BoD needs to also contemplate a firm's uncertainty appetite along with its supervisory role of developing a company's so-called risk appetite statement. The risk appetite statement is "a mutual understanding between the executive management and the board of directors with regard to what risk levels are acceptable, considering the enterprise's strategy in maximizing value."[172]

B. Preventable Risk, Strategy Risk and External Risk

There are a range of methods to categorize risks in the context of risk management. The categorization of risks is an important research process as it results in the creation of a framework or typology[173] that is essential in the development of a descriptive theory.[174] One

169 Merna, T. & Al-Thani, F. (2008; 14).

170 Kalia, V. & Müller, R. (2007: 22). "The ratio between the probability of an occurrence of damages and the expected measure of damage is called individual risk." Ibid.

171 "The more difficult it is to quantify and ascertain risks, the more advisable it is initiate risk dialogue to manage those risks." Kalia, V. & Müller, R. (2007: 22).

172 Lam, J. (2014: 78).

173 "The key characteristic of a typology is that its dimensions represent concepts rather than empirical cases. The dimensions are based on the notion of an ideal type, a mental construct that deliberately accentuates certain characteristics and not necessarily something that is found in empirical reality (Weber, 1949). As such, typologies create useful heuristics and provide a systematic basis for comparison. Their central drawbacks are categories that are neither exhaustive nor mutually exclusive, are often based on arbitrary or ad hoc criteria, are descriptive rather than explanatory or predictive, and are frequently subject to the problem of reification (Bailey, 1994)." Smith, K.B. (August 2002). Typologies, Taxonomies and the Benefits of Policy Classification. *Policy Studies Journal*. Vol. 30, Issue 3: 379-395. Quote retrieved from: http://island94.org/2010/06/Typology-versus-taxonomy.html (last visited on 15 May 2015).

such typology is based on the field research of Kaplan and Mikes which is based on three categories of risk[175] (Table 13):

- The first are preventable risks which are internal such as breakdowns in processes and mistakes by employees. [176] As they arise from within an organization, they are considered to be controllable.

- Second are strategy execution risks, which an enterprise undertakes voluntarily, having weighed them against the potential rewards derived from the company's strategy. [177]

- Third are external risks, as they are beyond a company's scope to manage and mitigate (i.e. they are exogenous in nature).[178] And they are outside the influence or control of an enterprise (i.e. uncontrollable).

Table 13: Typology of Enterprise Risk

Risk categories	Controllability and relationship to strategy	Control Approaches
I. Preventable (or undesirable) Risks	Organizations may (in theory) prevent or cost-efficiently minimize occurrence of risk. There is no strategic benefit from taking these risks.	- Internal control - Boundary systems - Mission and value statements - Internal audit
II. Strategy Execution Risks	Organizations may reduce the likelihood and impact of such risks in cost-efficient ways. Taking these risks is essential for achieving strategic returns.	- Risk identification with risk maps and registers - Risk mitigation initiatives - Risk monitoring linked to strategy review meetings and resource allocation
III. External Risks	Organizations cannot control the occurrence of such risks, but may be able to prepare and thus reduce the impact.	- Risk "envisionment" via scenarios, war games, and expertise-based mental models - Contingency planning - Insurance and hedging programs (limited use)

Source: Kaplan & Mikes (2013: Appendix 2).

174 Carlile, P.R. & Christensen, C.M. (2005:3).

175 Kaplan, R.S. & Mikes, A . (2012:4).

176 "Examples are the risks from employees' and managers' unauthorized, illegal, unethical, incorrect, or inappropriate actions and the risks from breakdowns in routine operational processes." Ibid.

177 Kaplan, R.S. & Mikes, A. (2012:5). "Strategy risks are quite different from preventable risks because they are not inherently undesirable." Ibid.

178 Kaplan, R.S. & Mikes, A. (2012:5). "External risks require yet another approach. Because companies cannot prevent such events from occurring, their management must focus on identification (they tend to be obvious in hindsight) and mitigation of their impact." Ibid.

C. Systemic Risk

The notion of systemic risk is closely associated with financial markets in the wake of the global financial crisis. Benjamin Bernanke, Chairman of the Board of Governors of the United States Federal Reserve System, defined systemic risks as "developments that threaten the stability of the financial system as a whole and consequently the broader economy, not just that of one or two institutions."[179] However this report adopts a broader and industry neutral definition as put forth by the OECD whereby a systemic risk "is one that affects the systems on which society depends."[180] However it is important to understand that systemic risk "refers to the prospect of a breakdown in the entire system as opposed to breakdown of individual parts"[181]in the context of this study. The degree of difficulty in identifying the direct or specific cause of the system's failure is what distinguishes a complicated system from a complex system.

D. Global Risk

This study also adopts a definition of global risk as put forth by the World Economic Forum (WEF) that has the following characteristics[182]:

- global geographic scope;
- cross-industry relevance;
- uncertainty as to how and when they may occur;
- high levels of economic and/or social impact; and
- requiring a multistakeholder response

Worth noting is that the OECD's working definition of a global shock highlights the swiftness of occurrence (or the surprise or shock element) as a distinct characteristic.[183] Clearly the element of surprise is an important consideration as "managing risk is managing surprise"[184] but it is inferred in the notion of uncertainty in WEF definition above.

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179 Bernake's definition was expressed in a letter dated 30 October 2009 to US Senator Bob Corker (see http://blogs.wsj.com/economics/2009/11/18/bernanke-offers-broad-definition-of-systemic-risk/). More recently the Congressional Research Service (CRS) defined it as "the possibility that the financial system as a whole might become unstable, rather than the health of individual market participants." (see http://www.fas.org/sgp/crs/misc/R42545.pdf).

180 OECD (2003:29). Among the systems critical to society considered illustrative by the OECD report include: health, transport, environment and telecommunications. Ibid.

181 Goldin, I. & Mariathasan, M. (2014: 27).

182 WEF (2012: 13).

183 The OECD's working definition of a global shock is a "rapid onset event with severely disruptive consequences covering at least two continents." OECD (2011:12). An 'existential risk' is arguably the most extreme manifestation of a global risk event. It is defined as one that threatens the entire existence of humanity (see http://www.existential-risk.org/concept.html).

184 Kalia, V. & Müller, R. (2007:83)

E. Catastrophic Risk

The term catastrophic risk is often used in the context of extreme events, particularly with regard to natural disasters such as hurricanes, floods and earthquakes. The Wharton Risk Management and Decision Process Center and the Wharton Center for Leadership and Change Management provide the following definition:

> "We define catastrophic risk broadly as events that can have severe, physical, financial or reputational impacts on the conduct of the firm's activities. These can be internal or external to the firm and typically require the involvement of top management and their Board of Directors."[185]

F. Uncontrollable Risk

In the context of project management, global risk is characterized as uncontrollable risk in related literature.,[186] However this paper introduces the broader application of the term "uncontrollable risk" in risk management. This in turn requires a more refined definition of the term that delineates specific attributes. For this study, uncontrollable risk exhibits the exogenous characteristics of an external risk per the risk typology of Kaplan and Mikes;[187] the societal characteristics of a systemic risk as defined by the OECD;[188] and the response characteristics of a global risk as identified by the WEF.[189] And similar to a catastrophic risk, it requires ultimately the attention of the BoD. A succinct working definition of an uncontrollable risk in a CRM context is as follows:

> *An uncontrollable risk is a critical uncertainty whose nature and causality may be known or knowable but the means to predict or prevent its occurrence are not yet available.*

Implicit in this working definition of uncontrollable risk is the notion that the probability and the mode of occurrence of such a risk event are indeterminable thereby inhibiting practical notions of control. Also implicit is the notion that any response to such a risk event would entail an enterprise working closely with its key stakeholders as well as collaborating with public sector actors given the system or systems affected by it.

185 Kunreuther, H., Michel-Kerjan, E. & Useem, M. (2013: 1).
186 Merna. T. & Al-Thani, F. (2008: 20).
187 Kaplan, R.S. & Mikes, A. (2012: 5).
188 OECD (2003: 29).
189 WEF (2012: 13).

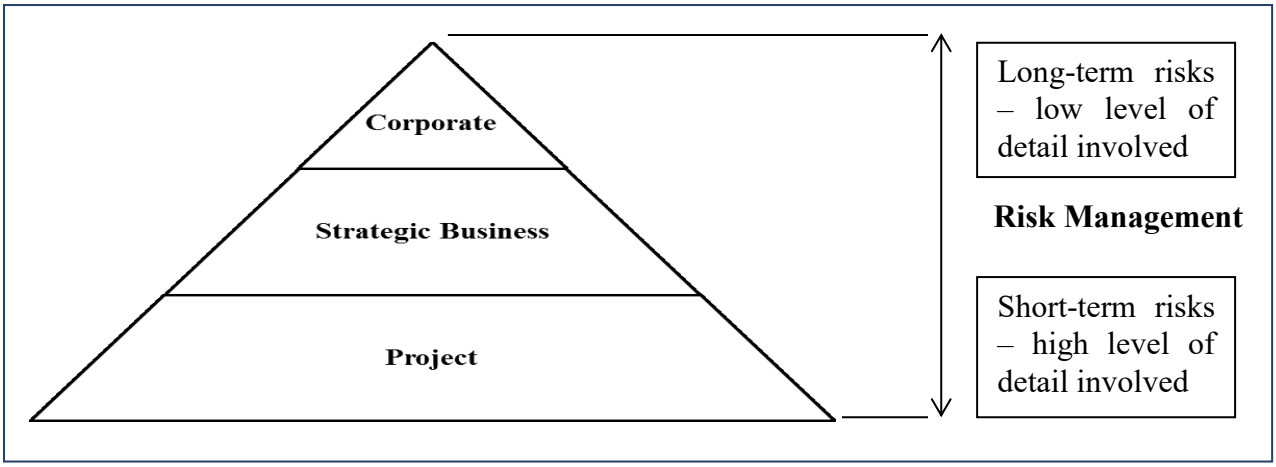
G. Enterprise Risk Management and Corporate Risk Management

As mentioned earlier, the COSO framework is acknowledged for providing a flexible standard against which to evaluate Enterprise Risk Management (ERM) in the context of existing internal control processes. It therefore defines ERM broadly as a process "effected by an entity's BoD, management and other personnel, applied in strategy setting and across the enterprise, designed to identify potential events that may affect the entity, and manage risk to be within its risk appetite, to provide assurance regarding the achievement of entity objectives."[190] This research will focus on two characteristics of the COSO definition: 1) the effect of the board on the ERM process and 2) the ability to identify potential events that may affect the entity. However the working definition of ERM for the purposes of this paper is "a 360˚ view of all risks facing the organization, including internal and external ones, and looks to provide an integrated approach to manage risk across divisions and functions."[191] The appeal of this working definition derived from Kalia and Müller lies with its conceptual linkages to both Business Continuity Management (BCM) and 'New Corporate Governance' as well as its direct applicability to uncontrollable risks.

As noted earlier in this section, ERM and CRM are often used interchangeably in research literature. However CRM is used predominantly in this study as the term "corporate" underscores the nexus between governance, risk management and compliance (GRC). Merna and Al-Thani have framed CRM conceptually as risk management being integral to three levels within an organization: corporate, strategic business and project.[192] In their view, the salient point is that by "classifying and categorizing risk within these levels, it is possible to drill down and roll up to any level of the organizational structure."[193] They use the term CRM to capture the variation in information levels as the impact of risk is both related to time (required for information flow) and enterprise structure. In their view, risk management is "dependent on the information available at the time of assessment, with each risk being assessed in more detail as more information becomes available" (Figure 10).

190 COSO (2004:8).
191 Kalia, V. & Müller, R. (2007:41).
192 Merna, T. & Al-Thani, F. (2008; 3).
193 Ibid.

Figure 10: Risk Information Levels within a Corporate Organization



Source: Adapted from Merna & Al-Thani, Figure 1.1 (2008: 3).

Other researchers have framed the concept of CRM around a relatively new dimension to ERM by focusing on the question of "why and how should a firm choose to hedge the financial risks that might affect its business by means of financial contracts such as derivatives?"[194] This is an important issue in corporate finance "as financial risk management has become a critical corporate activity and as regulators, such as the Securities & Exchange Commission (SEC) in the United States, have insisted on increased disclosure around risk management policies and financial exposures."[195] However a definition of CRM focused narrowly in corporate finance is far too limiting for purposes of this study.

H. Business Continuity Management

As observed by Kalia and Müller, the concept of Business Continuity Management (BCM) is closely associated with the desire of companies to survive potential extreme events such as terrorism, natural disasters, epidemics and major failures.[196] In their view, introducing ERM processes into an organization is the prerequisite before contemplating and instituting BCM measures.[197] As noted earlier, ISO 31000 (Risk Management – Principles and Guidelines) is acknowledged for providing practical guidance on how to implement ERM management processes and has also subsequently spawned a number of ISO products and working groups related to BCM.[198] ISO 22301 (Business Continuity Management Systems) defines as a:

194 Crouhy, M., Galia, D. & Mark, R., (2014: 45).
195 Crouhy, M., Galia, D. & Mark, R., (2014: 45-46).
196 Kalia, V. & Müller, R. (2007:29).
197 Kalia, V. & Müller, R. (2007:29). Such extreme events are similar to those cited by the OECD as emerging global risks. C.f. OECD (2003:5).
198 Although this list is not exhaustive, among the more recent ISO offerings that are BMC focused but stem from its ERM standard include:
- ISO 22301:2012 – Business continuity management systems – Requirements
- ISO 22313:2012 – Business continuity management systems – Guidance

> "a holistic management process that identifies potential threats to an organization and the impacts to business operations those threats, if realized, might cause and which provides a framework for building organizational resilience with the capability of an effective response that safeguards the interests of its key stakeholders, reputation, brand and value-creating activities."[199]

The working definition of BCM for the purposes of this paper is one also offered by Kalia and Müller which is the development of organization-wide resilience that allows an enterprise "to survive the loss of part of all its operational capabilities or significant loss of resources."[200] The appeal of both definitions lie with their emphasis on resilience, but ISO integrates threat identification into its BCM definition while Kalia and Müller do not. The author acknowledges that ERM and BCM are interlinked (in fact fused) but believes threat identification should be anchored in the former as a robust BCM approach is independent of whether the threat was identified as a potential risk or not.

I. Resilience

Resilience is a term associated historically with engineering in the context of stress testing materials or structures.[201] Its use and application in an ERM and BMC context are also increasing, particularly among professional service firms.[202] In the context of uncontrollable risks, this paper focuses on the definition of resilience developed by the author and introduced in the World Economic Forum's *Global Risk 2013* publication.[203] Resilience is a highly relevant concept for a BoD concerned with uncontrollable risks. Conceptualized as an adaptive system, a truly resilient company should then be capable of adapting to changing contexts, withstanding sudden shocks and recovering affected internal systems (Table 14).

- ISO 22320:2011 – Emergency management – Requirement for incident response
- ISO 22398:2013 – Guidelines for exercises
- ISO/PAS 22399:2007 – Guideline for incident preparedness and operational continuity management
- ISO/IEC 24762:2008 – Guidelines for ICT disaster recovery services
- ISO/IEC 27031:2011 – Guidelines for ICT readiness for business continuity

199 COSO 22301, 3.4.

200 Kalia, V. & Müller, R. (2007:29). "It is a relatively new discipline that originates in an evolution and fusion of already existing activities." Ibid.

201 "A definition that has long been used in engineering is that resilience is the capacity for 'bouncing back faster after stress, enduring greater stresses, and being disturbed less by a given amount of stress'." See WEF (2013: 37).

202 For example ISO published its ISO 28002 to develop supply chain resilience just five months after the March 2011 earthquake and tsunami in Japan. Another example is PWC which has created integrated its governance, risk and compliance practices under the resilience rubric (see http://www.pwc.com/gx/en/governance-risk-compliance-consulting-services/resilience/).

203 This author of this paper was the Editor-in-Chief of that report and developed the national resilience concept in the context of his action research on the effect of exogenous risks on enterprises.

Table 14: Definitions of Resilience

For an Object	For a System	For an Adaptive System
…Bouncing back faster after stress, enduring greater stresses, and being disturbed less by a given amount of stress…	…Maintaining system function in the event of a disturbance…	…The ability to withstand, recover from and reorganize in response to crises…

Source: Adapted from WEF, Table 22 (2013: 37).[204]

[204] Adapted from Martin-Breen, P. & Anderies, J.M. (November 2011). *Background Paper: Resilienc: A Literature Review*. Rockefeller Foundation. Retrieved from: http://opendocs.ids.ac.uk/opendocs/bitstream/handle/123456789/3692/Bellagio- Rockefeller%20bp.pdf (last visited on 15 May 2015).

V. Limitations

The range of uncontrollable risks for an enterprise to consider is theoretically limitless given their exogenous origin. Therefore the study of this topic requires practical and conceptual research boundaries to be established at the outset.

CRM is undoubtedly shaped by regulations at the international, federal (national) and cantonal (state/ municipal) level. The regulatory environment for CRM also certainly differs across industries and sectors with regard particularly to compliance. The possible combinations of regulatory level and industry type are therefore also nearly limitless. As such this research is limited to reviewing normative and best practice requirements that should apply to enterprises irrespective of industry or sector (and whether operating primarily in Switzerland or abroad) in order to illustrate consistently the application of the CRM framework in both a corporate governance and risk management context.

Therefore in the empirical portion of this study, the quantitative analysis focuses mainly on global risks identified by a global multi-stakeholder risk perception survey[205]that was designed and administered in the context of the action research conducted at the World Economic Forum (WEF). In addition, the board members interviewed were selected mainly from large multinational companies (MNCs) that operate across different regions, economies, cultures and industries but with the aim of identifying new approaches and practices that are equally relevant and applicable to medium and small enterprises as the focus of the qualitative analysis is on board behavior and conceptual approaches related to uncontrollable risks (not to the resources or technologies accessible a BoD).

Risk management is an emerging discipline without a single authoritative conceptual framework (this will be explored in theoretical review). The two most prominent international efforts have been the 2004 report of the Committee of Sponsoring Organizations of the Treadway Commission (COSO), "Enterprise Risk Management-Integrated Framework" and the International Organisation for Standardization's (ISO) publication, ISO 31000 ("Risk Management—Principles and Guidelines on Implementation") in 2009.[206] The COSO framework is acknowledged for providing a flexible standard against which to evaluate ERM in the context of existing internal control processes.[207] This study is oriented

[205] The Global Risks Perception Survey of the World Economic Forum (WEF).

[206] As stated early the COSO framework is acknowledged for providing a flexible standard against which to evaluate existing ERM processes whereas ISO 31000 is acknowledged for providing practical guidance on how to implement ERM management processes.

[207] "Internal control is an integral part of enterprise risk management. This enterprise risk management framework encompasses internal control, forming a more robust conceptualization and tool for management." COSO (2004: 6).

towards both frameworks because uncontrollable risks require an integrated CRM approach. However the COSO framework is examined more closely given its historical influence (related to its origin in audit and control) particularly in large industrialized economies with publicly listed multinational corporations (MNCs). The integrated COSO ERM framework is also evolving towards an increased supervisory role of the board. One such example is with setting an organization's risk appetite as part of its strategy function in response to criticism following the global financial crisis of 2008. In contrast ISO 31000 is comparatively new and was developed after the crisis and is perceived as seeking to "achieve convergence from a variety of standards, methodologies and procedures that differ between industries, subject matters and countries."[208]

Lastly, the study of uncontrollable risks is inherently inter-disciplinary as there are various political, legal, economic, societal, organizational and behavioral dimensions to consider when addressing them. This reality is also reflected by the preference in this study for using the term CRM over ERM in order underscore the integration of governance, risk management and compliance related corporate functions at the board level. Put another away, addressing uncontrollable risks require a holistic and integrated approach that naturally extends beyond the primary academic domain from which the research process originates. Therefore this research is neither limited to a legal analysis of the topic nor does it frame the primary research question as a legal one.

This research instead suggests there are emerging principles and methods that should be considered by a board concerned with uncontrollable risks. It is an exercise in descriptive theory building. However it is the hope of the author that further field based research on this topic in a variety of circumstances will lead to the development of a normative theory of uncontrollable risks.

[208] OECD (2014: 16).

VI. Summary of Part One

In the past ten years, Black Swan Events (BSE) and systemic risk have entered the lexicon of international business and the phrases “known unknowns”and “unknown unknowns” are now a part of risk parlance. This study describes the phenomena as the emergence of *uncontrollable risks* and examines them in the context of Corporate Risk Management (CRM). An uncontrollable risk is a critical uncertainty where the nature of a phenomenon and its causality may be known or knowable but the means to predict or prevent its occurrence are not yet available. Although the implications for governance, risk management and compliance are significant, there is no conceptual framework for a board to consider in such situations. Nor is there an operating framework for a board that can help them to navigate between routine emergencies, disasters and global shocks in a risk management context.

This first part (Introduction) presents the three objectives of the study and the contextual background for each:

1. Provide a framework to identify (ex ante) and categorize the critical uncertainties and global risks that are prevalent in an interconnected and interdependent global economy but outside the control of any single institution or organization.

2. Address the significant gaps in existing corporate governance and risk management frameworks with respect to such uncontrollable risks.

3. Analyze how such uncontrollable risks will impact the role of the Board of Directors (BoD) in the context of its governance, risk management and compliance (GRC) activities.

The objective of the complete study is to develop a descriptive theory that addressed the above three points and to provide a conceptual framework as well as practices for a BoD to consider in order to fulfill its CRM responsibilities.

Part Two: Theoretical Review

I. Introduction to Risk Management

A. Overview

As stated in part one, the terms Enterprise Risk Management (ERM) and Corporate Risk Management (CRM) are often used interchangeably in research literature. CRM is the preferred framework used in this study because of its holistic framing of important board functions such as governance, risk management and compliance (GRC). This second part (Theoretical Review) begins with a brief historical background for why risk management is considered an emerging field of study for both academics and practitioners. It presents a succinct contemporary review of the five evolutionary stages of risk management and of the rising importance of risk interconnectivity. It follows with an overview of the 2004 COSO ERM Integrated Framework and the exploration of a contingency theory of ERM to complete the first section. The second section focuses on challenges to risk management and includes contemporary criticism of ERM in the wake of the global financial crisis as well as current shortcomings in the ex ante identification of risks in the context of uncontrollable risks. It concludes by analyzing the future of force majeure and influence of behavioral science in the context of uncontrollable risks. The third section focuses on the growing interdependence and interconnectivity of global commerce and the related relevance of systems-thinking in risks management. It then introduces the emerging discipline of complexity science in the context of uncontrollable risks. Related conceptual frameworks: Normal Accident Theory, Situation Awareness Theory and Adaptive Leadership Theory are introduced. New Corporate Governance (NCG) is examined in detail as the optimal governance model in the context of uncontrollable risk. The final section introduces concepts of resilience and related new frameworks such as national resilience.

B. Development Stages of Risk Management

Kalia and Müller observed that the development of risk management can be conceptualized into five distinct historical phases which are often associated with a major global economic or corporate governance crisis.[209] The first stage of development occurred during the period before and during the "Great Depression" as new concepts emerged related to risk and uncertainty. Frank Knight's work on distinguishing between risk (randomness with knowable probabilities) and uncertainty (randomness with unknowable probabilities) stands out as an important conceptual advance.[210] In the field of macroeconomics, John Maynard Keynes, a

[209] Kalia, V. & Müller, R. (2007:39).
[210] Cleary, S. & Malleret, T. (2006: l26-127).

contemporary of Knight, also came to appreciate the uncertainty of future events and the limits of mathematical forecasting in the absence of large numbers of observable events that are both independent and homogenous.[211] Kalia and Müller also highlight two important American laws that were promulgated in the 1930s and 1940s in this initial development phase: the Banking Act of 1933, commonly known as the Glass-Steagall Act, which limited the activities of commercial banks with respect to securities and insurance markets and the McCarran-Ferguson Act of 1945 which exempted the insurance industry from federal regulation.[212] However, risk management discipline suffered as a result of the two legislative changes, particularly with regard to insurance as purchasing behavior became more ad hoc as a result of the regulatory fragmentation of the industry which resulted from the McCarran-Ferguson Act.

The second development phase occurs nearly fifty years after the first with the rise of credit risk management in the 1970s whereby the insurance industry assumed a much larger role as companies focused on the transfer of "insurable" risks outside of their organization. In this regard, Kalia and Müller highlight a 1975 article in *Fortune*, "The Risk Management Revolution," as among the first to suggest that the Board of Directors (BoD) should play a larger role in the coordination of fragmented risk management functions within a company in terms of preparing and supervising risk management related policies.[213]

The third development stage came a decade later when risk management branched into two directions: risk financing and risk control.[214] Risk finance centered on insurance related elements such as the use of deductibles and captives (or both) whereby captive insurers were companies formed for insuring risks associated with their parent or holding group. Risk control entailed comprehensive risk engineering, often in the context of insurance coverage. Kalia and Müller highlight the increased visibility of risk communication "primarily as a consequence of a loss of trust after large-scale accidents in the concerned insurance sectors."[215]

Between the third and fourth stage was the establishment of the Committee of Sponsoring Organizations of the Treadway Commission (COSO) which was formed in the United States by five private sector organizations in 1985: the Institute of Management Accountants (IMA), the American Accounting Association (AAA), the American Institute of Certified Public Accountants (AICPA), the Institute of Internal Auditors (IIA) and Financial Executives International (FEI). With its origins in addressing fraudulent financial reporting, COSO's

211 Ibid.
212 Kalia, V. & Müller, R. (2007:39).
213 Kalia, V. & Müller, R. (2007:40).
214 Ibid.
215 Kalia, V. & Müller,R. (2007:40).

research focused initially on internal controls related to proper accounting and auditing practices.

The fourth development phase began in the 1990s with the organizational enlargement of operational risk management as a consequence of crises that affected the relationship between major industrial insurers and their multinational clients.[216] Kalia and Müller note that was during this period that the term "Chief Risk Officer" came into use by General Electric (GE) Capital to describe the senior executive responsible for managing all aspects of risk.[217]

The fifth development stage was the introduction of Enterprise Risk Management (ERM) as a conceptual framework following the 11 September 2001 terrorist attacks on New York and Washington, D.C. The ERM concept entails taking "a 360˚ view of all risks facing the organization, including internal and external ones, and looks to provide an integrated approach to manage risk across divisions and functions"[218]. Kalia and Müller also highlight that the emergence of ERM during this period also gave "rise to the concepts of Business Continuity Management (BCM) where companies make sure that they survive even extreme events such as terrorism, natural disasters, epidemics and major failures."[219]

It was in 2004 that COSO published its seminal report, "Enterprise Risk Management – Integrated Framework" stating that ERM encompasses six capabilities that include:

> "• *Aligning risk appetite and strategy* – Management considers the entity's risk appetite in evaluating strategic alternatives, setting related objectives, and developing mechanisms to manage related risks.
>
> • *Enhancing risk response decisions* – Enterprise risk management provides the rigor to identify and select among alternative risk responses – risk avoidance, reduction, sharing, and acceptance.
>
> • *Reducing operational surprises and losses* – Entities gain enhanced capability to identify potential events and establish responses, reducing surprises and associated costs or losses.
>
> • *Identifying and managing multiple and cross-enterprise risks* – Every enterprise faces a myriad of risks affecting different parts of the organization, and enterprise risk management facilitates effective response to the interrelated impacts, and integrated responses to multiple risks.

216 Ibid.
217 Kalia, V. & Müller, R. (2007:40).
218 Kalia, V. & Müller, R. (2007:41).
219 Ibid.

• *Seizing opportunities* – By considering a full range of potential events, management is positioned to identify and proactively realize opportunities.

• *Improving deployment of capital* – Obtaining robust risk information allows management to effectively assess overall capital needs and enhance capital allocation."[220]

Although this study uses the term CRM instead of ERM, that is not to suggest that there is an obvious sixth phase of development that follows from the global financial crisis of 2008. However there are significant shifts with regard to the measuring and reporting of market risk. Among the most significant has been in the financial industry with respect to their trading portfolios. The concept of Value-at-Risk (VaR) translates "the riskiness of an entire portfolio into a common standard: the potential loss stated in a single currency, such as US dollars."[221] It evaluates the potential loss of a particular portfolio in the context of predetermined confidence level and holding period – but "definitely does not specify the worst possible loss – a common misperception."[222] In comparison, stress testing "quantifies the loss under extreme outlier events, without assigning any likelihood to such events or the consequent loss."[223] Today stress testing has gained strong endorsement among financial regulators and central banks because it provides "insight on the portfolio behavior that would result from large moves in key market risk factors."[224] Yet there are also concern with a regulator's selection and design of a particular scenario (e.g. China collapse) and the requirement that it be stress-tested by all the major bank under its jurisdiction. Although is clear that some ERM practices are falling in favor with regulators, it is not clear if others are necessarily falling out in industry; the perception remains that regulatory requirements related to compliance and risk management functions are increasing, particularly in the financial services industry. Moreover the OECD has noted in multiple reports after the global financial crisis that the 2004 guidance from COSO was not adequate as risks were neither linked to strategy nor their definitions clearly expressed.[225] Indeed COSO is now planning to update its 2004 Integrated Framework as a result of the global financial crisis of 2008 and the subsequent recession.[226] The OECD considers the ISO 31000 standards for implementation of risk management principles published in 2009 by the International Organization for

220 COSO (2004: 1).
221 Lam, J. (2014: 212).
222 Lam, J. (2014: 213).
223 Lam, J. (2014: 219).
224 Ibid.
225 OECD (2014: 15).
226 Millman, G. (21 October 2014), COSO Updating Enterprise Risk Management Framework, *The Wall Street Journal*. Retrieved from http://blogs.wsj.com/riskandcompliance/2014/10/21/coso-updating-enterprise-risk-management-framework/ (site last visited on 25 October 2014).

Standardisation (ISO) as the "de facto world standard"[227] but there is no empirical data that is provided that supports this conclusion based on observable practice.

C. Risk Interconnectivity versus Risk Interdependency

The use of the term CRM in this study also reflects the nascent realization globally that the role of the Board of Directors (BoD) is growing in significance this fifth development phase. There are also important national efforts to adapt to the changing context of globalization by attempting to revamp the role of corporate governance in risk management. Although Canada was not among three countries studied in-depth by the OECD in its 2014 report,[228] it is an example of a country that is proactively rethinking its framework for board oversight of enterprise risk. It is noteworthy considering that the Canadian banking system was mostly immune to the effects of the global financial crisis of 2008. In 2012 the Risk Oversight and Governance Board of the Chartered Professional Accountants of Canada (CPA Canada) developed a framework to:

- assist BoD to better identify and address critical risks
- understand how risks are interconnected; and
- recognize the potential compounding of risks should unfavorable events occur at the same time.[229]

With regard to risk identification in the wake of the global financial crisis, the CPA Canada report nonetheless cautions that:

> "Too often the risk identification process focuses on external risks such as natural disasters, potential actions of competition and environmental issues. Ironically, the most significant risks frequently lie internally. Internal risk identification requires an alert, unbiased board and to the degree possible, an objective executive team." [230]

227 OECD (2014: 16).
228 Norway, Singapore and Switzerland were the three OECD member countries studied in depth.
229 Caldwell, J. (2012).
230 Caldwell, J. (2012: 17).

Figure 11: Risk Identification Framework for Boards (CPA Canada)

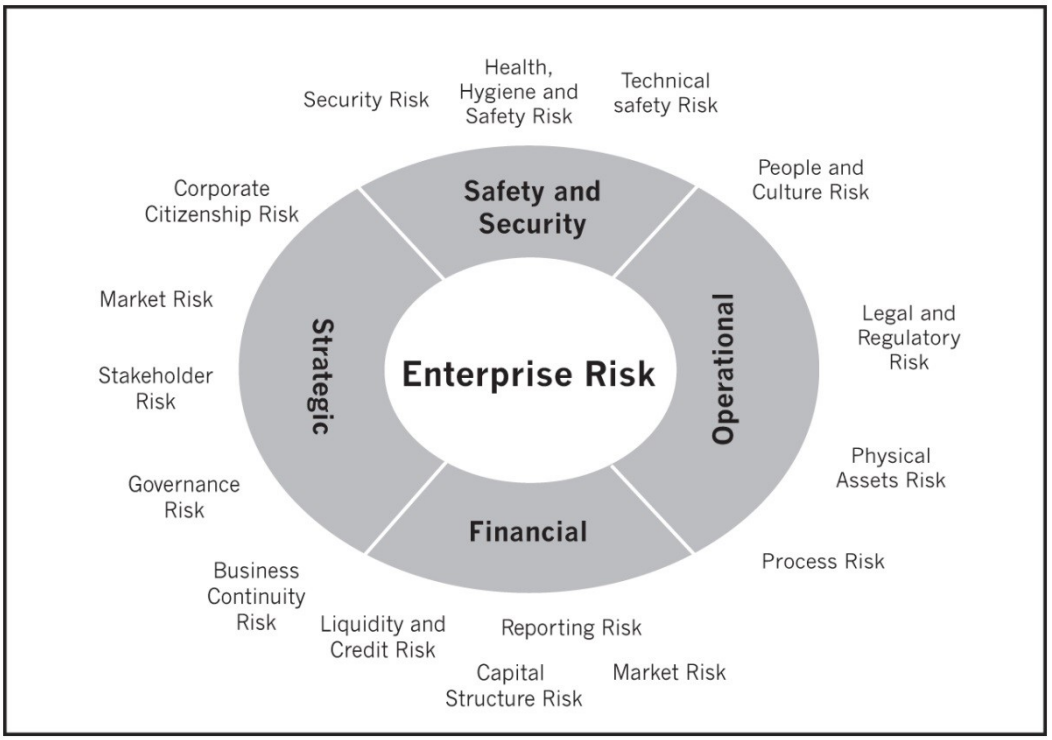
Source: Caldwell, (2012: 18)

However, the CPA Canada report's caveat regarding internal risk identification may also reflect a bias towards internal control, compliance and financial audit that are inherent in the accountancy profession. Moreover their suggested risk identification framework for a BoD (Figure 11) arguably requires further refinement as such risks "need to be classified so that can be easily assigned later on to the appropriate team to manage"[231]when considered by a BoD.

Kalia and Müller recommend aligning the identified risks with a firm's strategy classification to help link strategic planning to risk management (Figure 12). Their guidance tracks with the increasing importance of strategy related risk management at the board level globally.[232] However they caution that "classification has to be based on a logic that should reflect the uniqueness of the organization."[233]

231 Kalia, V. & Müller, R. (2007:64).
232 Deloitte (2013: 4). In a global survey of 300 companies, 81% of respondents have an explicit focus on strategic risk management and 67% of respondents identified it as a CEO and board level priority.
233 Kalia, V. & Müller, R. (2007:64).

Figure 12: Risk Classification in Depth



Source: Kalia & Müller, Figure 15 (2007:64).

The more salient consideration with regard to uncontrollable risk is with the CPA Canada report's observation regarding the interrelationship and compounding effects of risks (Figure 13):

> "We assert that when enterprises experience major value destruction or significant underperformance. It is almost never due to a single event."[234]

The report asserts that the compounding effect of multiple simultaneous occurrences fall into three broad scenarios that warrant the attention of a BoD:

1. "the compounding effect of interconnected risks"[235]
2. "the compounding effect of unrelated occurrences that arise at the same time"[236]
3. "the effect of a single event combined with several higher-risk conditions that have been present for a considerable period"[237]

234 Caldwell, J. (2012: 47).
235 Ibid.
236 Caldwell, J. (2012: 47).
237 Caldwell, J. (2012: 47).

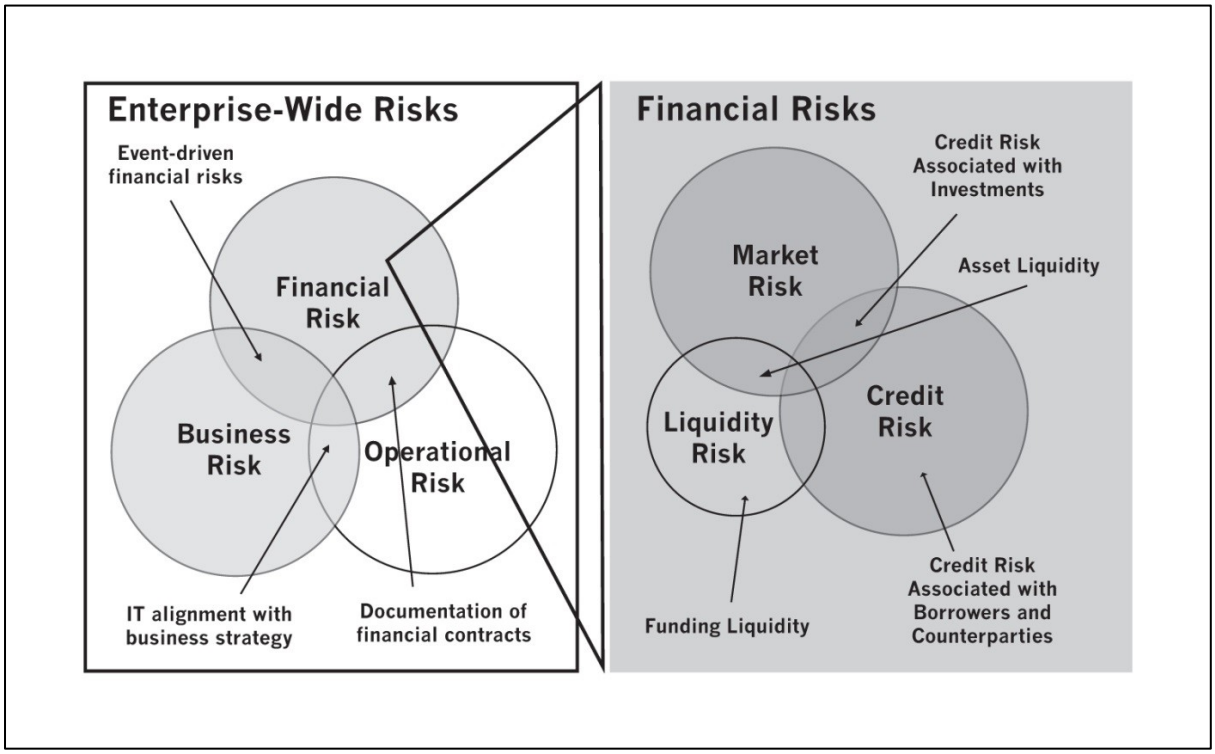
Figure 13: Risk Interconnectivity Analysis for Boards (CPA Canada)

Source: Caldwell, (2012: 47)

The CPA of Canada considers "evaluating the interconnectivity of risks and the compounding exposure when two or more occurrences take place simultaneously"[238] as the clearly the most difficult and important element of the risk oversight role of a BoD. It is a difficult analytical process as it presumes having a rudimentary understanding of the risk interdependency among the risks identified as interconnected. Interconnected and interdependent are two distinct concepts as the former can signal a loose coupling connection whereas the later signals a mutual dependency. The mapping of risk interdependence is therefore more intricate (Figure 14) because knowledge of the source and nature of any mutual dependency is required to assign such a relationship between or among risks. By comparison, the visualization of interconnected risks is an exercise based mainly on conjecture. Risk interdependence also reveals that "with such a complex, interlocking system of company-wide risks, it is obvious that a silo-based management strategy is inferior to the integrated framework of ERM."[239]

[238] Ibid.
[239] Lam, J. (2014 : 10).

Figure 14: Risk Interdependency Analysis



Source: Lam, Figure 1.3 (2014: 10).

Risk mapping and scenario analyses, built on either risk interconnections or risk interdependencies, are nevertheless gaining in appeal largely because "current quantitative models are incapable of accurately portraying risks, because they are blind to the risk contribution of black swans."[240] Among the most effective and new risk assessment processes to consider in the context of innovative risk mapping is the *Global Risk Report*[241] published annually by the WEF as cited by James Lam in the 2nd edition of *Enterprise Risk Management*.[242] Lam highlights among its strengths as a risk assessment process:

- The ability to integrate various risk assessments generated by a diverse group of experts
- An integrated reporting method that provides an analyses of risk interdependencies.

The processes and tools developed by the WEF that identify interconnected global risks and their cascading consequences will be examined in depth in part three and four of this study. When considered uncontrollable risks from a contemporary historical perspective, modern risk management can be seen as having evolved from attempting to understand its aggregate

240 Lam, J. (2014: 254).
241 The author of this section served as its Editor-in-Chief of the 2012 and 2013 editions.
242 Lam , J. (2014: 414).

elements followed by its integrated element and now its interconnected elements. Among the interconnected elements are risks that are difficult to control (Table 15).

Table 15: Evolution of Risk Management (1990s to 2010s)

1990s Operational Risk Management	2000s Enterprise Risk Management	2010s Corporate Risk Management

• **Aggregated** Elements:
  • Operations Risk
  • Market Risk
  • Credit Risk
	• **Integrated** Elements:
	  • Organizational Risk
	  • Business Risk
	  • Operations Risk
	  • Business Continuity Management
	  • Market Risk
	  • Credit Risk
		• **Interconnected** Elements:
		  • Governance
		  • Compliance
		  • Reputation Risk*
		  • Business Model Risk
		  • Systemic Risk*
		  • Global Risk*

Source: Author (* denotes risk element that is uncontrollable).

D. 2004 COSO ERM Integrated Framework

Enterprise Risk Management (ERM) emerged only recently as a conceptual framework from the aforementioned fifth development phase. Although the discipline itself is evolving, the normative literature considered "foundational" are the 2004 report of the Committee of Sponsoring Organizations of the Treadway Commission (COSO), "Enterprise Risk Management-Integrated Framework" and the International Organization for Standardization's (ISO) 2009 publication, ISO 31000 ("Risk Management—Principles and Guidelines on Implementation").[243] For purposes of this study, the differentiations between them are:

- 2004 COSO framework is acknowledged for providing a flexible standard against which to evaluate and integrate ERM processes (particularly in the context of existing internal control process such as audit).
- ISO 31000 is acknowledged for providing risk management principles on how to implement appropriate ERM processes in various industry and national settings .

[243] Both can be accessed at http://www.coso.org/-em.htm and http://www.iso.org/iso/home/standards/iso31000.htm).

This paper posits that the 2004 COSO framework puts greater emphasis on the supervisory role of the BoD, particularly with regard to setting an organization's risk appetite as part of its strategy function (and therefore warrants further examination in this study). The 2004 COSO framework also highlights the dual nature of ERM (risk and opportunities & value creation and value preservation) by defining it as:

> "[a] process, effected by an entity's board of directors, management and other personnel, applied in strategy setting and across the enterprise, designed to identify potential events that may affect the entity, and manage risk to be within its risk appetite, to provide reasonable assurance regarding the achievement of entity objectives. "[244]

Embedded in the COSO definition are important concepts relevant to a BoD in the context of uncontrollable risks, particularly the notions that ERM is:

- To be applied towards strategy setting[245]
- To include taking an entity level portfolio view of risk[246]
- Designed to identify potential events that could affect the entity[247]
- To help set an entity's risk appetite and manage risk in that context[248]
- To provide reasonable assurance to both the BoD and management[249]

These aforementioned concepts along with others are considered fundamental across organizations, industries and sectors. Its utility lies with providing a basis for setting the effectiveness of ERM in a manner that is also geared toward achieving an entity's four categories of objectives (as identified by the 2004 COSO framework):

1) Strategic – "high level goals, aligned with and supporting its mission"[250]
2) Operations – "effective and efficient use of its resources"[251]
3) Reporting – "reliability of reporting"[252]
4) Compliance – "compliance with applicable laws and regulations"[253]

244 COSO (2004: 2).
245 Ibid.
246 COSO (2004: 2).
247 Ibid.
248 COSO (2004: 2).
249 Ibid.
250 COSO (2004: 3).
251 Ibid.
252 COSO (2004: 3).

In the context of uncontrollable risks, it is worth nothing that the 2004 COSO framework acknowledges that strategic and operational objectives may be "subject to external events not always within the entity's control."[254]Therefore the aim of the framework is to "provide reasonable assurance that management, and the board in its oversight role, are made aware, in a timely manner, of the extent to which the entity is moving toward achievement of its objectives."[255]

The 2004 COSO framework consists of eight interrelated components that integrated with the aforementioned four categories of objectives. The eight components of ERM are:

1) Internal Environment[256]
2) Objective Setting[257]
3) Event Identification[258]
4) Risk Assessment[259]
5) Risk Response[260]
6) Control Activities[261]
7) Information and Communication[262]
8) Monitoring[263]

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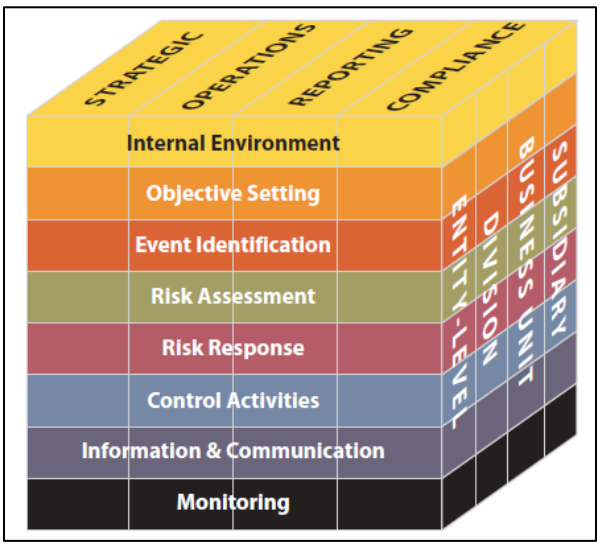
253 Ibid.
254 COSO (2004: 3).
255 Ibid.
256 "The internal environment encompasses the tone of an organization, and sets the basis for how risk is viewed and addressed by an entity's people, including risk management philosophy and risk appetite, integrity and ethical values, and the environment in which they operate." Ibid.
257 "Objectives must exist before management can identify potential events affecting their achievement. Enterprise risk management ensures that management has in place a process to set objectives and that the chosen objectives support and align with the entity's mission and are consistent with its risk appetite." COSO (2004: 3-4).
258 "Internal and external events affecting achievement of an entity's objectives must be identified, distinguishing between risks and opportunities. Opportunities are channeled back to management's strategy or objective-setting processes." COSO (2004: 4).
259 "Risks are analyzed, considering likelihood and impact, as a basis for determining how they should be managed. Risks are assessed on an inherent and a residual basis." Ibid.
260 "Management selects risk responses – avoiding, accepting, reducing, or sharing risk – developing a set of actions to align risks with the entity's risk tolerances and risk appetite." COSO (2004: 4).
261 "Policies and procedures are established and implemented to help ensure the risk responses are effectively carried out." Ibid.
262 "Relevant information is identified, captured, and communicated in a form and timeframe that enable people to carry out their responsibilities. Effective communication also occurs in a broader sense, flowing down, across, and up the entity." COSO (2004: 4).
263 "The entirety of enterprise risk management is monitored and modifications made as necessary. Monitoring is accomplished through ongoing management activities, separate evaluations, or both." Ibid.

However, event identification and risk assessment are the most problematic elements conceptually as their probabilities and mode of occurrence are unlikely to be known or measurable. The relationship between the aforementioned four categories of objectives (vertical columns) and the eight interrelated components (horizontal rows) can visualized in the three dimensional matric below (with an entity's organizational units representing the third dimension), which is commonly referred to as the "COSO Cube" (Figure 15).

Figure 15: COSO Cube



Source: COSO (2004:5).

E. Contingency Theory of ERM

In acknowledgement that risk management is an emerging discipline, Harvard Business School professors Annette Mikes and Robert Kaplan are developing a contingency framework that attempts to "hypothesize about 'fit' between contingent variables, such as risks types and the ERM mix, as well as about outcomes such as organizational effectiveness."[264]

This paper maintains that ERM does not yet provide a robust conceptual framework to address uncontrollable risks. There are an even stronger opinions that in general "risk management approaches are largely unproven and still emerging" and "that much academic research treats ERM as self-evident and fails to answer if its usefulness can be proven by more than its apparent popularity." [265]Kaplan and Mikes therefore argue that the effectiveness of ERM is contingent on the organization's context and circumstances.[266] The appeal of a

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264 Kaplan, R.S. & Mikes, A. (2013: 1).
265 Kaplan, R.S. & Mikes, A. (2013: 3).
266 Ibid.

contingency approach is that instead of searching for a universal risk management system that should be applied in all circumstances the focus is on the specific circumstance for using an appropriate risk management system for a particular firm. However they observed that much of the empirical research on ERM based on contingency theory has not produced significant results because of an inadequate and incomplete specification of how ERM is deployed in practice. Therefore they embarked on a ten-year field study of three companies where ERM was actively supported internally but each firm employed a completely different structure and role for their risk management function.[267] The only common characteristic in the ERM approaches of the three companies studied was the "use of highly interactive processes to address strategy execution risks"[268] and such "intensive interactions provoked the dialogue and debate necessary to overcome biases and keep people thinking rigorously about risks and bad outcomes."[269]

With respect to exogenous risks (which by their definition are unavoidable and impossible to predict), Kaplan and Mikes stress the need for an organization to focus on its resilience should they occur. In their view, "the assessment (and enhancement) of organizational resilience requires that the company introduce a process of risk envisionment – using experience, intuition, and imagination – to suggest plausible future disaster scenarios."[270] Kaplan and Mikes also point out that the 2004 COSO framework and the 2009 ISO 3100 both advocate an ERM approach that focuses primarily on strategy execution risks, whereas their prognosis is that "risk management will be most effective when it matches the inherent nature and controllability of the different types of risk the organization faces."[271] However this study posits that the prognosis for such an approach will be difficult given the prevalence of uncontrollable risk in an increasingly interdependent and interconnected business environment highlighted in part one (Introduction).

In the context of uncontrollable risk and the role of BoD, the afore-mentioned conclusions of Kaplan and Mikes raise the following important and inter-related research questions:

- How could a BoD introduce risk envisioning dialogue processes related to the ex ante identification of external risks? How can this be done to ensure that they are "highly interactive"?

267 Kaplan, R.S. & Mikes, A. (2013: 3).
268 Kaplan, R.S. & Mikes, A. (2013: 28).
269 Ibid.
270 Kaplan, R.S. & Mikes, A. (2013: 26-27).
271 Ibid.

- How can a BoD approach the issue of assessing organizational resilience in face of external risks?

- How does diversity (or its absence) within a BoD impact the above two questions?

Contemplating the three questions also reinforces the notion that CRM represents an evolution in risk management towards greater integration of GRC responsibilities to ensure a more holistic approach to uncontrollable risks. The questions are explored further in part three (Empirical Analysis) and part four (Summary and Recommendations) of this study.

II. Challenges to Risk Management

A. Criticism of ERM

As highlighted in the first section, the utility of the 2004 COSO framework for a BoD lies with its use as a starting point for their supervisory discussion with senior management on the entity's ERM. Implicit in this construct is that a board "is aware of and concurs with the entity's risk appetite."[272] The limitations of the 2004 COSO framework were also highlighted in the report as principally behavioral and related to decision-making.[273] However the two issues of risk appetite and decision-making remain a source of criticism of the COSO framework in the wake of the global financial crisis of 2008 as failures of both were revealed in some of the most sophisticated and successful international financial institutions. This criticism is not limited, or directed only, to the 2004 COSO framework but applies to contemporary risk management generally as ERM conceptually is "not a single thing, conceptually or practically."[274]

Michael Power of the London School of Economics and Political Science argues that while the programmatic aspirations of ERM are two-fold, its flaws at the design level are three-fold.[275] He frames the two programmatic elements as:

1) ERM promises that "mistakes of the past will be mitigated, if not avoided, by a more rational and synthetic conception of risk management, capable of a 'canopy-like' view

272 COSO (2004: 6).
273 "[L]imitations result from the realities that human judgment in decision making can be faulty, decisions on response to risk and establishing controls need to consider the relative costs and benefits, breakdowns can occur because of human failures such as simple errors or mistakes, controls can be circumvented by collusion of two or more people, and management has the ability to override enterprise risk management decisions." COSO (2004: 5).
274 Power, M. (2009: 849).
275 Power, M. (2008: 850).

of the organization."[276] Power interprets this an another way of framing the concept of *integrated* risk management as aiming for increased capital efficiency and more coherent insurance strategies at the firm level.[277]

2) ERM embodies an "aspiration of *enterprising* risk management, namely a conception of risk management which is positive, entrepreneurial and explicitly in the service of wealth creation."[278] Power interprets this as framing the logic of ERM as "win-win" whereby risks no longer represent downsides to business growth but can be considered market opportunities as well.[279]

Power's criticism stems from the two afore-mentioned programmatic elements of ERM and outline three fundamental design flaws that warrant scrutiny:

1) An "enterprise wide" view and a singular organizational "risk appetite" are highly problematic. "COSO and similar risk management texts presume that risk appetite can unambiguously be known and understood by organizations and the individuals within them. Yet, such a presumption lies in the face of behavioral studies which suggest that decisions in the face or risks are subject to framing and biases."[280]

2) Risk management practices continue to expand their scope based on the "logic of auditability." As the COSO framework is at its core an accounting-driven design, most efforts at implementation "will have an inherent tendency to elaborate detailed controls with corresponding document trails."[281] Powers argues that a key lesson from the global financial crisis was that the majority of cognitive and economic resources were devoted to "rules-based compliance" when instead greater effort should have been put towards the "critical imagination of alternative futures."[282]

3) The combination of the above-mentioned design flaws has led to the implementation of more costly narratives of risk accountability yet they "have proven to be incapable of articulating and comprehending critical risks, particularly those associated with interconnectedness."[283]

The notion that ERM has "operated as a boundary preserving model of risk management, rather than a boundary challenging practice which confronts and addresses the complex

276 Ibid.
277 Power, M. (2009:850).
278 Ibid.
279 Power, M. (2009: 850).
280 Power, M. (2009: 851).
281 Power, M. (2009: 852).
282 Ibid.
283 Power, M. (2009: 850).

realities of interconnectedness"[284] is also one of the main arguments for introducing the concept of uncontrollable risk in part one of this paper.

B. Ex Ante Identification of Risks

As highlighted in part one of this study, there is increasing concern that publicly listed companies "still focus largely on internal control and audit functions, and primarily financial risks, rather than on (ex ante) identification and comprehensive management of risks."[285] A McKinsey & Company survey of 772 corporate directors conducted in April 2013 confirmed that "directors now report a more complete knowledge of various company issues than they did before, they say their boards struggle to understand and make time to manage business risks – one of several areas where directors indicate room for further improvement."[286] These two observations are therefore hard to reconcile with the imperative that the "identification of risks is the most important and delicate step because it sets the agenda"[287] for top management and the BoD. The importance of risk identification is such that it requires "the whole organization to gain a complete picture of the risk landscape"[288] and therefore utilize both a bottom-up and top-down process. Based on the risks identified bottom up from within the organization, a top down process then "helps to aggregate these risks, analyse them, prioritize them, and finalise the responses and actions to overcome them."[289] It is well documented in research literature that companies should avail themselves to a variety of methods to identify risks as "it is clear that one technique cannot fit all organizations"[290] (Table 16).

284 Power, M. (2009: 854).
285 OECD (2014: 7).
286 McKinsey Global Survey (2013). *Improving Board Governance*.
287 Kalia, V. & Müller, R. (2007:63).
288 Ibid.
289 Kalia, V. & Müller, R. (2007: 63).
290 Shenkir, W.G., Barton, T.L., & Walker, P.L. (2010), Enterprise Risk Management: Lessons from the Field. In Fraser, J. and Simkins, B.J. (Eds.), *Enterprise Risk Management (p. 443)*, Hoboken, NJ: John Wiley & Sons.

Table 16: Risk Identification Techniques

Internal Interviewing & Discussion	External Sources	Tools, Diagnostics & Processes

• Interviews
• Questionnaires
• Brainstorming
• Self-assessment
• Facilitated Workshops
• SWOT Analysis
  o Strengths
  o Weaknesses
  o Opportunities
  o Threats
	• Comparison of other organizations
	• Discussion with Peers
	• Benchmarking
	• Risk consultants
		• Checklists
		• Flowcharts
		• Scenario Analysis
		• Value Chain Analysis
		• Business Process Analysis
		• Systems engineering
		• Process mapping

Source: Adapted from Fraser & Simkin (Eds.), Box 24.1 (2010: 443).

However the salient consideration for uncontrollable risk is regarding how a BoD can identify ex ante a risk that is unknown or unknowable. In the context of "Black Swans," this study suggests that a board should broaden their definition to apply to "extreme events which are either totally unpredictable or events that *could be foreseen* but have not been considered by an observer as plausible."[291] Most importantly, this requires a board to consider risks separately from their assigned probability (if any). It is worth reminding that a major source of criticism of board performance is their overreliance on probabilistic assumptions.

1. Known, Unknown and Unknowable Risks

The ex ante identification of risks is not a function of its probability (the quality of being probable) but of its knowability (the capability of being known). Therefore any effort to improve the ex ante identification requires a conceptual framework that acknowledges the reality that a risk is either known, unknown or unknowable. Such an ancillary framework, "*KuU"*, was developed by Professor Francis Diebold and colleagues at the Wharton School.[292] With regard to measurement (i.e. the capability to measure possible outcomes with their associated probabilities), the ***KuU*** framework is such that:

[291] Ivanstov, E. (2013: 12).
[292] WEF (2006: 6).

- ***The Known is represented by K*** which is "a situation where the probability distribution is completely specified" [293] and whereby both outcomes and probabilities are known.

- ***The Unknown is represented by u*** which is "a situation where probabilities cannot be assigned to at least some events."[294] and whereby events are known but probabilities are not. This fits Frank Knight's definition of uncertainty but can also be considered as ambiguity.

- ***The Unknowable is represented by U*** which is "a situation where even the events cannot be identified in advance"[295] and whereby neither events nor probabilities are known. This can also be considered simply as ignorance.

With regard to theory (i.e. understanding the underlying structure of the phenomena), the ***KuU*** framework is such that:

- ***K*** as the known is "a situation where the underlying model is well understood" [296]thereby a paradigm exits. ***K*** therefore can represent successful theory such as corporate governance where there is knowledge on the broad principles.

- ***u*** as the unknown is "a situation where there are competing models, none of which has ascended to the status of a paradigm."[297] If ***K*** represents theory then ***u*** can represent a hypothesis (or even conjecture) such as enterprise risk management.

- ***U*** as the unknowable denotes "a situation with no underlying model (or no model with scientific credibility)."[298] Therefore in the absence of ***K*** (theory) or ***u*** (hypothesis), we are entirely unaware (or ignorant) of ***U*** but this does not preclude the future development of either.

The salient consideration for unknown and unknowable risks is that "there are several competing models of how reality might unfold but no paradigm."[299] Therefore the concept of resilience rises to the forefront as there is no available mental model to consult which in turn inhibits our ability to exercise the "right" judgment. Choices under uncertainty are arguably

293 Diebold, F.X, Doherty, D.A. & Herring, R.J. (2010: 3).
294 Ibid.
295 Diebold, F.X, Doherty, D.A. & Herring, R.J. (2010: 3).
296 Diebold, F.X, Doherty, D.A. & Herring, R.J. (2010: 3).
297 Ibid.
298 Diebold, F.X, Doherty, D.A. & Herring, R.J. (2010: 3).
299 WEF (2006: 6).

the most difficult, particular in the absence of applicable decision-making theory. We nonetheless make such choices in a risk management context. For example, under the guise of political forecasting, we are often presented with choices (or scenarios) about which prediction of the future to rely upon. Yet in his landmark study of expert political judgment, Philip Tetlock demonstrated that is nearly impossible to achieve accurate long-term political forecasting.[300] However, Philip Tetlock offers some possible guidance that could apply in the context of uncontrollable risks in the short-term (which is more favorable even for political analysts):

> "Our salvation lies in multimethod triangulation – the strategy of pinning down elusive constructs by capitalizing on the complementary strengths of the full range of methods in the social science tool kit. Our confidence in specific claims should rise with the quality of converging evidence we can marshal from diverse sources. And, insofar as we advance many interdependent claims, our confidence in the overall architecture of our argument should be linked to the sturdiness of the interlocking patterns of converging evidence."[301]

From a behavioral perspective, Tetlock's key insight was in showing that political analysts were not only overconfident but what they know about the future but they were also reluctant to change their minds in response to new evidence. Therefore it was not surprising that the accuracy of long-term forecasts were no better than chance. Put another way, political forecasters who are self-critical and avoid simple heuristics are relatively better at assigning probabilities to future outcomes than their opposite. Tetlock has also found that people that are younger and of lower status in an organization (versus older and higher status) are more enthusiastic about assessing the accuracy of probability judgement.[302] This observation regarding generational differences will be explored in part three (Empirical Analysis) in the context of the ex ante identification of uncontrollable risks.

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300 Tetlock, P.E., (2005).

301 Tetlock, P.E., (2005: 7).

302 "How to Win at Forecasting: A Conversation with Philip Tetlock," www.edge.org (6 December 2012). Retrieved from https://edge.org/conversation/how-to-win-at-forecasting (site last visited on 2 May 2015).

2. Force Majeure

In risk management literature, events whose probabilities of occurrence and effect are not foreseeable are often characterized as "unknown unknowns" but are also considered as force majeure events.[303] In the context of uncontrollable risks, the relevance of a force majeure clause is clear particularly with regard to "known unknowns". Force majeure is a familiar clause in international business contracts (in French the terms means superior or greater force). Incorporating such a clause into an agreement excuses a party to the contract if some unforeseen and uncontrollable event prevents performance of their contractual obligations hence its direct relevance in the study of uncontrollable risks. It is an express allocation of risks by the contracting parties because they define what constitutes the force majeure event.
Attorneys Mark Augenblick and Alison Rousseau argue that the prior standard of "impossibility" to invoke force majeure has been replaced by "impracticability" as international arbitration panels increasingly will not enforce such a clause unless the specific impediment is defined.[304] They cite the International Chamber of Commerce's (ICC) Force Majeure Clause 2003 (ICC Clause) as representative of an emerging consensus within the international business community as its legal requirements.[305]

The standard of impracticability incorporated into the ICC Clause addresses the issues of control, foreseeability and avoidance:

> "Unless otherwise agreed in the contract between the parties expressly or impliedly, where a party to a contract fails to perform one or more of its contractual duties, the consequences set out in paragraphs 4 to 9 of this Clause will follow if and to the extent that that party proves:
>
> [a] that its failure to perform was caused by an impediment beyond its reasonable control; and
>
> [b] that it could not reasonably have been expected to have taken the occurrence of the impediment into account at the time of the conclusion of the contract; and
>
> [c] that it could not reasonably have avoided or overcome the effects of the impediment."[306]

303 Merna, T. & Al-Thani, F. (2008: 13).
304 Augenblick, M. & Rousseau, A. (2012). There is no universal definition as to what is required to invoke force majeure.
305 Ibid.
306 ICC (2003: 8).

For example, Augenblick and Rousseau use the example of a large solar flare that produces a geo-magnetic storm shutting down much of the power grid in North America for months. Their scenario is based on a national scientific assessment and represents therefore a "foreseeable" event where the probability of occurrence cannot be predicted but the impact is clearly catastrophic.[307] And although such a solar storm would appear to be an "act of god" and possibly be considered a "violent storm" as listed in Section 3(e) of the ICC Clause, Augenblick and Rousseau caution that a force majeure defense could still fail for an electric power utility company if a solar storm is determined to be foreseeable and its effects avoided for a reasonable cost.[308] This possible scenario conforms to the earlier notion of broadening the definition of a Black Swan Event (BSE) whereby an extreme event is either totally unpredictable or is one "that *could be foreseen* but have not been considered by an observer as plausible."[309] This is an important future consideration with respect to uncontrollable risks at the project level.

C. Judgment Traps and Biases

It is important to highlight that the proponents of the 2004 COSO framework also recognize the merit of some of its criticism following the financial crisis, particularly with respect to the shortcomings of an "enterprise wide" view and a singular organizational "risk appetite." Two subsequent publications by COSO acknowledged the need to revisit of the objectives and limitations of the ERM framework. In 2009 COSO published its report, "Strengthening Enterprise Risk Management for Strategic Advantage" to revisit how to improve oversight with respect to determining and managing the risk appetite of an organization.[310] As highlighted in part one, this paper argues for additional changes in board culture, composition and behavior if they are to be effective in the context of uncontrollable risks. For example, most approaches to Corporate Risk Management (CRM) typically fail to integrate research on human behavior to understand how risks are distorted by distinct heuristics and biases -- this is arguably a pervasive and persistent shortcoming of the discipline given the importance of sound judgment skills in evaluating uncontrollable risks. Therefore of greater salience for this study is the 2012 COSO report, "Enhancing Board Oversight: Avoiding Judgment Traps and Biases," which recognizes that "professional judgment is increasingly important as board

307 Augenblick, M. & Rousseau, A. (2012). Their example was that of a "Carrington Effect" which is a burst of X-rays from a sunspot. The largest such event happened in 1859 and one in 1989 caused hundreds of millions of dollars in damage to electric transformers in Canada and South Africa. They cite a 2008 U.S. National Academy of Sciences estimating that a future event could knock out electric power in those areas impacted in the US for months and possibly years.

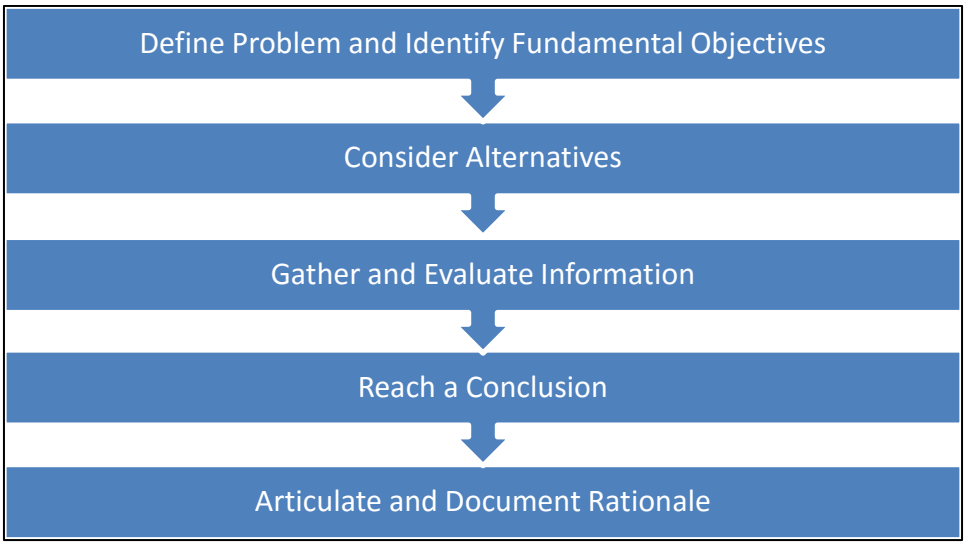
308 Ibid.

309 Ivanstov, E. (2013: 12).

310 COSO (April 2009).

members fulfill their responsibilities related to effective oversight of management's strategic planning, execution, fraud prevention and risk management processes" (Figure 16).[311]

Figure 16: Professional Judgment Process



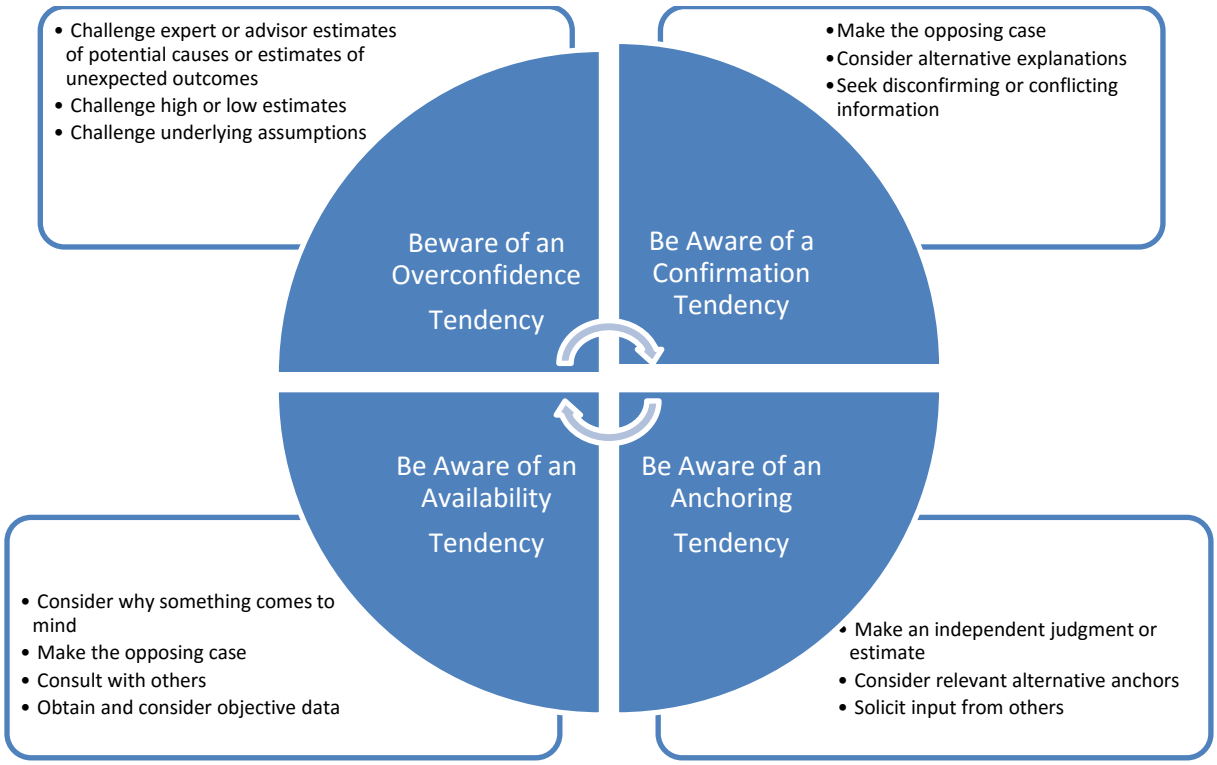
Source: Adapted from COSO, Exhibit 1 (2012: 3).

As mentioned in the introductory part of this, the effect of cognitive biases on board decision-making necessitates greater inquiry because the two fundamental forces reshaping the future business environment worldwide – uncertainty and complexity -- requires BoD to avoid known judgment traps but also to develop their situation awareness both individually and collectively in the context of uncontrollable risks.

The 2012 COSO report attempts to mitigate the effects of judgment traps and biases though acknowledging that "traps, tendencies and related biases will never disappear from people's judgment processes, understanding their nature can help us recognize situations in which our judgments can be biased"[312](Figure 17). The emphasis is on recognition as the critical first step is to be aware of the sources of bias and to recognize situations where judgment traps are likely to be present.

311 COSO (2012 : 17).
312 COSO (2012: 15).

Figure 17: Mitigating Biases in Judgment



Source: Adapted from COSO, Exhibit 3 (2012: 16).

John Beshears and Francesca Gino have identified four categories of judgement biases that can be particularly problematic in business contexts.[313] With regard to the ex ante identification of risks, there are two groups of biases that a BoD should recognize in the context of uncontrollable risks given their unknown or unknowable nature:

1. Biases related to the perceiving and judging alternatives
2. Biases related to the framing of alternatives

Each of these categories relates to the contemplation of alternatives and have several distinct biases that a BoD needs to contend with when deliberating on uncontrollable risks (Table 17).

[313] Beshears, J. & Gina, F. (2015: 57).

Table 17: Common Biases in Business Decision-Making

BIASES RELATED TO PERCEIVING AND JUDGING ALTERNATIVES
CONFIRMATION BIAS We place extra value on evidence consistent with a favored belief and not enough on evidence that contradicts it. We fail to search impartially for evidence.
ANCHORING AND INSUFFICIENT ADJUSTMENT We root our decisions in an initial value and fail to sufficiently adjust our thinking ways from that value.
GROUPTHINK We strive for consensus at the cost of a realistic appraisal of alternative courses of action.
EGOCENTRISM We focus too narrowly on our own perspective to the point that we can't imagine how others will be affected by a policy or strategy. We assume that everyone has access to the same information we do.
BIASES RELATED TO THE FRAMING OF ALTERNATIVES
LOSS AVERSION We feel losses more acutely than gains of the same amount, which makes us more risk-averse than a rational calculation would recommend.
SUNK-COST FALLACY We pay attention to historical costs that are not recoverable when considering future courses of action.
ESCALATION OF COMMITMENT We invest additional resources in an apparently losing proposition because of the effort, money, and time already invested.
CONTROLLABILITY BIAS We believe we can control outcomes more than is actually the case, causing us to misjudge the riskiness of a course of action.

Source: Adapted from Beshears & Gina, (2015: 57).

Among the methods to mitigate against cognitive biases in business decision-making (particularly in strategic planning) are the development and use of multiple scenarios. The meaning of the term scenario various across areas and functions but this study adopts the definition developed by one of the pioneers in scenario building, Paul J. H. Schoemaker in the context of strategic corporate planning. He describes a scenario as consisting of: "focused descriptions of fundamentally different futures presented in coherent script-like or narrative

fashion."[314] In his work on the conceptual and behavioral foundation of scenario development, Schoemaker identified some common biases that could be addressed through the use of scenarios:

> "Although the precise psychological effects of scenarios remain unclear (and are probably difficult to generalize), they seem to entail (1) framing, (2) availability and (3) anchoring effects."[315]

The salient consideration in the context of uncontrollable risk is the recognition of the "effects scenarios have on people's beliefs, degrees of confidence and problem perceptions."[316]

1. Hindsight Bias

With regard to risk management at the board level, "risks are normally discussed when they have occurred or identified before."[317] Moreover in the cases where the event is indeed triggered by an external risk, "they tend to be obvious in hindsight."[318] Therefore this study stresses that hindsight bias is arguably the most challenging for a BoD from among the well documented cognitive biases. Safety expert Stanley Dekker asserts that "to understand failure, you must first understand your reactions to failure"[319] and more importantly "the more you react, the less you understand."[320] In the context of uncontrollable risks, a board's supervisory responsibility is likely to entail investigating a risk management failure at some stage during their collective tenure. Moreover the board's review of a past performance failure will invariably influence the firm's future risk appetite and possibly lead to changes in risk management policies. The acknowledgement of cognitive biases can improve a board's prospective behavior by reducing its reliance on probabilistic assumptions or improving its ex ante identification of risks. The consideration of such biases also ensures that a BoD understands fully their company's past failures in risk management as they review its future strategy. In this regard, Dekker notes that most reactions to past failures share the following four common characteristics:

314 Schoemaker, P.J.H. (1993: 195).
315 Schoemaker, P.J.H. (1993: 201).
316 Ibid.
317 Kalia, V., & Müller, R. (2007: 63).
318 Kaplan, R.S. & Mikes, A. (2012:5).
319 Dekker, S. (2006: 21).
320 Dekker, S. (2006: 22).

1) **Retrospective:** "Reactions arise from our ability to look back on a sequence of events, of which we know the outcome."[321]

2) **Counterfactual:** "They layout in detail what people could or should have done to prevent the mishap."[322]

3) **Judgmental:** "They judge people (e.g. not taking enough time, not paying enough attention, not being sufficiently motivated) for supposed personal shortcomings."[323]

4) **Proximal:** "They focus on those people who were closest in time and space to the mishap, or to potentially preventing it."[324]

More importantly the above four characteristics often result in three common errors of failure analysis which this study asserts will make a corporation more vulnerable to uncontrollable risks in the future. Dekker warns that hindsight bias can turn "real, convoluted complexity into a simple linear story; a binary decision to err or not to err."[325] The three errors of analysis anchored to hindsight bias are:

- **Predetermined Outcome:** "We think that a sequence of events inevitably led to an outcome. We underestimate the uncertainty people faced at the time, or do not understand how very unlikely the actual outcome would have seemed."[326]

- **Linear Sequencing:** "We see a sequence of events as linear, leading nicely and uninterruptedly to the outcome we now know about. Had we seen the same situation from the inside, we would have recognized the possible confusion of multiple possible pathways…"[327]

- **Oversimplification:** "We oversimplify causality. When we are able to trace a sequence of events backwards (which is the opposite of how people experienced it at the time) we easily couple "effects" to preceding "causes" (and only those causes)…"[328]

321 Dekker. S. (2006: 21).
322 Ibid.
323 Dekker, S. (2006: 22).
324 Ibid.
325 Dekker, S. (2006: 25).
326 Dekker, S. (2006: 25).
327 Ibid.
328 Dekker, S. (2006: 25).

Related to hindsight bias is the concept of situation awareness which is examined later in this section. The loss of situation awareness is worth noting in this section as represents the difference between "what you now know the situation was actually like"[329] and "what people understood it to be at the time."[330] Therefore when examining any failure in risk management or unforeseen risk event, a BoD must guard itself from mixing their own reality of what took place with the reality experienced by the staff investigated.

III. Complexity

A. Overview

This study premised on the notion that uncertainty and complexity are reshaping the business environment worldwide and are increasing as a result of an exponential flow of goods, services, capital, people and data. This section begins with an exploration of how such flows have resulted in an increasingly interdependent and inter-connected global economy. It posits that multi-dimensional global flows and their expanding network effects drive higher levels of complexity that generate uncertainty as well as systemic risk. It frames the global economy as a complex system and introduces complexity science as an emerging interdisciplinary field "devoted to understanding, predicting and influencing the behaviors of complex systems."[331] It then introduces related theories that may assist a board in adapting to uncertainty and complexity in the context of their corporate governance and risk management responsibilities.

B. Global Economic Flows

Uncertainty and complexity are also symptomatic of the increasing international flows of goods, services, finance, data and people that has created the most tightly interconnected and interdependent global economy in human history. The McKinsey Global Institute conducted extensive research on how increasing global flows are contributing to GDP growth, and in particular new flows of data and communication.[332] Their 2014 report makes the strongest case to date that this is not a cyclical trend but a secular one:

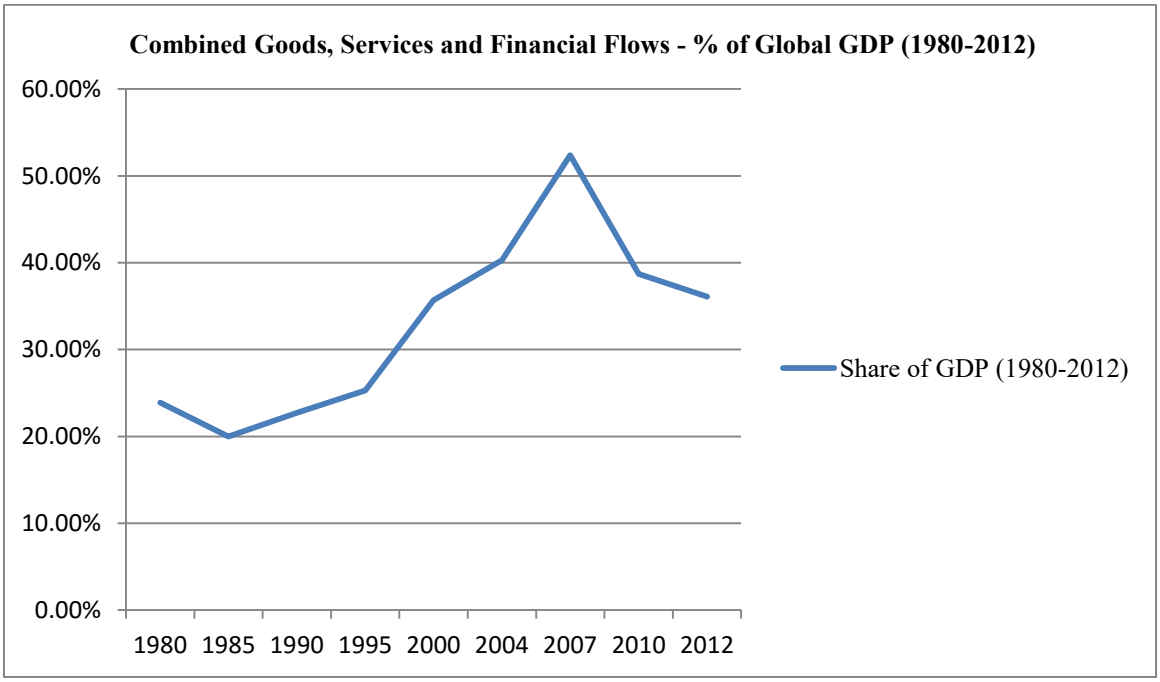
329 Dekker, S. (2006: 27).
330 Ibid.
331 OECD Global Science Forum (2009: 2).
332 McKinsey Global Institute (2014: 2). "We define goods and services flows as the sum of imports and exports of goods and services for each country; financial flows are the inflows and outflows of foreign direct investment, equity and bond flows, and cross-border lending and deposits; people flows include the number of people who move for long-term migration, short-term travelers, and students; and data and communication flows include the volume of cross-border Internet traffic and international call minutes. For each flow, we also explore emerging digital flows such as e-commerce, online work platforms, remittances and payments, and other microdata." Ibid, note 5.

- "By 2012, the combined value of goods and services plus financial flows reached $26 trillion [USD], or 36 percent of global GDP, compared with just $5 trillion, or 23 percent of world GDP in 1990."[333] (Figure 18).

- "Global online traffic has grown from 84 petabytes a month in 2000 to more than 40,000 petabytes a month in 2012 – a 500-fold increase."[334]

The McKinsey Global Institute report also forecasts that global flows of goods, services and finance could reach between $54 trillion USD and $85 trillion USD by 2025 (or 38 percent to 49 percent of global GDP) depending on a variety of factors, most notably the strength of economic growth in emerging economies and the impact on global flows from digital technologies.[335]

Figure 18: Traditional Flows of Goods, Services and Finance as % of Global GDP



Source: Adapted from McKinsey Global Institute, Exhibit E2 (2014: 4).

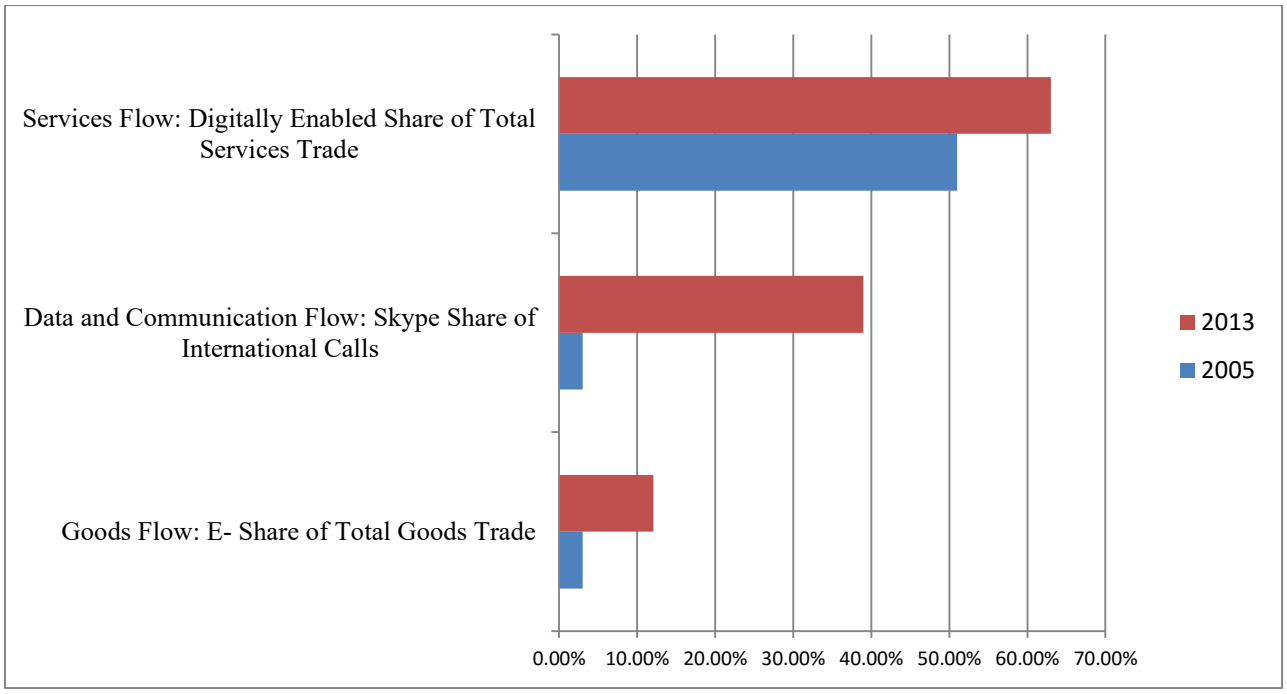
333 McKinsey Global Institute (2014: 4).

334 McKinsey Global Institute (2014: 5). One byte is the standard measure of one unit of digital information whereby one petrabyte equals 10^{15} bytes.

335 McKinsey Global Institute (2014: 6).

From the context of risk management and corporate governance, the salient points to consider are: 1) the networks of global flows are becoming deeper and broader and 2) the way such change is happening differs by the type of flow.[336] For example, the global network related to the flow of goods is the most complex and dispersed.[337] By comparison, as there are more services traded within regions than between regions, the global network of trade in services is much less dense than that of goods.[338] However service flows are growing significantly with two out of three countries having increased their ratio of services trade to GDP between 1990 and 2011.[339] Financial flows have also grown steadily with nearly half of the countries in the world experiencing an increase relative to GDP between 1993 and 2011. With regard to the flow of people, the international travel network is the most dispersed of all global flow networks but the international education network is among them most concentrated of all major global flows.[340] And the global network related to data and communication flows is developing and dispersing the fastest among all of the above cited flows and networks[341] (Figure 19).

Figure 19: Digitization of Cross-Border Global Flows



Source: Adapted from McKinsey Global Institute, Exhibit 13 (2014: 37).

336 McKinsey Global Institute (2014: 51).
337 Ibid. "Three out of every four countries around the world increased their ratio of goods trade (imports and exports) relative to GDP between 1990 and 2011."
338 McKinsey Global Institute (2014:52).
339 Ibid.
340 McKinsey Global Institute (2014:53).
341 Ibid.

The inference to draw from the interconnection and dispersion of global flows and their networks is that ours is indeed an interconnected and interdependent world economy that is still evolving. Although the McKinsey Global Institute's study cautions that traditional companies will "need to brace themselves for new wave of competition propelled by the low cost of starting up a business in a digital era,"[342] the tone overall remains optimistic as "this era of new global is unfolding new opportunities for globally minded entrepreneurs to disrupt established business models by operating as micro multinationals within global value chains."[343]

1. Emergence of Cyber Risks

Underlying the aforementioned global growth scenarios is an assumption that the basic infrastructure that digitally enables these flows (i.e. the Internet) does not itself present a threat to commerce. The reality however is that our ubiquitous connectivity to the Internet presents a variety of "cyber risks" and major new ones are discovered with greater frequency. For example, in the course of six months, two massive Internet security flaws were discovered in 2014. The "Heartbleed Bug" vulnerability was announced in April as it allowed for the theft of information normally protected by a commonly used cryptographic inscription system and the "Shellshock Bug" was discovered in September that allowed unauthorized access to a computer system via web servers.[344] What is important to consider is that both vulnerabilities are what security experts call a "zero day" exploit – this means that there are "zero" days for software programmers to fix the flaw between the moment the vulnerability is publicly known and the first attack is launched by a computer hacker.[345] A zero-day exploit is arguably among the top cyber-security threats today but is also indicative of the challenge presented by uncontrollable risks. Cyber risks are particularly challenging as they are emergent, complex and systemic: arguably they are the most menacing of the "known unknowns" that corporations must contend with on a daily basis (Table 18).

From a cyber-context, uncontrollable risks can be considered ubiquitous with the increasing use and spread of information technology as "organizations are unknowingly exposed to risks outside their own organization, having outsourced, interconnected, or otherwise exposed themselves to an increasingly complex, tightly-linked and unknowable network of networks."[346] Two recent incidents of cyber-risk in aviation illustrate the significant variance with regard to the type of risk event and the systemic impact within an industry or company.

342 McKinsey Global Institute (2014:16).
343 Ibid.
344 Jones, S. (25 September 2014), Shellshock Bug Threatens Internet's Backbone, Analysts Warn, *Financial Times*.
345 Ibid.
346 Zurich Insurance Company & Atlantic Council (2014: 8).

For example, it was reported on 29 April 2015 that American Airlines in the United States was forced to ground dozens of its aircraft because of problem with a software application (FliteDeck) used by pilots to view their daily flights plans digitally on iPad computer tablets issued by the company.[347] On 1 May 2015, it was reported that the Federal Aviation Authority (FAA) of the United States issued a warning and maintenance order concerning Boeing's 787 aircraft related to a software defect that cause a complete loss of electronic power and leading to a loss of control of the plane.[348]

Cyber risks was by far the risk management topic of greatest and immediate concern for those participating at the 2nd annual retreat of the WEF's Community of Chairman that took place from 18-19 April 2015 in Villars-sur-Ollon, Switzerland. Their perspectives on this topic are presented as part of the qualitative findings in part three of this study (Empirical Analysis).

347 BBC News (29 April 2015). American Airlines Grounded by iPad App Error. Retrieved from http://www.bbc.com/news/technology-32513066 (site last visited on 3 May 2015).

348 Gibbs, S. (1 May 2015). US Aviation Authority: Boeing 787 Bug Could Cause 'Loss of Control, *'The Guardian*. Retrieved from: http://www.theguardian.com/business/2015/may/01/us-aviation-authority-boeing-787-dreamliner-bug-could-cause-loss-of-control (last visited on 3 May 2015).

Table 18: Seven Aggregations of Cyber Risk

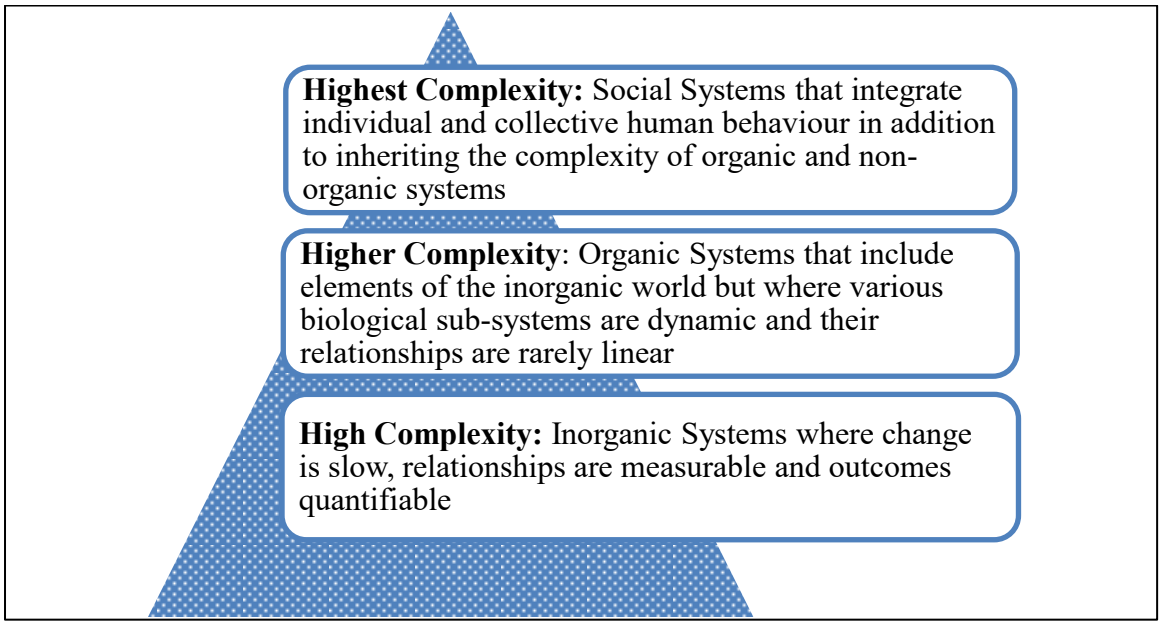
	Description	Examples
Internal IT enterprise	Risk associated with the cumulative set of an organization's (mostly internal) IT	Hardware; software; servers; and related people and processes
Counterparties and partner	Risk from dependence on, or direct interconnection (usually non-contractual) with an outside organization	University research partnerships; relationship between competing/cooperating banks; corporate joint ventures: industry associations
Outsourced and contract	Risk usually from a contractual relationship with external suppliers of services, HR, legal or IT and cloud provider	IT and cloud providers; HR, legal, accounting, and consultancy; contract manufacturing
Supply Chain	Both risks to supply chains for the IT sector and cyber risks to traditional supply chains and logistics	Exposure to single country; counterfeit or tampered products; risk of disrupted supply chain
Disruptive Technologies	Risk from unseen effects of or disruptions either to or from new technologies, either those already existing but poorly understood, or those due soon	Internet of things; smart grid; embedded medical devices; driverless cars; the largely automatic digital economy
Upstream Infrastructure	Risks from disruptions to infrastructure relied on by economies and societies, especially electricity, financial systems and telecommunications	Internet infrastructure like internet exchange points and submarine cables; some key companies and protocols used to run the e-internet (BGP and Domain Name System); Internet governance
External Shocks	Risks from incidents outside the system, outside of the control of most organizations and likely to cascade	Major international conflicts; malware pandemic

Source: Adapted from Zurich Insurance Company & Atlantic Council, Table 1 (2014: 8).

2. Socio-Economic Complexity

The salient consideration regarding global flows, digitization and cyber risk is that they confirm the high degree in which society depends on a multi-layered system such as the Internet to mobilize, maintain or monitor socio-economic progress. From a broader systemic perspective, a related and relevant consideration is that all organizations, particularly corporations, primarily depend upon on social systems which arguably are the most complex. (Figure 20). And therefore from a risk perspective Evgueni Ivanstov cautions that social systems "[i]nherit all the complexity of both non-organic and organic systems but also produce the new complexity of a human mind, social behavior and economic life."[349]

Figure 20: Socio-Economic Systems from a Risk Management Perspective



Source: Adapted from Ivanstov, Figure 1.2 (2014: 15).

Social-economic systems are highly complex irrespective of whether the frame of reference is at the community, national or regional levels. In the introductory part of this study, economists Ian Goldin and Mike Mariathasan assert that "[m]ore than simple connectivity, our increasing interdependence represents complexity"[350] and therefore "the world today should be defined as a complex system"[351] Moreover they categorize the global economy as representing only the first of three levels of increasing complexity.[352] A complex economy is considered by Goldin and Mariathasan to represent "small tent" or "Sante Fe[353]" complexity

349 Ivanstov, E. (2013: 15).
350 Goldin, I. & Mariathasan, M. (2014: 19).
351 Goldin, I. & Mariathasan, M. (2014: 21).
352 Ibid.
353 Santa Fe is a municipality in the United States of America located in the state of New Mexico. The reference in this instance however is to the Santa Fe Institute (www.santafe.edu) also located there and

(Table 19).[354] It is also the level of complexity most relevant to the concept of uncontrollable risk as introduced in this study.

Table 19: Levels of Socio-Economic Complexity

Conceptual Levels of Complexity	Complexity Characteristics & Categories
First Level • "Small Tent" (or Santa Fe) concerned with self-organization and adaptive systems[355]	Characteristics • Agents are heterogeneous • Dispersed interaction • No global controller • Cross-cutting hierarchical organization • Continual adaptation • Perpetual novelty • Out-of-equilibrium dynamics
Second Level • "Big Tent" concerned with complex and unstable dynamics[356]	Categories in addition to small tent typology • Cybernetics[357] • Catastrophe • Chaos
Third level • "Metacomplexity" concerned with all else	Encompasses all other definitions of complexity

Source: Author.

C. Complexity Science

In part one, the notion was introduced that increased connectivity both enables and creates systems that are globally integrated but also inherently complex. Moreover, it was argued that as a result of this globalization the world should be defined as a complex system. A complex system is not composed of "very large number of diverse interacting parts"[358] but they are "prone to surprising, large-scale, seeming uncontrollable behaviors."[359] Complexity science is an interdisciplinary field devoted to the study of complex systems with an emphasis on

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founded in 1984. It is a private, non-profit research institute dedicted to the science of complex adaptive systems (research that attempts to identify commonalities that link artificial, human, and natural systems). Cf. Arthur, W.B., Durlauf, S.N., & Lane, D.A. (Eds.) (1997). *The Economy as an Evolving Complex System II,* Reading, MA: Addison-Wesley.

354 Goldin, I. & Marathasan, M. (2014:21).

355 Rosser, J.B. (2011: 85).

356 Ibid.

357 "The science of communication and control theory that is concerned especially with the comparative study of automatic control systems (as the nervous system and brain and mechanical-electrical communication systems)." Definition retrieved from http://www.merriam-webster.com/dictionary/cybernetics (last visited on 26 April 2015).

358 OECD Global Science Forum (2009: 1).

359 Ibid.

human systems that present issues that are difficult to address via traditional scientific methods. Among them highlighted by the OECD Global Science Forum are:

- Nonlinearities and discontinuities
- Aggregate macroscopic patterns versus casual microscopic events
- Probabilistic rather than deterministic outcomes and predictions
- Change versus stasis

Examples of complex system dynamics (i.e. where small changes have big effects or vice versa) are often revealed in the context of a single risk event. Some past occurrences that exhibited complex system behaviors are:

- A single breakdown of a transformer in a small electrical substation leads to a massive disruption of an electrical power grid.
- An illness in a remote locality impacting only some individuals is actually a new pathogen that gives rise to a regional pandemic.
- Concern over a new but widely adopted financial derivative promoted as a risk reducing product instead triggers a stock market collapse and major bankruptcies.

In 2008 the OECD Global Science Forum convened a workshop to explore the extent to which complexity science could improve decision-making (for policymakers) and focused on four areas that considered promising from an applied perspective[360]:

- Epidemiology and contagion
- Complex dynamics of technologically connected environments
- Resilience and vulnerability to extreme events
- Societal implications of climate change

The discipline's primary aim is to identify patterns and tendencies in complex systems to determine how to positively influence the system's behavior.[361]Among the key characteristics of complex systems highly relevant in the context of uncontrollable risks are:

- **Adaptability**: "Complex systems are formed by independent constituents that interact, changing their behaviors in reaction to those of others, thus adapting to a changing environment."[362]

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360 OECD Global Science Forum (2009: 4).

361 Among the success stories cited by the OECD Global Science Forum were related to urban planning:Preventing stampedes by identifying patterns in crowd dynamics that are immediate precursors to stampeding despite what appears to be a chaotic process.
- Identifying persistent ordered patters (Power Laws) whereby the relative population sizes of cities in various countries over the past one hundred years fit a particular mathematical relationship (Zipf's Law) linked to positive feedback loops.

362 OECD Global Science Forum (2009: 6).

- **Emergence:** "Novel patterns that arise at a system level that are not predicted by the fundamental properties of the system's constituents or the system itself are called emerging properties."[363]

- **Self-organization:** "A system is formed that operates through many mutually adapting constituents is called self-organizing because no entity designs it or controls it."[364]

- **Attractors:** "Some complex systems spontaneously and consistently revert to recognizable dynamic states as attractors."[365]

- **Self-organized Criticality:** "Referring to the concepts defined above, a complex system may possess a self-organizing attractor state that has an inherent potential for abrupt transition of wide range of intensities."[366]

- **Chaos:** "One of the earliest known features of complex systems was chaotic dynamics characterized by extreme sensitivity to initial conditions. Chaotic systems are not 100% predictable, yet they exhibit order due to an underlying attractor."[367]

- **Non-linearity:** "When a system is linear, a change in one property produces proportional change in others… In some cases, small changes might have large effects on a nonlinear system, while large ones could have little or no effect."[368]

- **Phase Transitions:** "System behavior changes suddenly and dramatically (and, often, irreversibly) because a "tipping point", or phase transition point, is reached."[369]

- **Power Laws:** "Complex systems are sometimes characterized by probability distributions that are best described by a particular type of slowly decreasing mathematical function known as power law (instead of the more familiar bell-shaped normal distribution). When power laws hold, it is possible to predict future states of even highly complex systems, albeit only in a probabilistic manner."[370]

363 Ibid.
364 OECD Global Science Forum (2009: 7).
365 Ibid.
366 Ibid.
367 OECD Global Science Forum (2009: 8).
368 Ibid.
369 Ibid.
370 OECD Global Science Forum (2009: 9).

With regard to the practice (i.e. the tools and techniques) of complexity science, the OECD Global Science Forum identified the following for use in public policy:

- **Agent-based or Multi-Agent Models:** "In computerized, agent-based simulations, a synthetic virtual "world" is populated by artificial agents who could be individuals, families, organizations, etc. Each agent is endowed with particular traits (e.g. it has certain physical characteristics and obeys particular decision rules)."[371]

- **Network Analyses:** "Network analyses are based on maps of relationships or linkages among constituents in systems. From these maps, scientists seek to identify configurations that are especially stable (or particularly fragile)."[372]

- **Data Mining:** "Complexity scientists are developing techniques for finding patterns and relationships in large data sets with complex qualities."[373]

- **Scenario Modelling**: "Scenario models are artificially constructed, hypothetical models of complex systems that reflect their key constituents and dynamics. Scenario modelling varies the condition the systems face in order to anticipate the effect of various conditions and to identify policies that are robust to many likely features."[374]

- **Sensitivity Analysis:** "These methods allow the calculation of the degree to which outcomes vary in response to changes in system parameters."[375]

- **Dynamic Systems Modeling:** "Dynamical systems models are generally sets of differential equations or iterative discrete equations, used to describe the behavior of interacting parts in a complex system, often including positive and negative feedback loops. They are used to enable simulation of, among other things, the results of alternative system interventions (for example, which incentives are most likely to yield adoption of alternative energies by consumers and power companies)."[376]

Among the tools and techniques cited above, Part three of this study (Empirical Analysis) focuses particularly on the utility of Network Analyses in the context of uncontrollable risks.

371 OECD Global Science Forum (2009: 9).
372 Ibid.
373 OECD Global Science Forum (2009 : 10).
374 Ibid.
375 OECD Global Science Forum (2009 : 10).
376 OECD Global Science Forum (2009 : 10).

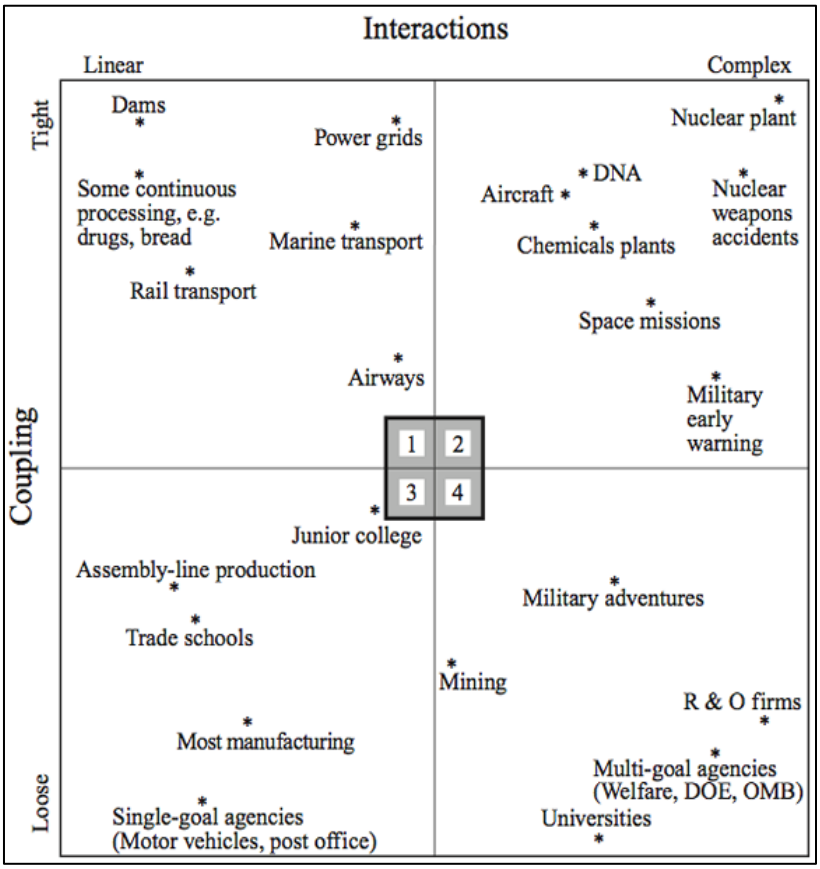
D. Normal Accident Theory

Our reliance on technological systems is increasing as the global economy becomes more interconnected and interdependent. From a risk management perspective, technologically advanced systems are critical for the identification, monitoring and mitigation of many hazards and risks yet the increasing complexity of such systems present challenges of their own. Sociology Professor Charles Perrow argues that in many instances the advanced technology deployed to ensuring safety (e.g. warning systems, safeguards) fail because systems complexity makes their failure inevitable or "normal."[377] Normal Accident Theory is premised on the notion that a system's susceptibility to accidents can be determined by examining two of their dimensions: interactive complexity and tight versus loose coupling (Figure 21).

Interactive complexity is the presence of unplanned or unexpected sequences of events that is not easily visible or comprehensible in a system. Its presence requires discerning if a system is tightly or loosely coupled. As described by Perrow, "[i]n tightly coupled systems the buffers and redundancies and substitutions must be designed in; the must be thought of in advance."[378] And in contrast he notes that "[i]n loosely coupled systems, there is a better chance that expedient, spur-of-the-moment buffers and redundancies and substitutions can be found, even though they were not planned ahead of time."[379] Normal Accident Theory points to the paradox that if prescribed safety measures result in increasing the complexity of a tightly coupled system that is exposed to interactive complexity then the likelihood of an accident increases.

377 Perrow, C. (1999).
378 Perrow, C. (1999: 94).
379 Perrow, C. (1999: 95).

Figure 21: Interactions, Complexity and Coupling (Tight & Loose)



Source: Perrow, Figure 9.1, Interactions/Couplings Chart (1999: 327).

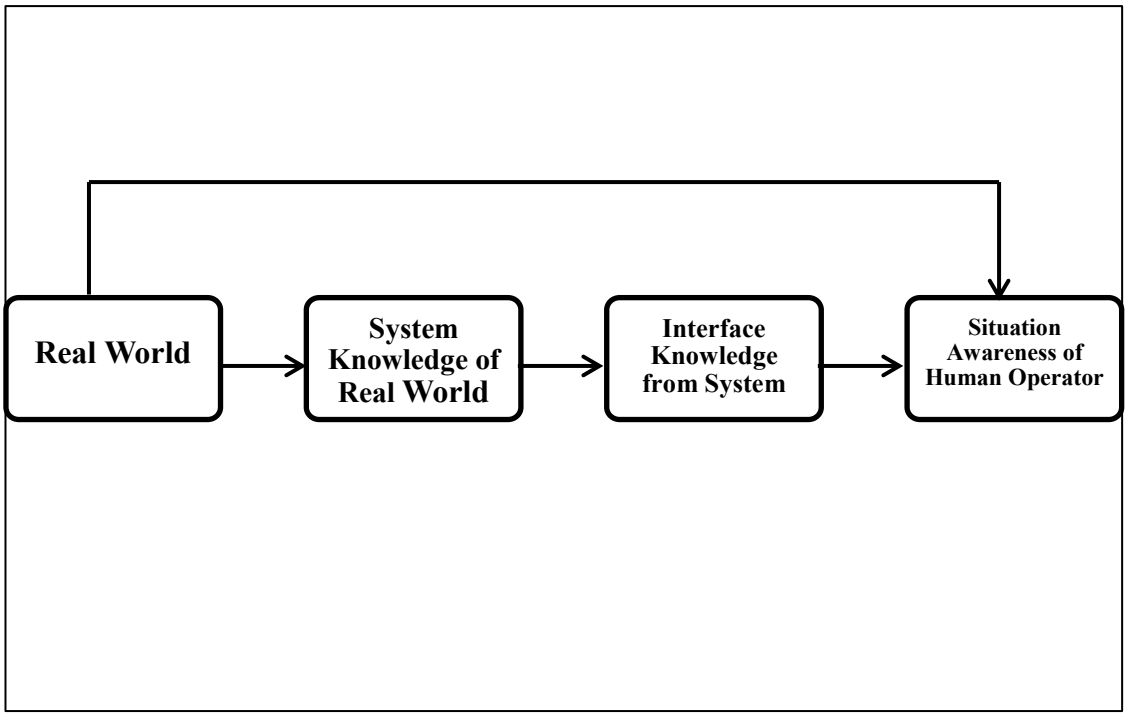
E. Situation Awareness Theory

Decision-making in the context of complex systems requires a BoD not only to avoid known judgment traps as outline in the previous section but also to develop their situational awareness (SA). Situational awareness can be defined as "consisting of a person's state of knowledge about a dynamic environment"[380]and therefore increasingly relevant in the context of confronting increasing uncertainty and complexity as a result of operating in an interdependent and interconnected global economy. Situation Awareness Theory as developed by Mica Endsley, who serves as the Chief Scientist of the United States Air Force, relates to the dynamics of human decision-making linked to tasks that are often physical or perceptual but as well as "human behavior involving highly complex cognitive tasks with increasing frequency."[381] SA refers to developing an understanding of what is happening around you now and thinking ahead as to what is likely to happen in the near future while continuously updating both (Figure 22).

The salient consideration from systems view is that successive interactions between a person (human operator) and an intervening system can result in the loss of information (transmission error) at each transition.[382] First the initial system may not acquire all the necessary information from the "real world" as most only collect only certain information per its design. Second of the information collected not all of can be displayed to the human operator. And third, human factors (e.g. perception, attention, working memory) may prevent the human operator from acquiring all the information that is potentially available from the system. In the context of Corporate Risk Management (CRM), the degree to which the necessary risk information is acquired systematically and the manner in which that risk information is presented will significantly influence the situation awareness of the entire board.

380 Endsley, M. (1995: 60).
381 Endsley, M. (1995: 32).
382 Endsley, M. (1995: 50).

Figure 22: Situation Awareness (SA) Inputs



Source: Adapted from Endsley, Figure 5 (1995: 50).

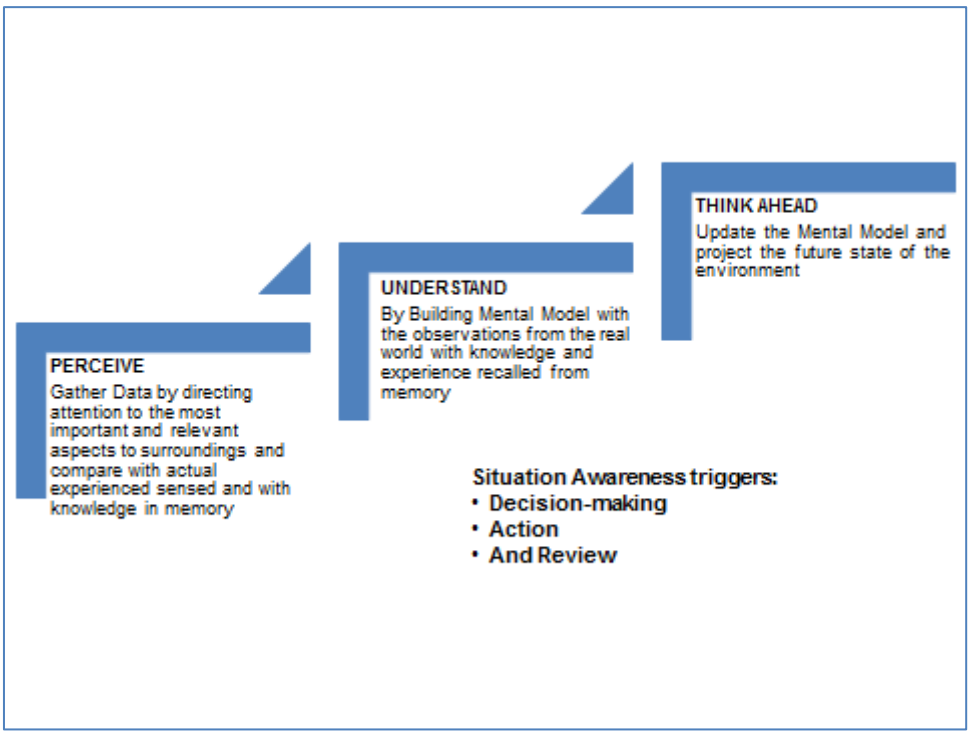
Aviation and air traffic control are two areas where situation awareness has long been recognized as an important measure of performance – in both examples, lapses in situation awareness can directly lead to catastrophic consequences. This study argues that the two fundamental forces reshaping the future business environment globally – uncertainty and complexity -- requires a BoD to develop their situation awareness as a team in the context of uncontrollable risks. Endsley argues that team situation awareness can be "conceived as the degree to which every team member possesses the SA required for his or her responsibilities."[383] However she highlights that it is not sufficient if one team member knows completely a required piece of information but the other not at all when both team members need to know a piece of information. Endsley uses the example of an aircraft cockpit where both the pilot and copilot need to know certain information. The situation awareness of the team has suffered if only the copilot has this information and the pilot in charge of the aircraft does not.

Situation awareness is also relevant when facing an uncertain and complex situation as the context of a problem often "determines the ability of individuals to adopt an effective problem-solving strategy"[384] or rather the specifics of a situation will determine the adoption

[383] Endsley, M. (1995: 39).
[384] Ibid.

of the appropriate mental model that triggers the choice of strategy (Figure 23). Endsley notes that "in the absence of an appropriate model, people will often fail to solve a new problem, even though they would have to apply the same logic as that used for a familiar problem."[385]

Figure 23: Situation Awareness Building



Source: Adapted from Airbus Flight Operations Notes, Figure 1 (2007: 3).

In a major risk event, the situation awareness of a board is critical with respect to fulfilling their supervisory role in a moment of crisis or adversity. Building SA in times of crisis should be the board's performance objective. There is the presumption that the BoD has the subject-specific areas of competence already in place on the board to fulfil its strategic direction and controlling functions (Figure 24).

[385] Endsley, M. (1995: 39).

Figure 24: Desired Board Know-How in a Biotechnology Firm

Source: Adapted from Hilb, Figure 2-5 (2008: 82).

F. Adaptive Leadership Theory

Another way to approach uncontrollable risks is to recognize that a seemingly technical challenge may not have readily known technical solution because in reality the challenge is a novel one. Ronald Heifetz and Marty Minsky have identified the single biggest failure of leadership is to treat adaptive challenges like technical problems.[386] Their research suggests two types of leadership challenges: adaptive and technical change. When the problem definition, solution, and implementation are clear, they categorize this as a technical change. In contrast, an adaptive change requires a novel solution and new learning. Their conclusion is that adaptive change must come from the collective intelligence of the employees at all levels to learn their way toward solutions. Along those lines, the argument was put forth in introductory part of this paper that ERM, as a developing discipline, does not provide a robust mental model (conceptual framework) to address uncontrollable risks. This study asserts that in the context of a highly interconnected and interdependent global economy the challenge of uncontrollable risks is an adaptive rather than technical (Table 20).

386 Heifetz, R. & Minksy, M. (2002).

Table 20: Adaptive Leadership in Risk Management

	Leadership Approach	*Leadership Responsibility*	*Risk Context*
Technical Change	• Zoom in on the problem itself • Apply current "know-how" • Provide proven solutions • Take immediate action	Those with the authority (actual or apparent) to take action	Probability distribution of risk is completely specified (both outcomes and probabilities are known) Underlying model or paradigm exists to explain the risk
Adaptive Change	• Zoom out to get a systemic view • Apply "outside the box" thinking • Learn about new means or methods • Experiment	Those closest to the problem at hand	Risks are known but the probabilities are not Risks cannot be identified in advance No new hypothesis or underlying model or paradigm exists to explain the risks

Source: Adapted from Heifitz & Minsky (2002).

G. Positive Deviance Approach

To succeed at risk management, the conventional wisdom is to set the tone at top – i.e., the involvement and endorsement of the BoD and senior management are seen as critical for setting the right tone within an organization. Some experts go as far to recommend that "the CEO must first communicate that risk management is a top priority for the company at presentations, meetings and other forums."[387]

This study asserts that the emergence of uncontrollable risk presents an adaptive challenge as opposed to a technical one. Moreover it also endorses the notion that adaptive change must come from the collective intelligence of the employees at all levels to learn their way toward solutions. Therefore managing uncontrollable risk will require a framework that taps the collective intelligence within an organization as well as its key stakeholders.

One such method that should be considered by a BoD is the positive deviance (PD) approach to behavioural and social as researched and developed by Richard Pascale and Jerry Sternin.[388] After 14 years of study, they observed that:

> "There are people in your company or group who are already doing things in a radically better way. The process we advocate seeks to bring the isolated success strategies of these "positive deviants" into the mainstream. Ordinary change management methods don't do a very good job at that: Managers overlook the isolated successes under their noses or, having spotted them, repackage the discoveries as templates and disseminate them from the top. This seldom generated the necessary enthusiasm to create change."[389]

The PD approach is premised on the notion that however intractable a problem may appear to be, an answer may present itself if communities are invited to address it and to self-organize their own solution. It is also premised on the notion that leaders are often not aware of the human resources and social assets that a community has to solve an agreed-upon problem.

Therefore as an organization becomes aware of the uncontrollable risks it faces, its leadership should first reflect on that nature of the challenge facing it – i.e., is the company facing an adaptive or technical challenge in risk management. If it sees an adaptive change that requires a novel solution and new learning, then it should consider a PD approach if it also requires behavioural and attitudinal changes (Table 21).

387 Lam, J. (2014: 39).
388 Pascale-Tanner, R., & Sternin, J. (2005).
389 Pascale-Tanner, R., & Sternin, J. (2005).

Table 21: Traditional versus Positive Deviance Approach to Change

TRADITIONAL APPROACH TO CHANGE	POSITIVE DEVIANCE APPROACH TO CHANGE
Leadership as Path Breaker Primary ownership and momentum for change come from above.	**Leadership as Inquiry** Leader facilitates search; community takes ownership of the request for change.
Outside in Experts identify and disseminate best practices.	**Inside Out** Community identifies preexisting solutions and amplifies them.
Deficit Based Leaders deconstruct common problems and recommend best-practice solutions. Implications: "Why aren't you as good as your peers?"	**Assed Based** Community leverages preexisting solutions practiced by those who succeed against the odds.
Logic Driven Participants thin into a new way of acting.	**Learning Driven** Participants act into a new way of thinking.
Vulnerable to Transplant Rejection Resistance arises from ideas imported or imposed by outsiders.	**Open to Self-Replication** Latent wisdom is tapped within a community to circumvent the social system.
Flows from Problem Solving to Solution Identification Best practices are applied to problems defined within the context of existing parameters.	**Flows from Solution Identification to Problem Solving** Solution space is expanded through the discovery of new parameters.
Focused on the Protagonists Engages stakeholders who would be conventionally associated with the problem.	**Focused on Enlarging the Network** Identifies stakeholders beyond those directly involved with the problem.

Source: Adapted from Tanner-Pascale & Sternin (2005: 4).

IV. New Corporate Governance

As noted in part one of this study (Introduction) the risk management component of corporate governance is an important public policy concern for the OECD largely due to the following deficiencies:[390]

> "Corporate governance standards should place sufficient emphasis on ex ante identification of risks."[391]
>
> "Currently risk governance standards tend to be very high-level, limiting their practical usefulness, and/or focusing largely on financial institutions."[392]
>
> "It is not always clear that boards place sufficient emphasis on potentially "catastrophic" risks, even if these do not appear to very likely to materialize."[393]

390 OECD (2014). The report reviews the corporate governance framework and risk management practices for both private sector and state owned enterprises in the twenty seven members of the OECD Corporate Governance Committee.

391 OECD (2014:7).

392 Ibid.

> "Boards should be aware of the shortcomings of risk management models that rely on questionable probability assumptions."[394]

However there are no remedies prescribed by the OECD in the 2014 report with regard to addressing these broad but important concerns. Moreover the absence of "one size fits all" prescriptions for each of the aforementioned shortcomings is not surprising as Professor Martin Hilb has observed that corporate governance models are influenced by the value system that prevails in a particular country context.[395] Hilb finds that the expression of their influence can be seen in the two predominant corporate governance models. The "market based" model is focused on promoting and maximizing shareholder value and its geographic roots are deep in the United States, United Kingdom and Australia.[396] The "relationship-based" model is focused on promoting and maximizing a broader group of stakeholders and its geographic roots are deep in Europe (Germany) and East Asia (Japan).[397] The OECD's own description of corporate governance is applicable to both models:

> "Corporate governance involves a set of relationships between a company's management, its board, its shareholders and other stakeholders. Corporate governance also provides the structure through which the objectives of the company are set, and the means of attaining those objectives and monitoring performance are determined."[398]

Implicit in the OECD definition is the notion that the BoD provides strategic direction to an enterprise and this role also entails identifying strategic risks and determining the risk appetite of the company.[399] This paper, however, posits that a third model of corporate governance is the most appropriate approach not only in the context of uncontrollable risks and the aforementioned OECD concerns but in order to address the questions from the previous section on:

- How can a BoD introduce risk envisioning dialogue processes related to the ex ante identification of uncontrollable risks that are highly interactive?

- How does a BoD approach the issue of assessing organizational resilience in the context of uncontrollable risks?

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393 OECD (2014: 7).
394 OECD (2014: 8).
395 Hilb, M. (2008: viii in preface).
396 Hilb, M. (2008: viii in preface). This model is often referred to as the Anglo-American model of corporate governance.
397 Ibid.
398 OECD (2004: 13).
399 Kalia, V. & Müller, R. (2007: 18).

- How does diversity (or its absence) within a BoD impact the above two questions?

This third model of corporate governance is 'New Corporate Governance' as conceptualized by Martin Hilb is defined as:

> "[a] system by which companies are strategically directed, *integratively* managed and holistically controlled in an entrepreneurial and ethical way in a manner appropriate to each particular context."[400]

The 'New Corporate Governance' framework is comprised of four distinct elements (Table 22) which Hilb describes as being based on a reverse KISS principle ("Situational, Strategic, Integrated and Keep It Controlled"). In the context of uncontrollable risks, this section introduces each of the model's four dimensions (situational, strategic, integrated and controlling). The empirical part of this study focuses more narrowly on the situational and strategic dimensions in the context of uncontrollable risks.

[400] Hilb, M. (2008: 9).

Table 22: Traditional and New Corporate Governance Dimensions

General Dimensions	Traditional Corporate Governance	New Corporate Governance	Uncontrollable Risk Dimension
Situational Implementation	No difference between national, industry and corporate culture	Implementation appropriate to the specific context of each firm	Considers not only organizational complexity but differentiates between complicated and complex operating environments – recognizes adaptive versus technical challenges
Strategic Direction	Strategic development is not a function of the supervisory board	Strategic development is central function of the supervisory board	Considers board culture, structures and composition to promote risk envisioning dialogue and to mitigate judgment biases and common heuristics
Integrated Board Management	Only isolated nomination and remuneration committees in publicly listed companies	Integrated and targeted selection, appraisal, compensation and development of the supervisory and managing boards	Considers establishing uncertainty appetite along with risk appetite as well as improving board performance in terms of situation awareness
Holistic Monitoring	Controlling the financial dimension only	Holistic monitoring of results from the perspective of shareholders, clients, employees and the public	Considers the glocal dimension in terms of a risk event and desired organizational resilience and is receptive to positive deviance approach

Source: Adapted from Hilb, Table 0-1 (2008:10).

Hilb's research highlighted four significant shortcomings in corporate governance guidelines that extend to the global financial crisis of 2008. [401]

1. "[M]ost national corporate governance guidelines propose a "one size fits all" approach which is dangerous; it may support good governance, but it does not guarantee that the governance of a firm will become great;
2. there is a lack of strategic direction in much of board practice;
3. board selection, appraisal, remuneration and development often lack integration and professionalism;
4. and often there is a lack of in-depth know-how in risk-management at board level."[402]

401 IFC (2009: 2).
402 Ibid.

This study focuses on the fourth element: how to improve a board's performance with respect to its risk management responsibilities.

A. Situational Dimension of New Corporate Governance

The situational dimension is noteworthy with regard to its direct applicability to the concept of resilience which will be explored later in this part of the study. Hilb's elaboration of the situational dimension to 'New Corporate Governance' highlights the importance of national context[403]whereby he proposes that firms adopt:

- the global relevance of aspects of board best practices that emerge from 'market-based' models of corporate governance and;
- the local governance best practices that emerge from 'relationship-based' models of corporate governance.

Hilb's framework not only integrates the strength of the market-based and relationship-based models but promotes the above "glocal" approach.[404] Hilb's argument is that "for a world-class [or glocal] company to be consistently more innovative and successful than its competition locally, the board has to systematically and sustainably pursue and regularly measure the satisfaction and the voluntary loyalty of shareholder, customers, employees (including management) and the public."[405] The advantages of the glocal approach in composition of the BoD and management team are four-fold:

- "[O]ptimal use of international board and HR potential"[406]
- "[B]etter alignment of board and management teams of foreign subsidiaries with the global vision and strategies of the home office, simultaneously taking into consideration local conditions and strengths"[407]
- "[D]evelopment of a cosmopolitan learning oriented corporate culture, in which a strong competitive synthesis of the comparative and transferable strengths of the different national cultures can be achieved"[408]
- "[C]reation of attractive personal development possibilities for the board members and executives of different national companies"[409]

403 IFC (2009: 2).
404 Hilb, M. (2008: 22).
405 Hilb, M. (2008: 23). In the New Corporate Governance framework, Hilb attributes the highest level of internationalization ("Development Stage IV") to those firms that pursue a glocal approach with respect to the composition of their board and management team. See Hilb (2009: 64).
406 Hilb, M. (2008: 64).
407 Ibid.
408 Hilb, M. (2008: 64)

The quantitative analysis presented in the empirical part of this paper supports the notion that Hilb's conceptualization of a 'glocal' enterprise (and its governance) is better suited to address uncontrollable risk and to strengthening resilience. Moreover the qualitative analysis will support the Hilb's observation that "globalization means that firms must confront themselves with increasingly complex competitiveness requirements regardless of their size"[410]applies equally to uncontrollable risks.

B. Strategic Dimension of New Corporate Governance

The strategic dimension is noteworthy with regard to its direct applicability to the judgment traps and biases associated with decision-making as highlighted earlier. Hilb proposes that four main preconditions must be met for integrated board management to be successful:

- Diversity in terms of the "strategically targeted composition of the board team"[411]
- Trust in terms of a "constructive and open-minded board culture"[412]
- Network in terms of an "efficient board structure"[413]
- Vision in terms of "stakeholder oriented board measures of success"[414]

The quantitative analysis presented later in this paper focuses particularly on the diversity requirement of Hilb's conceptualization of successful integrated board management. The paper posits that this framework is well-suited for identifying uncontrollable risks and in avoiding judgment errors in risk-related decision-making[415] (Figure 25).

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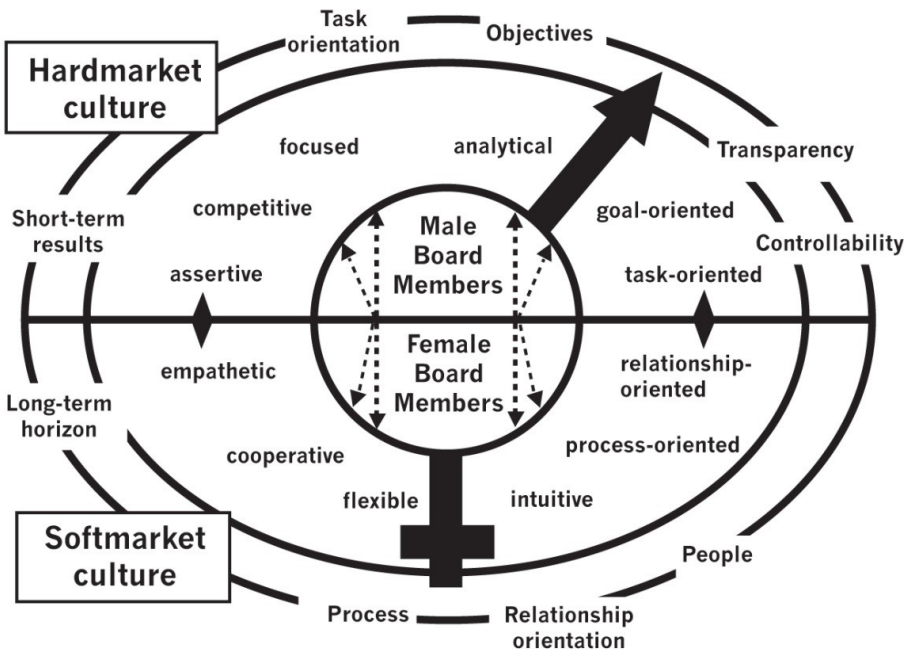
409 Ibid.
410 Hilb, M. (2008: 65).
411 Hilb, M. (2008: 75).
412 Ibid.
413 Hilb, M. (2008: 75).
414 Hilb, M. (2008: 75).
415 New Corporate Governance espouses "neither a large representative board nor a small professional board" but suggests a third option of a small, legally accountable, well-diversified board, comprising a maximum of seven members (including an independent Chairperson, independent members and the CEO). Hilb also suggests that such boards conduct its activities with just an integrated audit and risk management committee and an integrated board management committee (responsible for nomination, feedback, remuneration and development of the board and top management). Hilb (2008: 96).

Figure 25: Board Member Strengths (Based on Gender and National Culture)



Source: Hilb, Figure 2-8 (2008: 86).

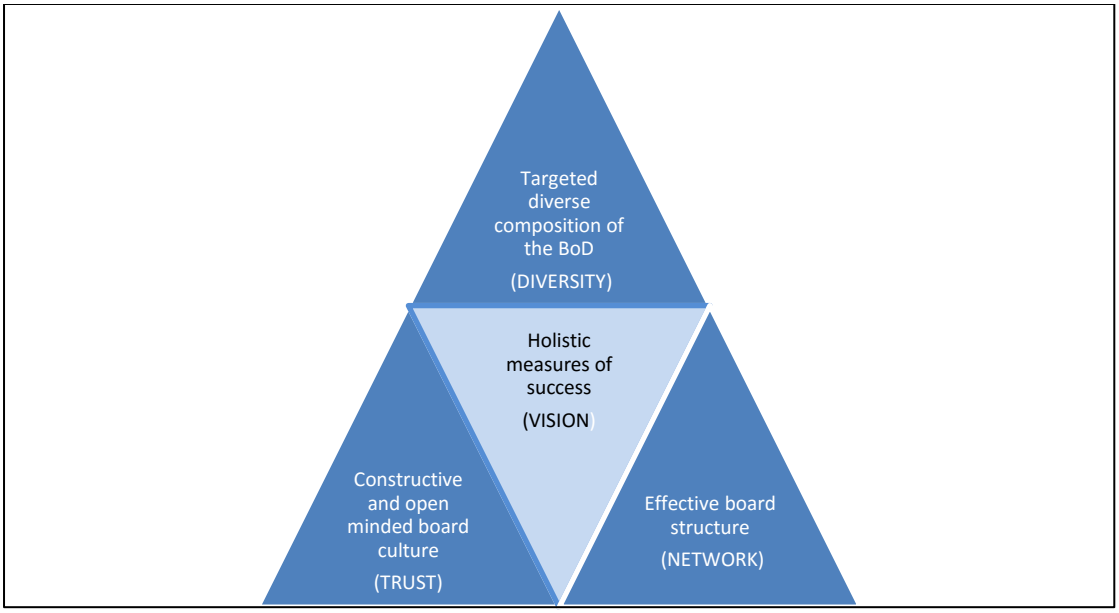
C. Integrated Dimension of New Corporate Governance

The integrated dimension is noteworthy with regard to its direct applicability to the theories of Situation Awareness, Adaptive Leadership and Positive Deviance. Hilb's notion of integrated board management comprises of three dimensions (Figure 26):

1) Strategic elements consisting of:
    - an exemplary board team
    - constructive, open culture
    - effective board structure and
    - stakeholder oriented board success standards
2) An integrated cycle concept that examines:
    - selection and composition of the board
    - performance review and feedback mechanisms
    - board remuneration
    - professional development of board members

3) An evaluation methodology evaluates board performance regularly[416]

Figure 26: Preconditions for Successful Integrated Board Management



Source: Adapted from Hilb, Figure 2-1 (2008: 75).

D. Controlling Dimension of New Corporate Governance

The controlling dimension refers to an integrated approach to the monitoring function of the BoD as it relates to their auditing, risk management, communication and evaluation responsibilities.[417] In terms of monitoring risk management, Hilb reinforces the notion that this task is not only the responsibility of the full board but is on par with its responsibility of providing strategic direction. However, Hilb advocates a single integrated committee for audit and risk management as the review of those systems is "often lacking at both strategic and operational levels." [418] The ultimate goal is for the board and executive management to "define an integrated, future-oriented risk management concept: one which is integrated with the existing planning and leadership processes, which is equally directed to the realization of opportunities and which does not constrain entrepreneurial freedom."[419]

416 Ibid.
417 Hilb, M. (2008: 157).
418 Hilb, M. (2008: 158).
419 Hilb, M. (2008: 165).

This paper focuses on the integrated risk management function of the board as outlined by Hilb and its applicability to uncontrollable risks. The risk management approach of New Corporate Governance is consistent with the COSO ERM framework by tasking the board and executive management to define:

> "an integrated, future oriented risk management concept; one which is integrated with the existing planning and leadership processes, which is equally directed to the realization of opportunities and which does not constrain entrepreneurial freedom."[420]

Hilb recommends that a board begin with a spiral (or cyclical) approach to risk management that begins with an understanding of "existing risk controlling"[421] then moves to developing a "desired risk strategy"[422] then the "identification of obstacles"[423] and finally to "risk management measures."[424] This study explores the notion that a board should also consider determining its approach and appetite to critical uncertainties (uncontrollable risk) in a similar manner.

V. Resilience Management

As defined in part one, resilience is a term associated historically with engineering in the context of stress testing materials or structures.[425] In the prior discussion on contingency theory, organizations are advised to focus mostly on its resilience when confronted by an exogenous risk given the limits of ERM in a situation where the event is unavoidable and unpredictable. Therefore resilience is a highly relevant concept for a board concerned with uncontrollable risks.

Resilience management extends beyond ERM "to address the complexities of large-integrated systems and the uncertainty of future threat"[426]and therefore a truly resilient

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420 Ibid.

421 Hilb, M. (2008: 166). This involves listing all types of risk associated with key objectives that are strategically relevant to the board of directors and are operationally relevant to executive management. The challenge is with determining the relevance of the risk, its likelihood of occurrence and the consequences of an occurrence.

422 Hilb, M. (2008: 168). This phase entails examining the company's strategy and risk policy to pursue one of the following options: 1) avoid the risk, 2) accept the risk, 3) reduce the risk, 4) transfer the risk (via insurance or a hedge) or 5) extend the risk to pursue an opportunity.

423 Hilb, M. (2008: 169). Hilb suggest suggests asking the following questions when identify risk barriers: 1) is the risk concept realistic? 2) have the risk processes been identified completely? And 3) are there enough financial, time and human resources available for management of this risk at the board and executive management level?

424 Hilb, M. (2008: 170).

425 "A definition that has long been used in engineering is that resilience is the capacity for 'bouncing back faster after stress, enduring greater stresses, and being disturbed less by a given amount of stress'." See WEF (2013: 37).

426 Linkov, I. et al (2014 : 407).

company should be conceptualized as an adaptive system (e.g. capable of adapting to changing contexts, withstanding sudden shocks and recovering affected internal systems). A resilience management framework includes (Figure 27):

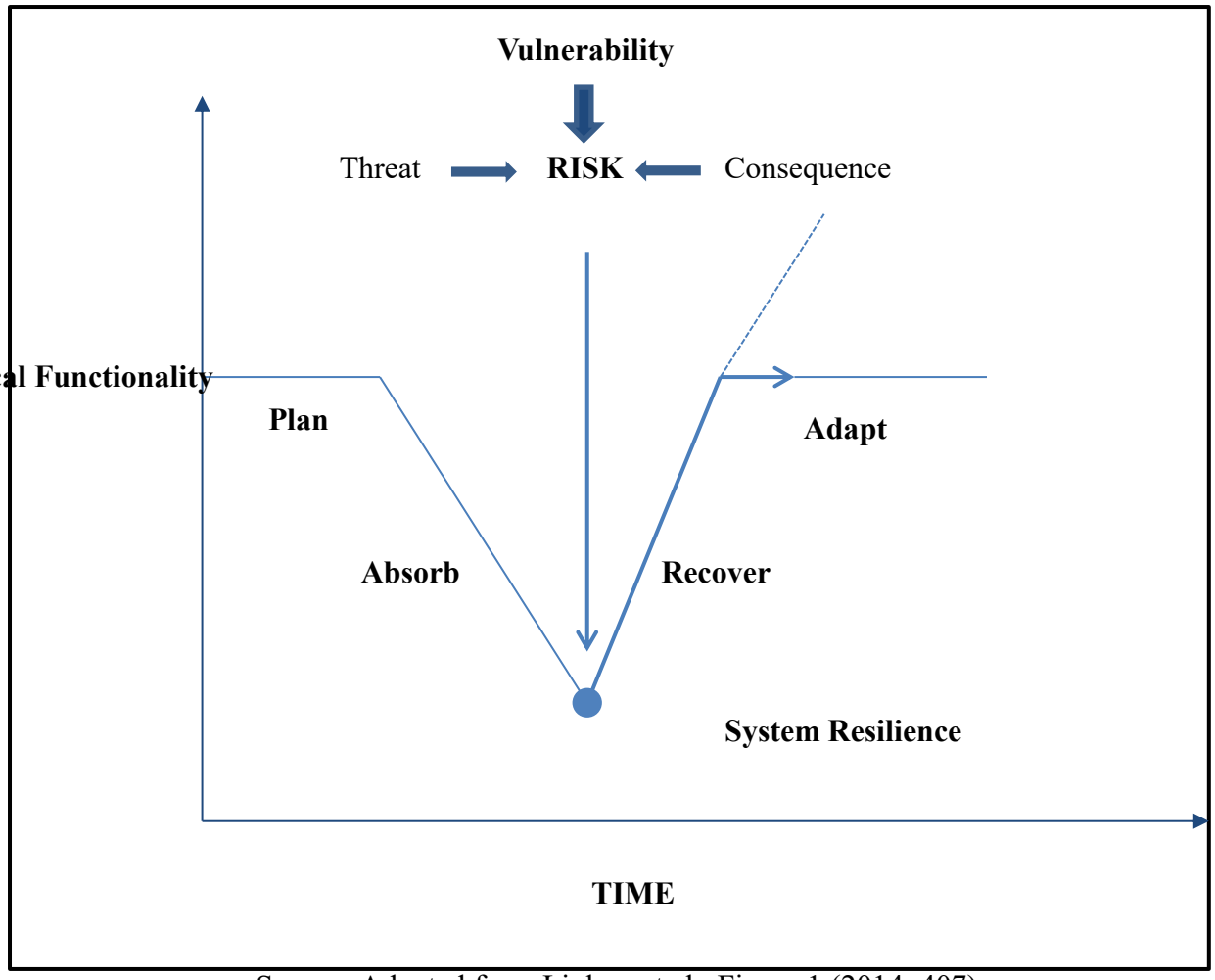
- Risk analysis that characterizes: threats, vulnerabilities and consequences.
- Risk analysis that determines the expected loss of critical functionality.
- An assessment of a system's ability to plan for, recover from and adapt to the risk event over time.
- An assessment of the total reduction in critical functionality and the resilience of the system (based on the slope of the absorption curve and the shape of the recovery curve).
- An assessment of whether the system is highly resilient by adapting in such a way that future functionality of the system may improve with respect to its initial performance.

It is important to understand that "resilience is not a substitute for principled system design or risk management"[427] but instead "is a complimentary attribute that uses strategies of adaption and mitigation to improve traditional risk management."[428] From a corporate governance perspective, a BoD should be aware that the strategies to build resilience include: "flexible response, distributed decision-making, modularity, redundancy, ensuring the independence of component interactions or a combination of adaptive strategies to minimize the loss of functionality and to increase the slope of recovery."[429]

Another important concept for the BoD is that interconnectivity not only applies to sources of risk but also to networks. The management of a single critical infrastructure system (Internet, electricity or telecommunications) relies on the functioning of a network of interconnected systems; resilience therefore can be enhanced by studying and improving networks with respect to their interconnectivity.[430] And as noted in the earlier case of United Airlines, social media networks also function in a similar manner and therefore their enhancement is also a component of resilience for a company to consider.

427 Ibid.
428 Linkov, I. et al. (2014: 407).
429 Ibid.
430 Linkov, I. et al. (2014: 208).

Figure 27: Resilience Management Framework



Source: Adapted from Linkov et al., Figure 1 (2014: 407).

As noted earlier, ERM practices based on probabilistic quantitative methods are of limited use with respect to uncontrollable risks which are complex and uncertain by nature. Therefore assessing and building organizational resilience becomes the best course of action for a BoD. Yet resilience building, like ERM, is an emerging discipline. Neither provides a conceptual framework to address uncontrollable risks inherent in a highly interconnected and interdependent global economy.

A. National Resilience Framework

The aforementioned discussion focused on organizational resilience but a contingent approach to the challenge of uncontrollable risks points to national resilience as a possible conceptual framework for a BoD that is concerned with uncontrollable risks. The concept of national resilience was conceived by the author and then introduced in the World Economic Forum's *Global Risk 2013* publication. It was influenced by the "glocal" approach of New Corporate Governance (integrating the strength of the 'market-based' and 'relationship-based' models). [431]

All enterprises operate within national borders. Moreover ERM and BCM are premised on some degree of state involvement when an uncontrollable risk event occurs. Second, uncontrollable risks are systemic in nature and therefore impacting systems that are maintained or managed by the public sector. Therefore it is helpful to conceptualize a country as a complex system itself -- but one that is comprised of critical national and sub-national systems and one that is also integrated into regional and global systems. Conceptualized as a system, a truly resilient country should then be capable of adapting to changing contexts, withstanding sudden shocks and recovering affected systems. Therefore it is worth repeating Hilb's argument that "for a world-class [or glocal] company to be consistently more innovative and successful than its competition locally, the board has to systematically and sustainably pursue and regularly measure the satisfaction and the voluntary loyalty of shareholder, customers, employees (including management) and the public."[432]

Building further on the conceptualization of a country as an adaptive system requires firstly identifying the critical sub-systems that operate at the national level. The sub-system taxonomy developed by the World Economic Forum (WEF) in its prototype national resilience framework is intriguing in this context.[433] The WEF identified five major national sub-systems that should be evaluated against five components of resilience.

The five national subsystems are:

- Economic: "Economic subsystem: includes aspects such as the macroeconomic environment, goods and services market, financial market, labour market, sustainability and productivity." [434]

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431 Hilb, M. (2008: 22).

432 Hilb, M. (2008: 23). In the New Corporate Governance framework, Hilb attributes the highest level of internationalization ("Development Stage IV") to those firms that pursue a glocal approach with respect to the composition of their board and management team. See Hilb (2009: 64).

433 The conceptualization of the prototype national resilience framework was develop in the context of the action research at the WEF.

434 WEF (2013: 37).

- Environmental: "Environmental subsystem: includes aspects such as natural resources, urbanization and the ecological system." [435]

- Governance: "Governance subsystem: includes aspects such as institutions, government, leadership, policies and the rule of law." [436]

- Infrastructure: "Infrastructure subsystem: includes aspects such as critical infrastructure (namely communications, energy, transport, water and health)." [437]

- Social: "Social subsystem: includes aspects such as human capital, health, the community and the individual." [438]

Each of the five subsystems is assessed across five components of resilience. The five components are categorized further into two types (resilience characteristics and resilience performance). There are three "Resilience Characteristics" to consider:

> **Robustness:** "Robustness incorporates the concept of reliability and refers to the ability to absorb and withstand disturbances and crises. The assumptions underlying this component of resilience are that: 1) if fail-safes and firewalls are designed into a nation's critical networks and 2) if that nation's decision-making chains of command become more modular in response to changing circumstances, then potential damage to one part of a country is less likely to spread far and wide." [439]
>
> **Redundancy:** "Redundancy involves having excess capacity and back-up systems, which enable the maintenance of core functionality in the event of disturbances. This component assumes that a country will be less likely to experience a collapse in the wake of stresses or failures of some of its infrastructure, if the design of that country's critical infrastructure and institutions incorporates a diversity of overlapping methods, policies, strategies or services to accomplish objects and fulfil purposes." [440]

435 Ibid.
436 WEF (2013: 37).
437 WEF (2013: 37).
438 WEF (2013: 37).
439 WEF (2013: 38).
440 Ibid.

> **Resourcefulness:** "Resourcefulness means the ability to adapt to crises, respond flexibly and – when possible – transform a negative impact into a positive. For a system to be adaptive means that it has inherent flexibility, which is crucial to enabling the ability to influence resilience. The assumption underlying this component of resilience is that if industries and communities can build trust within their networks and are able to self-organize, then they are more likely to spontaneously react and discover solutions to resolve unanticipated challenges when larger country-level institutions and governance systems are challenged or fail." [441]

Complementing the above mentioned characteristics are two "Resilience Performance" factors that describe how a particular system performs in a crisis:

> **Response:** "Response means the ability to mobilize quickly in the face of crises. This component of resilience assesses whether a nation has good methods for gathering relevant information from all parts of society and communicating the relevant data and information to others, as well as the ability for decision-makers to recognize emerging issues quickly." [442]

> **Recovery:** "Recovery means the ability to regain a degree of normality after a crisis or event, including the ability of a system to be flexible and adaptable and to evolve to deal with the new or changed circumstances after the manifestation of a risk. This component of resilience assesses the nation's capacities and strategies for feeding information into public policies and business strategies, and the ability for decision-makers to take action to adapt to changing circumstances." [443]

There is an important sixth "R" that is unmentioned in this framework – Reserves. For a national economy, budget reserves are arguably the most important guarantor of resilience as evidenced by the continuing saga over the future fate of Greece in the European Union on account of its fiscal history. With or without adequate reserves, national resilience is linked to adaptability (*timely adaptation* in response to a changing environment) and to recoverability (the capacity for *speedy recovery* after a crisis). The ability to adapt to a changing environment and to recover from a crisis is critically important from both an enterprise risk management and a corporate governance perspective. However an executive team faces an intrinsic disadvantage when confronted by uncontrollable risk as ERM strategies are most effective when the predictability of risk is relatively high and its effects and remedies are

441 WEF (2013: 38).
442 WEF (2013: 38).
443 Ibid.

largely known. In an entirely opposite situation, resilience should be emphasized over preventive strategies.

The challenge for a corporation is that resilience is strengthened over time – i.e., it entails experiencing and recovering from multiple shocks. It is hard to imagine that the devastation from the Great East Japan Earthquake could have been much worse (beyond a full-fledged nuclear meltdown). Yet if analyzed narrowly in terms of earthquake preparedness and earthquake recovery, Japan's resilience had in fact strengthened over time as a result of past natural disasters (Table 23).

Table 23: Resilience Building over Time (Earthquakes)

Earthquake	Year	Dead or missing	Lessons from the Disaster	Post-Disaster Policy Changes
Nobi	1891	7,300	Government made aware of the importance of earthquake measures.	Disaster prevention investigation committee established; research began into Western methods for earthquake resistant construction.
Great Kanto (Tokyo)	1923	105,000	Building constructed using Western methods collapsed; large-scale fires from traditional wooden houses.	Revised town construction law, with anti-fire planning codes and the world's first earthquake resistance regulations.
Miyagi	1978	28	Concrete apartment buildings thought to be resistant collapsed.	Major revision of construction standards; new design law aimed to ensure all new buildings can withstand a seismic intensity 7* earthquake.
Hokkaido Nansei-oki	1993	230	Tsunami arrived before the warning system could function.	Shortened forecast time from five minutes to three minutes.
Hanshi Awaji (Kobe)	1995	6,437	98% of buildings that were destroyed were built before the amended construction law. Local government functions disrupted: - Prime Minister not notified for 2 hours - Delayed response by firefighters - Delay in identifying - Donations insufficient for rebuilding	Law enacted improving earthquake resistance of existing structures. Rapid top-down response enabled: - Crisis center established at the PM's residence - Law revised to expedite emergency response - Better observation points to identify damage - Government upped financial support for victims

Source: Adapted from WEF, Figure 21 (2012: 30).

VI. Summary of Part Two

Part two (Theoretical Review) introduced the development of risk management into five distinct historical phases which are often associated with a major global economic or corporate governance crisis. Although there is no obvious sixth phase of development that follows from the global financial crisis of 2008, there are significant shifts with regard to the measuring and reporting of market risk particularly in the financial industry with respect to their trading portfolios. For example, stress testing has gained strong endorsement among financial regulators and central banks.

At the board level, there are efforts being made to assist directors to better identify critical risks; to understand how such risks interconnect; and to recognize the potential compounding of those risks. The most important consideration with regard to uncontrollable risks is the compounding effect of multiple simultaneous occurrences of a risk event. It is also a difficult analytical process for a Board of Directors (BoD) as it also requires having a rudimentary understanding of the risk interdependency among the risks identified as interconnected. Moreover, interconnected and interdependent are two distinct concepts. In this regard, risk mapping and scenario analyses are gaining in appeal as quantitative models are incapable of accurately portraying uncontrollable risks given their uncertain nature. Among the most effective and new risk assessment processes to consider in the context of innovative risk mapping is the *Global Risk Report*[444] published annually by the WEF which will be examined in-depth in part three (Empirical Analysis).

Although the discipline of risk management is still evolving, the normative literature considered "foundational" are the 2004 report of the Committee of Sponsoring Organizations of the Treadway Commission (COSO), "Enterprise Risk Management-Integrated Framework" and the International Organization for Standardization's (ISO) 2009 publication, ISO 31000 ("Risk Management—Principles and Guidelines on Implementation"). The 2009 ISO framework emphasizes the implementation of an international standard of risk management principles across all industries whereas COSO places an emphasis on supporting the integration of existing risk management process. However the two issues of risk appetite and decision-making remain a source of criticism of the COSO framework in the wake of the global financial crisis as failures of both were revealed in some of the most sophisticated and successful international financial institutions.

Kaplan and Mikes therefore argue that the effectiveness of Enterprise Risk Management (ERM) is contingent on the organization's context and circumstances.[445] The appeal of a

444 The author of this section served as its Editor-in-Chief of the 2012 and 2013 editions.
445 Ibid.

contingency approach to ERM is that instead of searching for a universal risk management system that should be applied in all circumstances the focus is on the specific circumstance for using an appropriate risk management system for a particular firm. There is increasing concern that publicly listed companies continue to perform poorly with regard to the ex ante identification of risks. However the salient consideration in the context of uncontrollable risks is regarding how a board can identify ex ante a risk that is unknown or unknowable.

This study contends that an uncontrollable risk event presents an adaptive challenge to an organization rather than a technical one. Moreover given its supervisory role with regard to Corporate Risk Management (CRM), the BoD is therefore the foremost collective intelligence within an enterprise. The board is also the appropriate forum for the in-depth review of uncontrollable risks provided that they have adopted an integrated corporate governance framework: such as New Corporate Governance (NCG). The NCG framework is comprised of four distinct elements which Martin Hilb describes as being based on a reverse KISS principle ("Situational, Strategic, Integrated and Keep It Controlled"). The Theoretical Review introduces each of the model's four dimensions (situational, strategic, integrated and controlling). Part three (Empirical Analysis) will focuses more narrowly on the situational and strategic elements such as the diversity of the board team and the open-mindedness of board culture in the context of uncontrollable risks.

One source of major criticism on ERM practices is the ex ante identification of risks. Based on part two (Theoretical Review), the practical challenges to consider in part three (Specific Empirical Analysis) and part four (Summary and Recommendations) include:

- How does a BoD introduce "risk envisioning" processes related to identifying uncontrollable risks and their interconnectivity in a manner that is "highly interactive"?

- How does a BoD approach the issue of assessing organizational resilience in the context of uncontrollable risks?

- How does diversity (or its absence) within a BoD impact the above two questions?

Acknowledging that the means to predict or prevent an uncontrollable risk event are not yet available, organizations are advised to focus on strengthening resilience. The study posits that organizational resilience coupled with Business Continuity Management (BCM) is the essential when confronted by catastrophic risk that is unavoidable and unpredictable. Therefore resilience is a highly relevant concept for a BoD concerned with uncontrollable risks.

Part Three: Empirical Analysis

I. Research Overview

The objective of the empirical analysis is to contribute to the understanding of uncontrollable risks by using quantitative and qualitative methods; results from both methods should assist a Board of Directors (BoD) conceptually and practically. As presented in part one (Introduction), the following definition of an uncontrollable risk is used throughout this study:

> *An uncontrollable risk is a critical uncertainty whose nature and causality may be known or knowable but the means to predict or prevent its occurrence are not yet available.*

Based on the above definition, there is a presumption that the probability and the mode of occurrence of such a risk event are indeterminable thereby inhibiting practical notions of control. Moreover there is the related presumption that any response to such a risk event entails collaborating with various stakeholders including public sector actors. Therefore the integrated research question addressed by this dissertation is framed as follows:

> *What are uncontrollable risks and how do they affect the role of the BoD and what can be done to address those effects?*

Part one of the study introduced working definitions and relevant categories of risk in order to present the framework of Corporate Risks Management (CRM) and to explain what are uncontrollable risks. Part two (Theoretical Review) examined existing risk management frameworks as well as common practices, relevant social science theories and relevant new disciplines (e.g. complexity and behavioral sciences) to address the second element of the integrated research questions: the effect of uncontrollable risks on the role and responsibility of a BoD.

Therefore the third part (Empirical Analysis) and fourth part (Summary and Recommendations) aim to present research findings and practical recommendations regarding what actions a BoD should consider to address the effects of uncontrollable risks. The quantitative and qualitative research in the third part focuses specifically on the inter-related problems of:

- Improving the ex ante identification of, and differentiation among, uncontrollable risks by promoting a diversity of risk perspectives.

- Developing approaches to risk mapping that consider risk interconnectivity (i.e., intersecting vulnerabilities and cascading consequences) even if the linkages are considered very unlikely to materialize.

The fourth part of this study (Summary and Recommendations) will integrate the quantitative and qualitative research findings to suggest:

- How a BoD can introduce risk envisioning dialogue related to the ex ante identification of uncontrollable risks in a highly interactive manner.

- How a BoD can approach the issue of assessing organizational resilience in the context of uncontrollable risks.

- How promoting diversity within a BoD and focusing on risk interconnectivity can improve the outcomes of both.

A. Objectives

Uncontrollable risks are similar to the "known unknowns" in risk parlance, but also encompass "unknown unknowns" because their probability and mode of occurrence are indeterminable in many instances. Therefore uncontrollable risks require further innovation of routine or traditional risk management methods as insurance protection, risk avoidance and hedging strategies are of limited application. Given both the emergent[446] and contingent[447] nature of the problems, a hybrid approach of quantitative and qualitative research methods were undertaken to explore them.

The ex ante identification of risks is a particularly vexing challenge for a BoD and is even more so in terms of uncontrollable risks. Insights from behavioral science and complexity science indicate that diversity of thinking within a board would be an essential and constructive attribute to address this challenge. A quantitative research approach was taken to test this assumption with regard to diversity and risk perception.

A second important challenge, conceptually as well as in practice, for a BoD is in the identification and analysis of interconnected risks, particularly with exogenous risks

446 Emergent in this context refers to the notion of emergence associated with complexity science whereby novel patterns, entities and regularitiese emerge that were not predicted by a system's constituents or the system itself.

447 Contingent in this context refers to the notion of contingency associated with organizational theory whereby there is no best way of risk management and any optimal approach will be dependent upon the internal and external situation as presented.

considered unlikely to materialize in terms of their probability. Criticism of current corporate governance of risk management suggests that significant performance improvements are possible in this regard despite the dearth of practical guidance available to a BoD on this problem. A qualitative research approach was taken to test this performance assumption by interviewing board members from multinational corporations confronted by both the problem and the criticism.

B. Approach

As stated in part one (Introduction), a new empirical study is often considered to be exploratory in the absence of conceptual frameworks or clear proposals related to the phenomena that readily available and easily accessible. The salient observation in this regard is that Black Swan Events (BSE), systemic risk and global shocks have each entered the lexicon of Enterprise Risk Management (ERM) in the absence of a robust practical framework for their identification, mitigation and management.

Therefore this study has categorized major risk events such as the financial crisis in 2008, the H1N1 influenza pandemic in 2009 and the Great East Japan Earthquake in 2011 as uncontrollable because their nature and causality may be known or knowable but the means to predict or prevent its occurrence are not yet available. Having categorized the phenomena under the rubric of uncontrollable risks, the study examines their association with existing methods of identifying exogenous or external risks (or rather uncertainties). It also examines if such methods successfully reduce the reliance upon questionable probability assumptions as well as enable the contemplation of risk interconnectivity in a systematic manner.

Moreover this study of uncontrollable risks and their impact on a BoD can be further characterized as moving from nascent to intermediate theory. Intermediate theory development entails proposing new constructs or provisional theoretical relationships, which in turn rely upon on the integration of quantitative and qualitative data. Therefore a hybrid research strategy was selected. This strategy was enabled primarily by action research methods because of its efficacy for linking theory with practice by: 1) observing events and processes; 2) collecting personal accounts by participants and 3) capturing changes in the accounts as time passes. However, the more salient consideration for pursuing an action research approach is that it is concerned with "systemic relationships, rather than with single theories – the aim is to understand conceptual and theoretical frameworks where each theory can be understood in the context of other related theories."[448] Part four (Summary and Recommendations) will further demonstrate the merits of this approach as the influence of

[448] Eden, C. & Huxham, C. (1996: 80).

uncontrollable risks are considered in the context of the theoretical frameworks introduced in part two (Empirical Analysis).

C. Limitations

As highlighted in part one (Introduction), the range of uncontrollable risks for an enterprise to consider is theoretically limitless given their exogenous origin. Their study therefore requires practical and conceptual research boundaries to be established and as such limits were applied with regard to the hybrid research strategy.

The quantitative research conducted was focused exclusively on survey data related to fifty global risks (annual surveys were conducted in 2011 and 2012).[449] The surveys were designed by the author and administered in the context of the action research conducted at the World Economic Forum (WEF). The survey population was limited to individuals known through their current affiliation with a Forum community, active engagement in a related project or recent participation in a formal activity. The surveys required access to the Internet as it was sent exclusively by electronic mail (email) and required opening an online survey.

The qualitative research conducted focused primarily on the formal interview of board members of corporations affiliated with the WEF. The individuals selected were mainly from multinational companies (MNCs) given the experience and sophistication in operating across different regions and economies as well as working with different cultures and multiple industries. However the research aim was to identify new approaches and practices at the board level that would be relevant, applicable and accessible to small and medium enterprises. The qualitative analysis was therefore focused on basic board behavior and common conceptual approaches to uncontrollable risks that were not dependent upon resources or technologies available or accessible to only large MNCs. Given the sensitive nature of the research topic, the interviews were conducted confidentially and therefore responses presented in this study are not attributed directly to an individual or a particular company. However, all persons interviewed were either already known by the author in his professional capacity or were introduced to him by a common acquaintance familiar with the research topic.

[449] The Global Risks Perception Survey of the World Economic Forum (WEF).

II. Research Procedure

As noted in the prior section, a hybrid research strategy was selected for this study while the results were obtained via an action research approach. In its most common interpretation, action research is considered to produce outputs that result "from an involvement with members of an organization over a matter which is of genuine concern to them."[450] In the context of the action research conducted in this study, the umbrella organization is the World Economic Forum (WEF), whose members represent major institutions from the public and private sectors and the matter of genuine concern to them is global risks (i.e. uncontrollable risks). Their involvement entails research activities conducted by the author to collect quantitative and qualitative data related to uncontrollable risks.

The WEF was established in January 1971 when a group of European business leaders met under the patronage of the European Commission and European industrial associations in Davos, Switzerland at a seminar organized by Professor Klaus Schwab of the University of Geneva. He subsequently established a membership funded, not-for-profit foundation that was initially called the European Management Forum and subsequently changed its name to the World Economic Forum in 1987 to reflect its global mission of improving the state of the world through public-private collaboration. As of 2014, its operating budget was over CHF 200 million with over 500 staff located in offices in Geneva, New York, Beijing and Tokyo. On 23 January 2015, its status as an international institution was formalized by an agreement with the Swiss Federal Council under the country's Host-State Act (HSA).[451]

The quantitative data was collected via two international surveys to measure differences in the perceptions of global risks. The second and largest (in terms of sample size) of the two surveys was used for this study; a revamped Global Risk Perception Survey (GRPS) was designed by the author and administered by the WEF in 2011 and then revised and administered again in 2012.[452] Its redesign and findings are introduced in the section that follows. The scope of the qualitative analysis was informed by via workshops with members of the WEF's Risk Response Network (RRN)[453] in 2013. This was then followed by structured interviews of board members from large multinational corporations (MNCs) as well as semi-structured interviews with members of the WEF's Community of Chairpersons

450 Eden, C. & Huxham, C. (1996: 75).

451 See http://www.weforum.org/news/world-economic-forum-gains-formal-status-switzerland (last visited on 6 May 2015). The HSA can be found at: https://www.eda.admin.ch/eda/en/fdfa/foreign-policy/international-law/privileges-and-immunities/host-state-act.html (last visited on 7 May 2015).

In June of 2011, the author was offered the opportunity to revamp the WEF's risk program , partly in the context of his doctoral studies and the action research conducted in this study.

453 The launch of the WEF's Risk Response Network was publicly announced on 26 January 2011 at its Annual Meeting in Davos, Switzerland. See http://www.weforum.org/news/risk-response-network-proactively-preparing-threat-global-risks (site last visited on 12 April 2015). It was subsequently disbanded as a formal initiative in September 2013 as part of a broader reorganization at the WEF. The author had left his adjuct role in the risk programme at the end of the WEF's fiscal year (30 June 2013).

in 2015[454]. Again all of the activities were conducted in the context of the author's action research at the WEF on uncontrollable risks.

A. WEF Global Risk Report (2006 – 2013)

As noted in part one (Introduction), the World Economic Forum (WEF) published the first edition of its annual report on global risks in 2006. It stemmed from an earlier initiative in 2004 that aimed to "identify and assess key current and emerging systemic risks to global business, to study the links between them to assess their likely effect on different markets and industries, and to advance the thinking around more effective mitigation."[455] The initial list of 25 global risks were a selected using a qualitative process of consulting with risk experts from the public and private sector. The selection was determined subjectively and based on six criteria across five categories of global risks.[456]

A second edition of the report was published in 2007 and featured 23 risks; the methodology for the selection was unchanged and the risks were assessed in terms of likelihood (probability expressed in percentage terms) and severity (expressed in either costs in USD or in number of deaths caused).[457] A notable analytical change was the inclusion of a qualitative "global risk barometer" based on expert judgement of whether the seriousness of a global risk has become more or less acute.[458] The notable practice contribution was the recommendation to national governments to create the position of a "Country Risk Officer" similar to the Chief Risk Officer (CRO) position in business enterprises.[459] The position is "intended as a focal point for managing a portfolio of risk across disparate interests, setting national prioritization of risk and allowing governments to engage in the forward action needed to begin managing global risks rather than coping with them."[460] Coming a year before the onset of the financial crisis of 2008, the most notable global risk (in hindsight) that was identified was a "blow up in asset prices/excessive indebtedness." The risk was described as follows:

The WEF is funded principally by its 1000 members and partners that comprise mainly of leading multinational corporations and represented mainly at Forum activities at the executive management (CEO) and supervisory board (Chairman) levels.

455 WEF (2006: 2). The report is at: http://www.weforum.org/pdf/CSI/Global_Risk_Report.pdf (last visited on 6 May 2015).

456 WEF (2006: 14).

457 WEF (2007: 8). "In addressing likelihood, actuarial principles were applied in the few cases where sufficient data existed; in most cases only qualitative assessments, based on expert opinion, were possible. In assessing severity, two indices were considered: destruction of assets/economic damage and – where applicable – human lives lost. Although some risks are inherently long term (such as climate change), and others (such as an oil-price shock) could occur in the near term, all risks were evaluated within a 10-year time frame." Id. At 5.

458 WEF (2007: 10). The report is at: http://www.weforum.org/pdf/CSI/Global_Risks_2007.pdf (last visited on 6 May 2015).

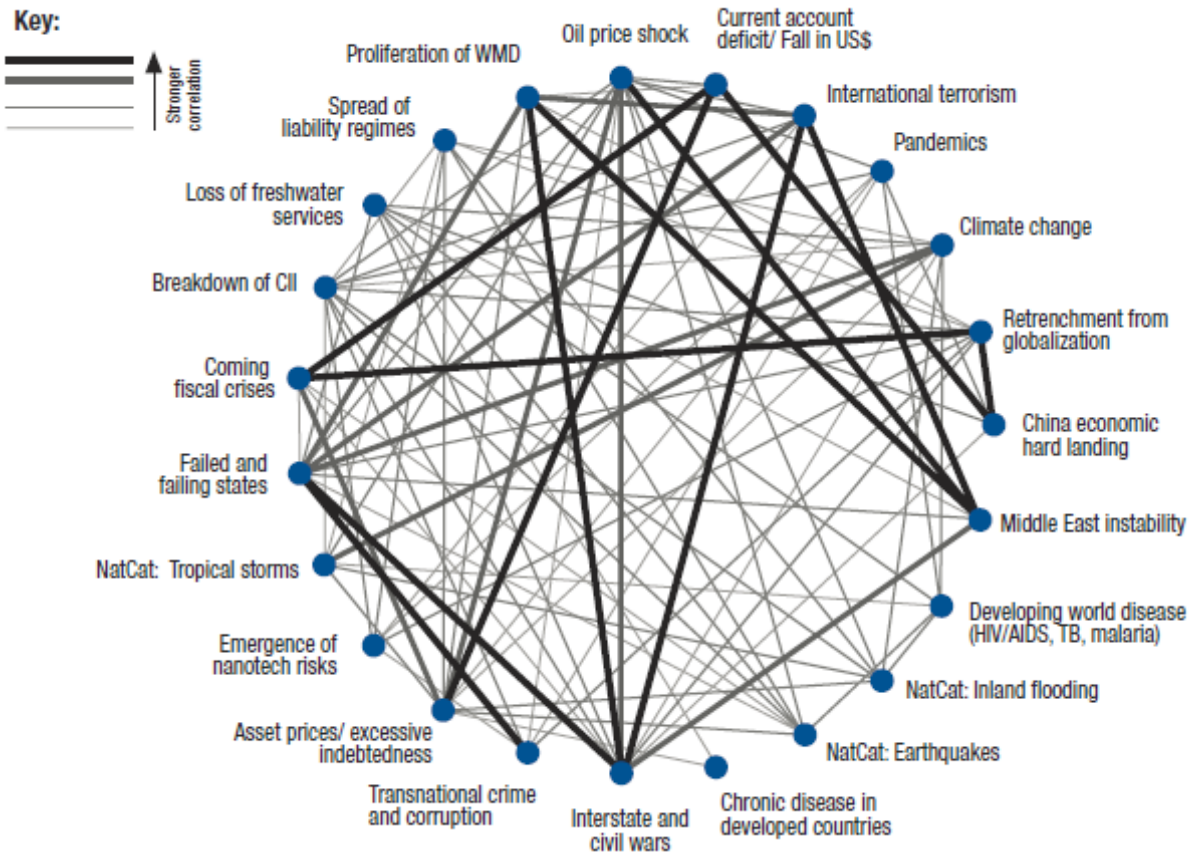
459 WEF (2007: 5).

460 Ibid.

> "House prices have doubled in most mature markets (and in some emerging markets) in real terms over the last 10 years, putting price-to-income ratios at all-time highs. Many experts fear a major correction, with differential impacts on consumption, economic growth and other asset prices." [461]

The other significant development from the 2007 report was with mapping risk connectivity. The report produced its first correlation matrix across the global risks, which laid the foundation for further innovation in this area in the following year's report (Fig 28).

Figure 28: Global Risks Correlation Matrix



Source: WEF, Correlation Matrix (2007: 13).

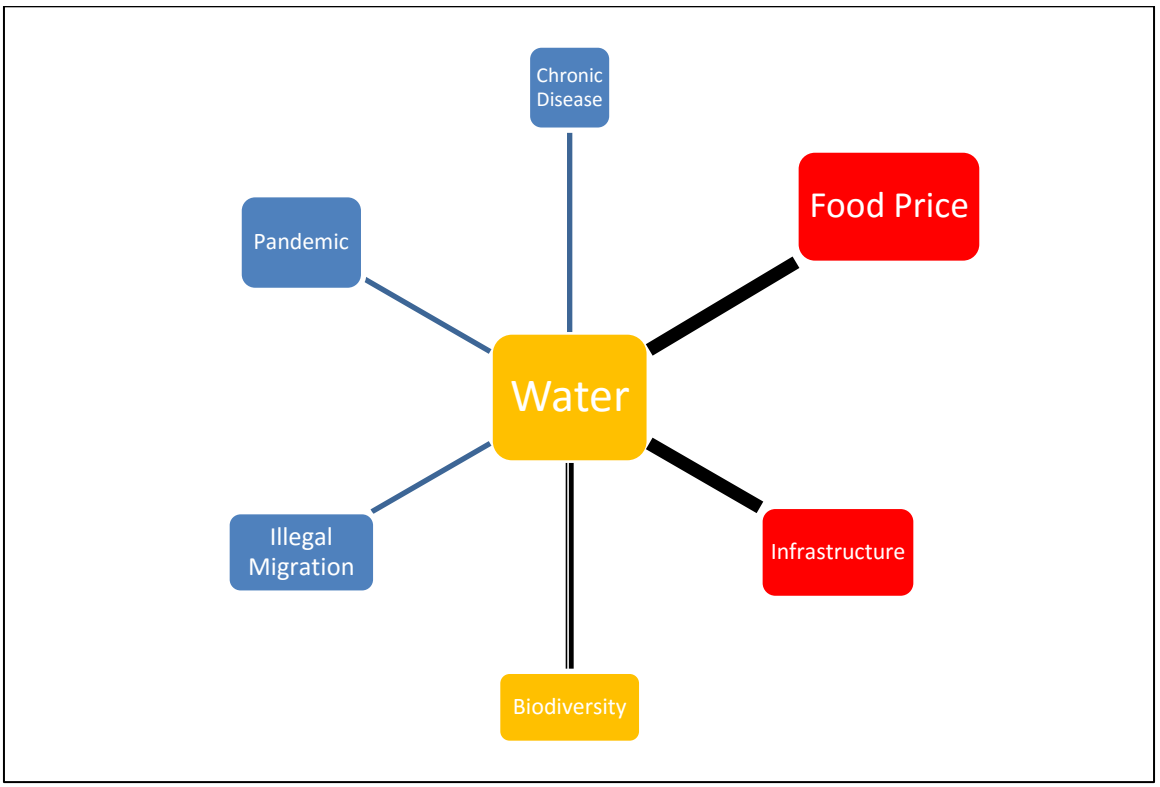
The following 2008 report was relatively unchanged with regard to the number and types of risks assessed and their methods of assessment; however the topic of systemic financial risk would loom large throughout the year. The notable research difference with the report was its attempt to apply social network analysis to understand the correlation between the risks. Attention was given to how the structure and ties affect risk transmission versus treating each risk as a discrete unit of analysis.[462] The spatial proximity of the nodes represented similarity

461 WEF (2007: 10).

462 WEF (2008: 25). The report is at: http://www.weforum.org/pdf/globalrisk/report2008.pdf (last visited on 6 May 2015).

in risk correlations (i.e. risks with similar bivariate correlations are closed to together).[463] The aim of the map was to illustrate the different ways in the identified risks are interconnected as well as possibly identifying "pivotal nodes" that are critical to the diffusion of risk across the system.[464] The result was a map or rather a network diagram with the size of the nodes denoting the severity of individual global risk and the thickness of the connecting lines showing the strength of correlation between the risks (Figure 29).

Figure 29: Visualization of a Global Risk Node (Water)



Source: Adapted fromWEF, Figure 8 (2009: 16).

After multiple economic shocks, the 2009 report introduced greater rigor into both its qualitative and quantitative approach. The roster of risks increased to 36 from 31 the previous year.[465] The mapping methodology introduced in 2008 was maintained in terms of assessing the strength of a risk relationship. The map itself was referred to as the Risks Interconnection Map (RIM) with its highlighted connections based on the survey data of a Global Risk Perceptions Survey (GRPS) completed online by over 120 experts.[466] The 2010 edition once again featured the RIM developed by using the GRPS data collected from more than 200 experts who were surveyed to assess the likelihood, severity and interconnections of the

463 WEF (2008: 26).
464 Ibid.
465 WEF (2009: 5). The report is at: http://www.weforum.org/pdf/globalrisk/2009.pdf (last visited on 6 May 2015).
466 WEF (2009: 6).

global risks identified by the WEF. However the 2010 report also acknowledged that the interconnections identified did not always reflect a direct causal relationship but also suggested indirect linkages based on common impacts or mitigation trade-offs.[467]

The 2011 report was once again developed from data collected from a perception survey conducted online that received approximately 580 valid responses across 37 global risks.[468] Since 2006 the number of global risks had changed each year, largely due to the inclusion and exclusion of region or country specific geopolitical risks but the five categories of global risks in the report have remained the same. Survey respondents for the 2011 report were asked to do the following:

- Assess risk likelihood and impact over a ten year time horizon (2010-2020)
- Provide their level of confidence in their answers
- Choose up to six other risks they judged were related to the risk being assessed
- Add data (optionally) on the dominant type of interconnection between risks

The 2011 report acknowledged that how risks are perceived is not equivalent to the actual exposure faced. This and as well as other conceptual and methodological issues highlighted in earlier additions would drive the design and development of the 2012 and 2013 reports in the context of the action research conducted at the WEF on uncontrollable risks. The quantitative analysis that follows stems from changes made to the 2012 and2013 reports but the main findings are based on data used in the 2013 publication.

B. WEF Community Consultations

As noted earlier regarding the action research conducted in this study, the umbrella organization is the World Economic Forum (WEF). It is described as such because their members and stakeholders represent major institutions from the public and private sectors but their engagement is anchored to one of the WEF's multiple communities. In the context of this action research study, the matter of genuine concern to them was identified was global risks (i.e. uncontrollable risks). Their involvement on this issue was the focus of the action research activities that led to the collection of quantitative and qualitative data related to uncontrollable risks. This section introduces the WEF communities that participated in this study but begins with an introduction of the institution itself.

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467 WEF (2010: 36). The report is at: http://www3.weforum.org/docs/WEF_GlobalRisks_Report_2010.pdf (last visited on 6 May 2015).

468 WEF (2011: 43). The report is at: http://www.weforum.org/reports/global-risks-report-2011 (last visited on 6 May 2015).

The World Economic Forum in its own words, "builds, serves and sustains communities through an integrated concept of high-level meetings, research networks, task forces and digital collaboration."[469] Its function however has been characterized by external academic researchers as "a transnational think tank addressing a non-national audience" whereby "the partnerships, the working groups, and the communities, significantly extends the reach of the WEF, allowing it to reach across organizational boundaries."[470] In their 2014 case study of the WEF, Christina Garsten and Adrienne Sörbom characterize the institution as a brokerage of ideas and knowledge in the policy market:

> " In spite of neither selling nor buying products, and in spite of not being a formal regulator of market actors, it functions as a market intermediary through its involvement as a third party at the level of discourse. In this role, the Forum promotes ideas and practices that relate to the organizing or reorganizing of markets in various ways." [471]

They categorize the institution's promotion activities into three general types that include "networking (bringing the right people together to meet and discuss the right subject), construction of organizational techniques (such as ranking and indexing), and diffusion of solutions (official and non-official in the form of reports, media contacts, projects, etc.)."[472] In their analysis, the WEF functions essentially as a hub "where topics, solutions and people are chosen and decided upon" at the invitation of the organization. However the salient functional consideration in their view is the following:

> "What they do at the table, and to what degree the Forum is able or interested in steering what happens at the table, is an empirical question. It varies from setting to setting. What is of importance here is the organizing role of the Forum." [473]

In the context of this research topic (uncontrollable risks and the role of the BoD), there are two WEF organized communities of direct and material relevance:

- The WEF's Risk Response Network (RRN) was formed in winter of 2011 and then disbanded in autumn 2013 as its experts were integrated into other WEF expert

469 See page 2 of their institutional brochure, which is available online at: http://www3.weforum.org/docs/WEF_InstitutionalBrochure_2014.pdf (last visited on 6 May 2015).
470 Garsten, C. & Sörbom, A. (2014: 2).
471 Garsten, C. & Sörbom, A. (2014: 6).
472 Ibid.
473 Garsten, C. & Sörbom, A. (2014: 6).

communities.[474] By engaging a pool of over 1500 leaders and experts from academia, industry and international organizations, the aim of the initiative was to examine critical global risks beyond the capacity of any single country or company to tackle. The community's principal research contribution to this study is in their response to the WEF's Global Risk Perception Survey of 2012 and 2013. In addition, the author organized a one-day workshop (Advisory Meeting on Global Risks) held on 12 June 2013 in Geneva, Switzerland that convened 84 members of the RRN to discuss issues linked to this study. A list of member institutions of the RRN (as of July 2011) is included in the appendices.

- The WEF's Community of Chairman was established in 2013 and remains one of its most senior and select group of business leaders. Participation is limited only to the non-executive chairman of a supervisory board (and in some instances the lead independent director). It has engaged 75 such chairs in various private discussions on topics selected by its members. The community's principal research contribution to this study has been the participation of its members in formal and informal interviews related to uncontrollable risks conducted by the author exclusively in his research capacity for this study.

[474] Global risks are defined in the Global Risks Report as risks which no single country, region, sector or industry is likely to be able to confront or prevent on their own

C. Board Member Interviews

Interviews were arranged with supervisory board members of multinational corporations based in North America, Europe and Asia. For formal interviews, the questions were presented in advance of the interview date, the actual interview itself allowed for additional questions or comments given the researcher's familiarity with both the respondent and the topic of inquiry. Given the sensitive nature of the research topic from both a competitive and liability perspective, the interviews (formal and informal) were conducted confidentially and in equal number. Therefore all responses cited in this study are not attributed directly to an individual or a company. All persons interviewed formally were either already known by the author in his professional capacity or were introduced to him by a common acquaintance familiar with the research topic. Also nearly the same number of informal interviews were also conducted that contributed to this study.[475] The benefits of allowing unstructured elements into such interviews in the context of this study are:

- Developing a practical understanding of an as-of-yet not yet fully understood or appreciated experience (uncontrollable risks) in a particularly setting (board discussions).
- Allowing the researcher the opportunity to test his preliminary understanding of uncontrollable risks yet allow for the respondent to provide new ways of framing and understanding of the issue.
- Providing important guidance on how to design future structured interviews or surveys to support additional research on uncontrollable risk.

In this regard, the author was invited as an academic researcher to participate at the 2nd annual retreat of the World Economic Forum (WEF) Community of Chairman that took place on 18-19 April 2015 in Villars-sur-Ollon, Switzerland. Many participants were interviewed informally at that event (two were done formally as part of this study); a list of participants is included in the appendix.

475 See http://www.qualres.org (last visted on 8 May 2015) for an overview of qualitative research guidelines and the characteritics of unstructured interviews. The website is funded by The Robert Wood Johnson Foundation as part of its Qualitative Research Guidelines Project to help resesarchers in developing, evaluating and engaging in qualitative research projects in a healthcare setting.

III. Quantitative Analysis

A. Global Risk Perception Survey (GRPS)

The Global Risks Perception Survey (GRPS) is administered in the summer or autumn before the report's final release in January of the subsequent year (i.e. the 2010 GRPS provides the data for the 2011 report). Moreover since the initial publication of the Global Risks Report (GRR) in 2006, the number of global risks assessed each year has varied due to the inclusion and exclusion of region or country specific geopolitical risks. However the five categories of global risks in the GRPS have remained the same. The survey is conducted entirely online whereby a WEF addressed e-mail is sent to that invites experts to respond via a survey website administered by a third party vendor. The author modified the design of the GRPS administered in 2011 and 2012 in the context of his action research related to uncontrollable risks. The quantitative analyses of the data from those two surveys substantiate many of the recommendations at the board and company level presented in part four of the study (Summary and Recommendations). However only the results of the 2012 GRPS are analyzed in depth for this study given its larger number of respondents as well as additional metrics (e.g. age group) in comparison to the 2011 survey data.

The definition of global risk as put forth by the WEF in the GRPS has the following characteristics[476]:

- global geographic scope;
- cross-industry relevance;
- uncertainty as to how and when they may occur;
- high levels of economic and/or social impact; and
- requiring a multistakeholder response

For the purposes of this study and of the analysis of the GRPS data that follows, it is also important to consider:

- The definition and use of the term (or its variants) in the public sector. For example, the OECD's working definition of a 'global shock' highlights the swiftness of occurrence (or the surprise or shock element) as a distinct characteristic.[477]

- The definition and use of the term (or its variants) in the private sector. For example, in risk management literature, global risk is referred to as uncontrollable risk in the context of external risks related to project planning.[478]

476 WEF (2012: 13).
477 OECD (2011: 12).
478 Merna. T. & Al-Thani, F. (2008: 20).

1. Survey Redesign (2011 & 2012)

The quantitative research for this study builds off the redesign of the GRPS in 2011. However the research findings are based exclusively on 2012 GRPS as part of the action research adopted for this this study. Perception surveys are prone to criticism as such a survey seeks to reveal what people think and as such the data is based on opinion rather than fact (i.e. hard data that can be accurately measured and collected at regular intervals). Moreover a perennial criticism in the context of risk management research is with the notion that how risks are perceived is not equivalent to the actual exposure faced. However this study contends that such argumentation is less salient considering the following four observations highlighted in part two (Theoretical Review) :

1. In the wake of the global financial crisis, the OECD warns of the shortcomings of risk management models that rely on questionable probability assumptions.
2. The OECD also advises that corporate governance standards should place sufficient emphasis on ex ante identification of risks.
3. Behavioral science cautions that when presented with a choice, most of us are averse to ambiguity and therefore will prefer a probabilistic outcome over an outcome where the probabilities are unknown or unknowable.
4. Complexity science reveals that complex system dynamics result in small changes having big effects or vice versa.

Moreover there is significant academic research that support the notions that "[r]isk perception has a crucial influence on risk-taking behavior"[479] and that "people are poor assessors of risk."[480]Therefore the efforts to redesign the GRPS were not directed at addressing or rebutting prior methodological criticisms but to give greater consideration to the aforementioned four concerns and to recognize that subjectivity is a key factor in risk assessment. The data analyzed in this section is based on the data collected from the redesign of the 2011 and 2012 surveys (Table 24).

[479] Merna, T. & Al-Thani, F. (2008: 33). Empirical evidence is cited demonstrating its influence on individual, team and group behavior.

[480] Ibid.

Table 24: Changes in the GRPS (2011 & 2012)

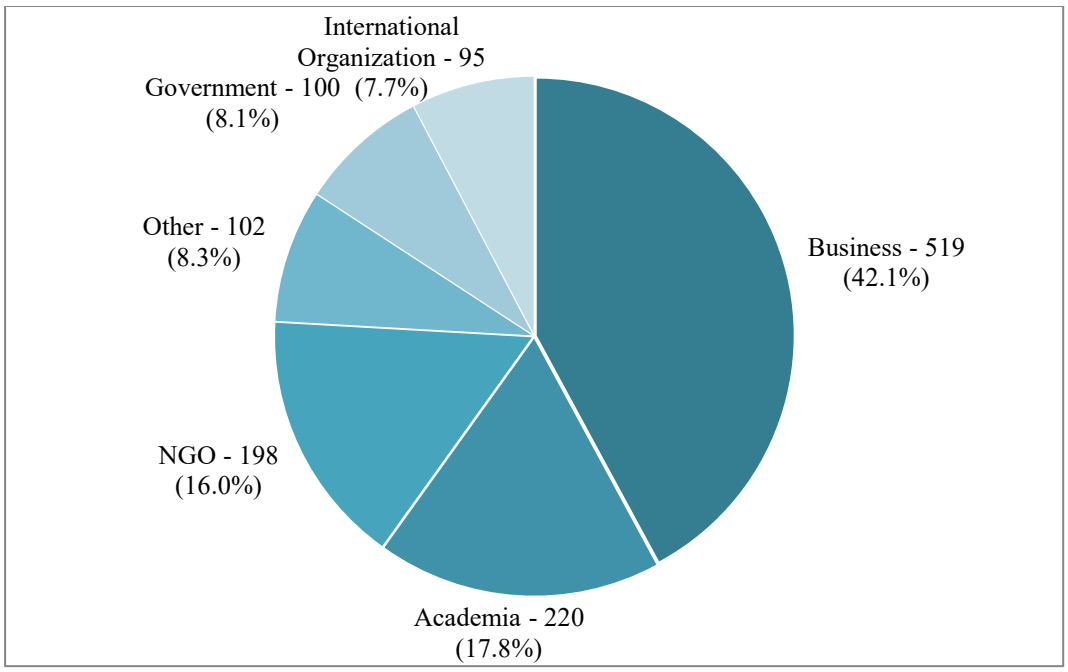
GRPS Elements (--2010)	Changes in 2011 and 2012	Comment
Assess global risks over ten year time horizon	Assess over ten year time horizon but also track same set of risks for ten years	Change of approach introduced in 2011
Asses 37 global risks in five categories	Assess 50 global risks in five categories	
Assess perceived impact in terms of USD (in billions)	Perceived global impact assessed beyond economic consequences on a simple 1 (low) to 5 (high) scale	Change of scale introduced in 2011
Assess perceived likelihood in terms of range of probabilities	Perceived likelihood of risk occurring in the next ten years is done with a simple 1 (very unlikely) to 5 (almost certain) scale	Change of scale introduced in 2011
Inclusion of global risk that specifies a region or country of origin (e.g. slowing of the Chinese economy)	Removal of all country or region specific references to any global risk	Change introduced in 2011
Asking respondents to volunteer their organizational affiliation (e.g. government, business, academia, international organization).	In addition respondents were asked to share their primary area of expertise with regard to the five categories (e.g. societal issues, economic issues, geopolitical issues, technological issues and environmental issues).	Change introduced in 2011
Measuring organization and region related differences in risk perception	Refined analysis of differences across groups	
Not considered	Asking respondents to volunteer information on their gender (Male or Female)	Change introduced in 2011
Not considered	Asking respondents to volunteer information on their age	Change introduced in 2012

Source: Author.

2. Survey Population (2012)

The 2012 Global Risks Perception Survey (GRPS) was administered in September to provide data for the Global Risk 2013 publication that was released in January by the World Economic Forum (WEF). After identifying the most appropriate communities to consider for the survey, over 6000 individual affiliated with WEF were contacted via email. The survey was announced to them as confidential and that results were anonymous. There were 1006 respondents that completed the entire survey (all questions). This is a significant result considering that it is a fairly extensive and time consuming questionnaire (the prior year had 469 complete responses by comparison). Although all potential respondents were known to be fluent in English, one possible explanations for the higher yield in 2012 (compared to all other previous years) include offering the questionnaire itself in multiple languages (11) as 831 respondents elected to do the survey in English (respondents identified 101 countries as their residence). Another explanation is the inclusion of new and younger (age-wise) communities of the WEF into the research process, most notably its Global Shapers Community consisting of a network of young leaders between 20 and 30 years old organized in over 300 cities worldwide.[481] There were 241 respondents that identified themselves as members of the Global Shapers Community. The survey population data presented below is based on 1234 responses to the online survey where the required information was submitted and judged complete for statistical analysis (Figures 30 -33).

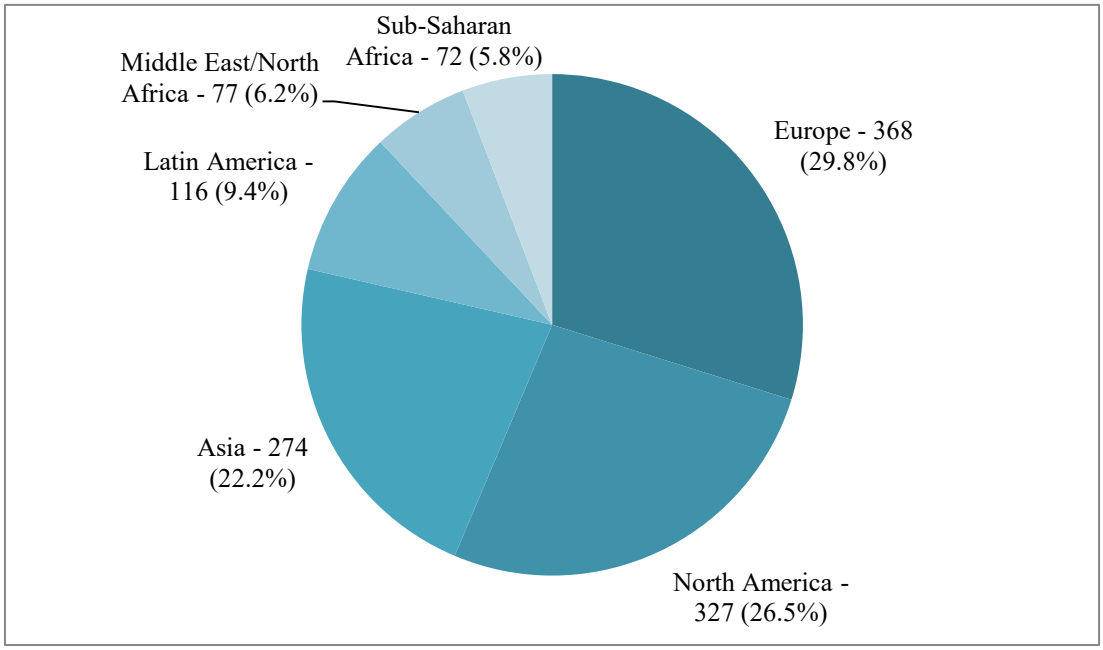
Figure 30: 2012 GRPS Respondents by Organizational Background



Source: Adapted from WEF, Figure 41 (2013: 61).

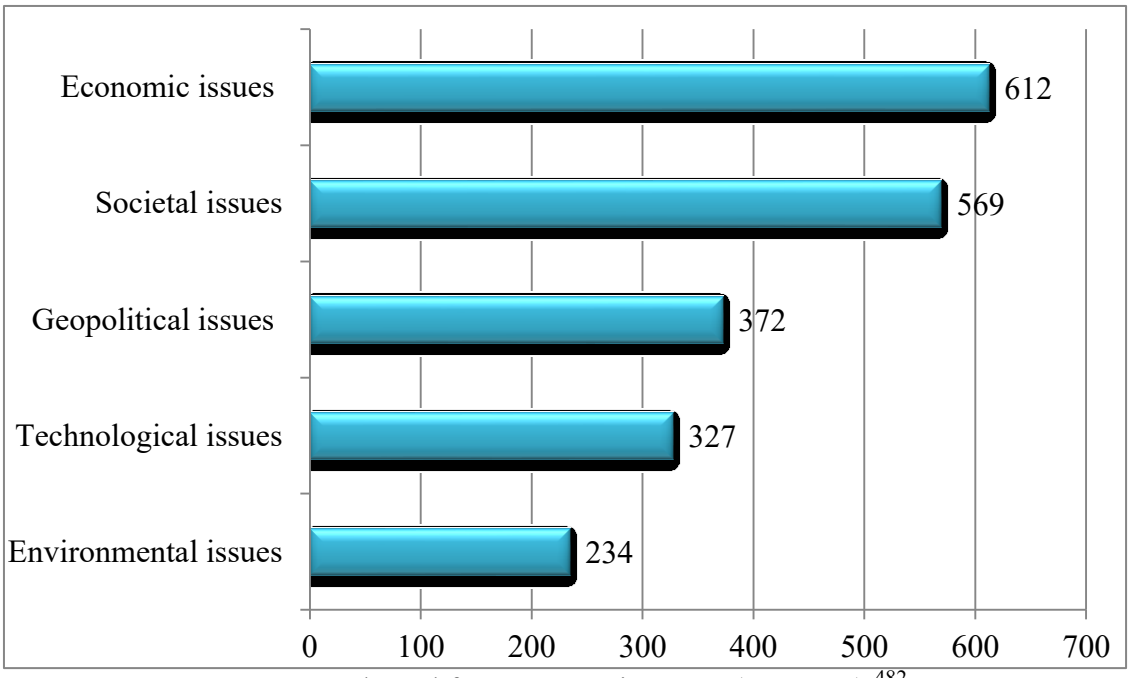
[481] See https://www.globalshapers.org/ (last visited on 9 May 2015).

Figure 31: 2012 GRPS Respondents by Region



Source: Adapted from WEF, Figure 41 (2013: 61).

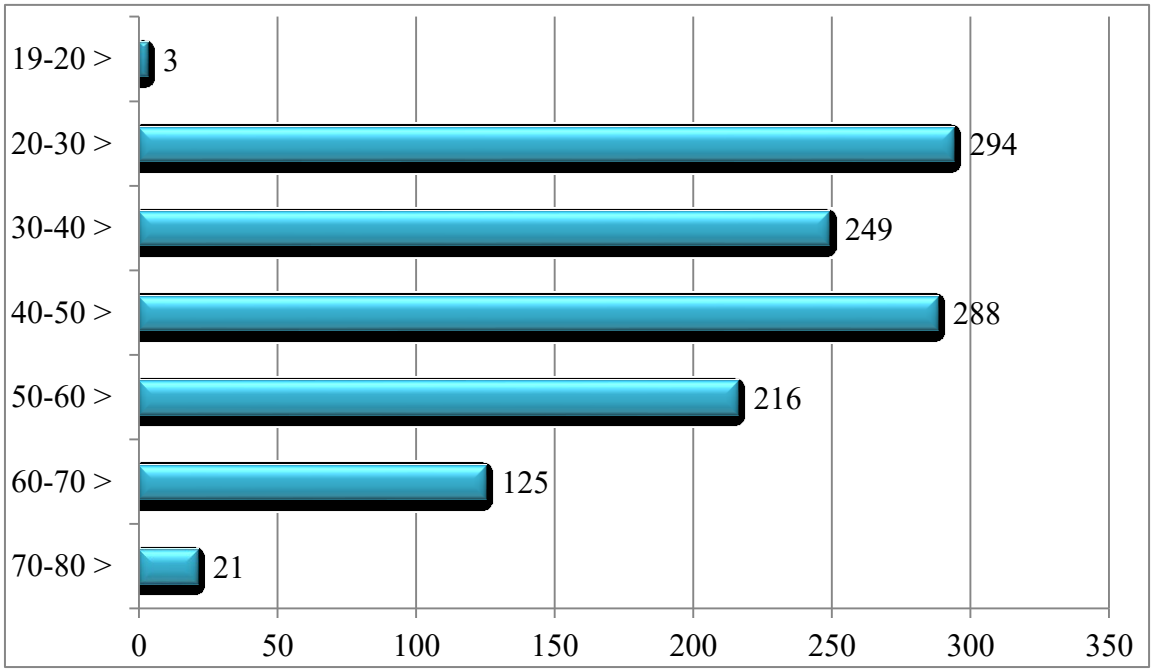
Figure 32: 2012 GRPS Respondents by Expertise (Multiple Permitted)



Source: Adapted from WEF, Figure 41 (2013: 61).[482]

[482] Multiple selections were permitted for this question.

Figure 33: Age Distribution of 2012 Survey Participants



Source: Adapted from WEF, Figure 41 (2013: 61).

The demographic information presented above was based on information collected from the first of three sections of the 2012 GRPS questionnaire. Regarding the gender distribution of the 1234 respondents, approximately 71% were male and 29% were female. There average age of survey respondents was 43 years old. The gender and age distribution of people related to organizational background and region is nearly identical; the data is only representative of this specific population and not representative of wider populations.

3. Survey Questions (2012)

The above-mentioned demographic information was gathered from respondents in the initial section (Respondent Section) of the Global Risk Perception Survey (GRPS) questionnaire. The two key changes in this section was asking respondents to volunteer their age (year of birth) and to identify the country about which they have the most expertise in (along with the city and country of their residence). The two subsequent sections of the GRPS questionnaire focus directly on the evaluation of and the connections between fifty global risks. Full descriptions of each of the fifty global risks are provided in the appendices.

In the second section (Global Risks), respondents were asked to evaluate fifty global risks organized under five categories. The first evaluation asked respondents to assess the likelihood of the risk occurring over the next ten years using a 1 to 5 scale. The second evaluation asked of the same risk that if it were to occur then what would be its impact globally. Both questions (likelihood and impact) were presented using Linkert-type scales where the respondent can select an integer within a range representing a low value (1) to a high value (5) as well as points in between. With regard to assessing likelihood, 1 represented "Very Unlikely" and 5 represented "Almost Certain" and for impact 1 meant "Low" and 5 meant "High." From the GRPS, the top global risk among fifty perceived as being most likely to occur over the next ten years was "severe income disparity." The top global risk among fifty perceived as having the greatest impact in the event it occurred was "major systemic financial failure."

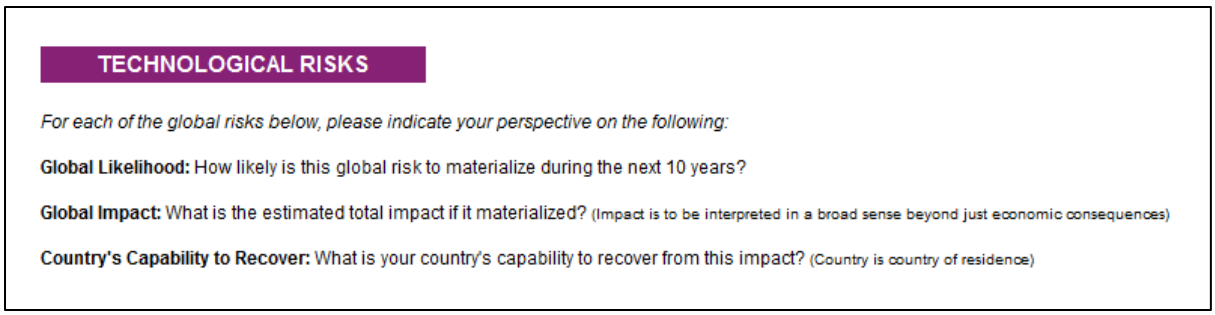
An important third evaluation was added for each of the fifty global risks that was also linked to the country of expertise information submitted by respondents. The new question asked if this risk materialized in your country of expertise, what is the ability of the country to adapt/or recover from the impact (Figure 34)? The introduction of this question is linked to the author's research on the relationship between resilience and uncontrollable risks. Part two of this study (Theoretical Review) highlighted the relevance of organizational resilience with the introduction of national resilience as a possible conceptual framework for organizations concerned with catastrophic risks.[483] The concept was influenced by the "glocal" approach of New Corporate Governance also introduced in part two of this study.[484] In the wake of recent catastrophic risk events (e.g. the Great East Japan Earthquake of 11 March 2014), such data could assist governments in their ex ante efforts to assess their country's resilience to such

[483] National resilience framework introduced in this study posits that all enterprises operate within national borders and implicate some degree of state involvement when an uncontrollable risk event occurs. As uncontrollable risks are systemic in nature (and impacting systems that are maintained or managed by the public sector) it is helpful to conceptualize a country as a complex system itself -- but one that is comprised of critical national and sub-national systems and one that is also integrated into regional and global systems.

[484] Hilb, M. (2008: 22).

shocks. However the findings are ancillary to the main research objectives study and therefore not integrated into this paper. Moreover the question was abandoned in subsequent editions of the GRPS.

Figure 34: Representation of the GRPS Question Online



Source: WEF and Author.

The later part of Section 2 of the 2012 GRPS focuses on the issue of risk interconnections (the interconnection questions were first introduced by the author in the 2011 GRPS). It first attempts to assess the single most important risk from a systemic perspective for each of the five categories of ten global risks – economic, environmental, geopolitical, societal and technological – under the rubric of "Centers of Gravity." It then asks respondents to identify strong connections between pairs of risks among the fifty presented. Respondents were asked to identify a minimum of three such risk pairs and a maximum of ten. Out of a theoretical maximum of 1225 possible pair combinations of 50 fifty global risks, respondents identified 529. The combination of all the interconnection responses is the basis of the network diagram which is presented as the Risk Interconnection Map (RIM) which is discussed. The GRPS results related to risk interconnectivity (Centers of Gravity) are also explored in-depth later in this study under "Identification of Risk Interconnections."

B. Quantitative Findings (2012 Data)

Determining how well data from the Global Risks Perception Survey is representative (of the survey population of roughly 6000) is measured by two important statistics – the survey's margin of error and confidence level. Margin of error will decrease as the sample size increases up to a limit and 95 percent level of confidence is the normal standard for industry use. In analyzing the collected responses on the likelihood and impact of the fifty global risks (the two question were answered completely by 1234 respondents), the spread of the 2012 GRPS survey answers and the survey sample size resulted in a maximum margin of error of 0.07 units based on a 95% confidence level.

1. Differences in Perception: Likelihood and Impact of a Global Risk

Since publication of the second edition of the World Economic Forum (WEF) Global Risks in 2007, the key research findings are the annual assessment of a selection of global risks (presented under the same five categories) in terms of their likelihood and severity or impact. The number and definition of the global risks studied, measurement scale for impact and the survey's population and sample size have varied over the years but its subject matter has remained the same. As highlighted in the second part (Theoretical Review), Philip Tetlock demonstrated that is nearly impossible to achieve accurate long-term political forecasting.[485] In a similar fashion this study does not posit that the Global Risks Perception Survey is any more effective at forecasting their likelihood or impact than other available or possible methods. The salient consideration for this study is whether such a unique survey (in terms of its population, sample, topic and measurement) can provide further insights on how to monitor, measure or mitigate uncontrollable risks. The ex ante identification of risks remains a vexing challenge but theoretical insights from part two of this study (citing evidence from the fields of behavioral science and complexity science) indicate that diversity of thinking (i.e., rather perceptions and opinions) could be a beneficial attribute in this regard. Therefore the author took the opportunity presented by the GRPS (i.e., the prospect of its redesign) to make it an element of the action research for this study.

The objective of the quantitative inquiry of diversity of perceptions on global risks is not about establishing empirically if there are determining factors that improve the accuracy of risk identification or the calculation of their probability of occurrence. The shortcomings of such goals have been presented in the theoretical review (part two) in discussions on the influence of complexity science and behavioral science on risk management. Moreover the unknown and unknowable nature of uncontrollable risks mostly precludes this. With regard to uncontrollable risk and the role of BoD, the empirical aim of the following quantitative analysis is to determine if diversity in terms of gender, age, organization, region and expertise impacts the following practical question:

> *How does diversity (or its absence) within a BoD possibly impact its ability to perceive risks differently and therefore impact its capacity innovate in the area (.e.g. by introducing a "risk envisioning" dialogue on identifying uncontrollable risks and their interconnectivity in a manner that is "highly interactive").*

In risk management terms, the aim is to explore if different personal and professional backgrounds result in our thinking differently about common or shared challenges to a degree that might compel different approaches to them. For example, such differences can

[485] Tetlock, P.E., (2005).

also influence the risk appetite of an organization. The table below highlights the relevant and statistically findings from the 2012 GRPS with regard to differences in perception on global risks in this context (Table 25).

Table 25: 2012 GRPS Findings (Differences of Perception)

Source of Difference	Nature of Difference (Statistically Significant)
Age Based	Perceptions about 8 out of 50 global risks differed between those under 40 and those over 40.
Age Based	Environmental risks were the source of 4 out of the 8 differences between respondents under 40 versus those over 40.
Age & Expertise Based	In terms of assessing likelihood, expert respondents under the age of 40 chose higher scores than those over the age of 40.
Age Based	In terms of likelihood, only 4 global risks were rated more likely by respondents over the age of 40 than under 40: prolonged infrastructure neglect, failure of climate change adaptation, rising greenhouse gas emissions and diffusion of weapons of mass destruction.
Age Based	In terms of impact, respondents aged 40 or younger tend to rate most risks higher than respondents over 40 (there is no risk where the over 40 group's impact scores are significantly higher).
Expertise based	The category of environmental risks had the largest percentage of risks that differed between experts and non-experts.
Expertise based	Generally experts perceived risks in their domain of expertise as more likely to occur than non-experts.
Expertise based	Non-experts found four risks to be more likely than experts from those categories: • severe income disparity (Economic) • unmanageable inflation and deflation (Economic) • rising religious fanaticism (Societal) • unforeseen consequences of nanotechnology (Technological)
Expertise based	In terms of assessing impact, the fewest differences were found between experts and non-experts (15 in total with none from the geopolitical category and just one in the technology category).
Gender Based	In terms of likelihood, females were more pessimistic and rated the global risks more likely to occur.
Gender Based	The global risk with the biggest difference in male and female views measured 0.41 (on 1 to 5 scale) and was "unprecedented geophysical destruction."
Gender Based	In terms of impact, the genders differed for 39 out of 50 global risks (notably all ten risks in the geopolitical category).
Gender based	Men perceived the impact of global risks lower in all 39 cases where gender differences were found (largest difference of 0.43 was for "entrenched organized crime").
Organization based	In terms of assessing impact, differences based on organizational background were found for less than half of the risks.
Organization based	In terms of impact, NGO respondents perceived them higher while business respondents lower among organizations.
Region based	Latin Americans perceived economic risks as having a 50% higher impact than other regions.
Region Based	Europeans generally perceived global risks as having lower impact (exception being "mineral resource supply vulnerability").

Source: Author.

Intuitively we expect difference of perceptions across regions and national cultures but the analysis above clearly highlights the importance of age, expertise and gender as well. The implications therefore for risk management at the board level are significant given that the composition of a BoD in most major economies remains mostly male and over 40 years old. This same demographic in the 2012 GRPS appears the least inclined to worry about global risks.

The perception remains that older, male dominated boards were as much to blame as the executive team in failing to manage risks at financial institutions that today are characterized as "systemically important." In this regard, the media continues to highlight academic research that links board diversity (gender, race, age, etc.) to taking on less risk[486] or market research that shows boards with women result in few corporate scandals.[487]It is therefore plausible that an entirely male BoD with an average age of over 40 may have the most difficulty contending with uncontrollable risk. This supposition is in line with the promotion of "targeted diversity" on the board team as elaborated by Martin Hilb under the rubric of New Corporate Governance (NCG).[488] Hilb highlights the need to examine the comparative strengths of older and younger members of boards and top management (Fig 35). Moreover, as noted earlier, Philip Tetlock found that people that are younger and of lower status in an organization (versus older and higher status) are more enthusiastic about assessing the accuracy of probability judgement.[489] This is a critical insight when considering the admonition from the OECD that "boards should be aware of the shortcomings of risk management models that rely on questionable probability assumptions."[490]

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486 Casey, M. (30 July 2014). Study Finds a Diverse Corporate Board Rein in Risk, Good for Shareholder, *Fortune*. Retrieved from http://fortune.com/2014/07/30/study-finds-a-diverse-corporate-boards-rein-in-risk-good-for-shareholders/ (last visited on 11 May 2015).

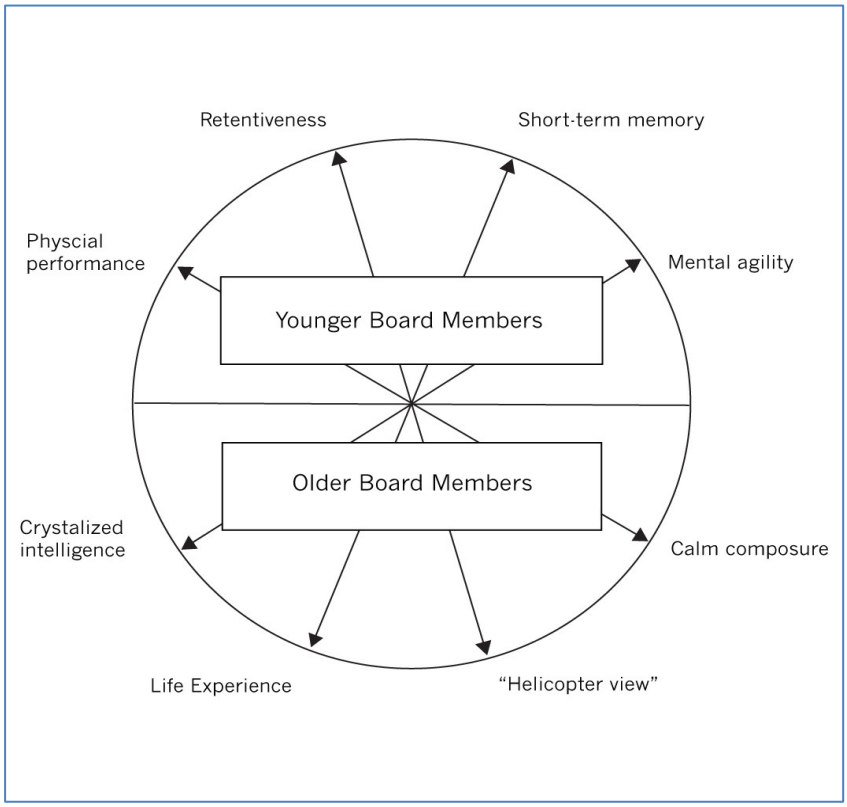
487 Grene, S. & Newlands, C. (8 March 2015). Boards without Women Breed Scandal, *Financial Times*. Retrieved from: http://www.ft.com/intl/cms/s/0/cdb790f8-c33d-11e4-ac3d-00144feab7de.html (last visited on 11 May 2015).

488 Hilb, M. (2008: 84).

489 "How to Win at Forecasting: A Conversation with Philip Tetlock," www.edge.org (6 December 2012). Retrieved from https://edge.org/conversation/how-to-win-at-forecasting (site last visited on 2 May 2015).

490 OECD (2014: 8).

Figure: 35: Comparative Strengths of Board Members (Age Based)



Source: Hilb, Figure 2-7 (2008: 85).

In the later discussion on the ex ante identification of uncontrollable risks, the need for a risk envisioning dialogue that they are highly interactive is also highlighted. In this regard, it is worth considering that two (among four) preconditions that Hilb cites for an integrated board management to be successful are "diversity in terms of the "strategically targeted composition of the board team"[491] and "trust in terms of a "constructive and open-minded board culture."[492] This study posits that such attributes also contribute to improve the situation awareness of the board in a moment of complex crisis.

Lastly to conclude the discussion of the GRPS results, what is also worth noting is the absence of any statistically significant differences in perceptions of some global risks. For example, "extreme volatility in energy and agriculture prices" and "major systemic financial failure" did not have any significant differences among groups in terms of perceptions about their likelihood (all 48 other global risks had at least difference per group). Conversely the "failure of drug policies" had the most group differences with regard to likelihood, particularly between regions. The 2012 statistical data related to the points above are provided in the appendices.

491 Hilb, M. (2009: 75).
492 Ibid.

C. Identification of Risk Interconnections

1. Center of Gravity Concept

In the second part of this study (Theoretical Review), Robert Kaplan and Annette Mikes stress the need for an organization to focus on its resilience with respect to exogenous risks (which by their definition are unavoidable and impossible to predict). They also suggest that "the assessment (and enhancement) of organizational resilience requires that the company introduce a process of risk envisionment – using experience, intuition, and imagination – to suggest plausible future disaster scenarios."[493] Yet they also recognize that an organization may face limits in doing so with respect to the expertise, knowledge and resources available internally. Therefore their diagnosis is that "risk management will be most effective when it matches the inherent nature and controllability of the different types of risk the organization faces."[494] However this study argues that the prognosis for such an approach will be difficult given the prevalence of uncontrollable risk in an increasingly interdependent and interconnected business environment. The afore-mentioned conclusions of Kaplan and Mikes present an important research question:

- How does a BoD introduce risk envisioning dialogue related to the ex ante identification of uncontrollable risks and ensure that they are highly interactive?

One option that emerges frequently in risk management consulting in response to the question is to develop scenarios:

> "Scenarios are a powerful took in the strategist's armory. They are particularly useful in developing strategies to navigate the kinds of extreme events we have recently seen in the world economy."[495]

Another innovative approach to the question is the visualization of risk connections similar to the Risk Interconnections Maps (RIM) discussed in the context of the WEF's Global Risks report. As highlighted in the Theoretical Review, "evaluating the interconnectivity of risks and the compounding exposure when two or more occurrences take place simultaneously"[496] as the clearly the most difficult and important element of the risk oversight role of a board. What is common to both approaches is the presumption that they are time and resource intensive in their development and in their presentation as is the case with many of the strategic thinking techniques highlighted in research literature (Table 26). However, the

493 Kaplan, R.S. & Mikes, A. (2013: 26-27).
494 Ibid.
495 Roxbourgh, C. (November 2009). The Use and Abuse of Scenarios, McKinsey Quarterly Retrieved from: http://www.mckinsey.com/insights/strategy/the_use_and_abuse_of_scenarios (last visited on 12 May 2015).
496 Ibid.

qualitative research (board member interviews) that follows will show that time and resources are the major constraints to engaging a BoD in risk envisioning exercises.

Table 26: Strategic Thinking Techniques

Techniques	Systematic thinking tool?	Internal communication device?	Identifier of strategic issues?	Problem scope?	Uncertainty bounding?
Lateral thinking and brainstorming (Osborne, 1953; de Bono, 1973)	No	No	Somewhat	Broad	No
Synectics and morphological analysis (Gordon, 1961; Zwicky, 1969)	Medium	Perhaps	Perhaps	Limited	No
Delphi method (Linstone and Turoff, 1975; Wedley et al., 1978)	High	Yes	No	Narrow	Yes
Dialectic reasoning (Mitroff and Emshoff, 1979; Schwenk and Cosier, 1980)	Perhaps	Perhaps	Yes	Broad	Perhaps
Multiple scenarios (Wack, 1985a, b; Huss, 1988)	Medium	Yes	Yes	Broad	Yes
Requisite decision modeling (Berkely and Humphreys, 1982; Philips, 1982)	High	Yes	Perhaps	Narrow	Perhaps
Dynamic systems analysis (Forrester, 1961; Sterman, 1988; Senge, 1990)	High	Yes	Perhaps	Medium	Perhaps

Source: Adapted from Schoemaker, Table 1 (1993: 195).

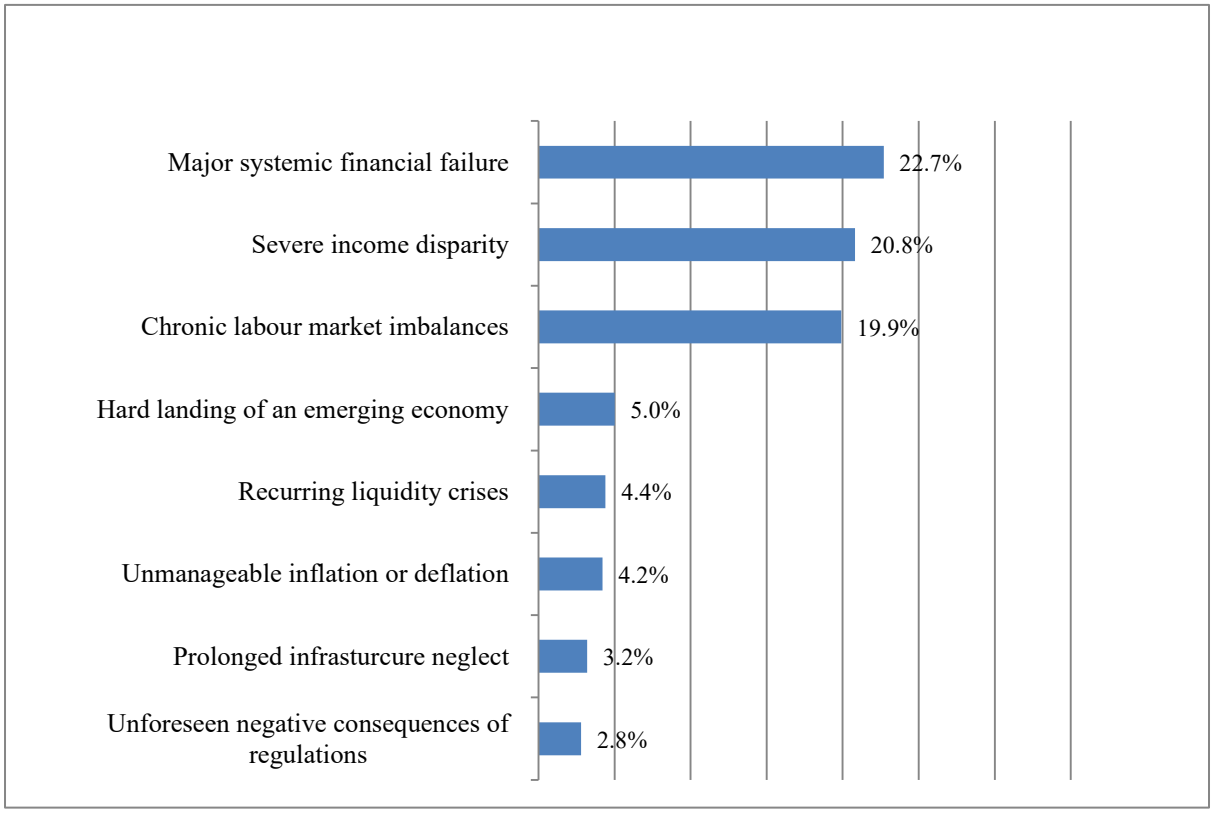
Therefore among the practical challenges for consideration in this study was identifying a process that would allow an organization to expand their thinking with regard to uncontrollable risks beginning with the roster of risks identified already as important or significant by existing risk management practices and processes (e.g., risk register, master risk list, risk map). In addition such a process would also ideally integrate elements of complexity science (i.e., systems thinking) in the discussion of those risks by acknowledging their possible interconnectivity but more importantly underscoring the notion that small events can have big consequences and vice versa.

With regard to risk management at the board level, the "identification of risks is the most important and delicate step as it sets the agenda"[497] Therefore any attempt at envisioning uncontrollable risks would need to integrate the organization's master risk list (or risk register) at the outset. The Global Risks Perception Survey (GRPS) provided the author an ideal platform for experimentation. Identifying a practical solution to this risk management challenge (per the above mentioned parameters) was integrated into the action research of this study. The fifty global risks were well defined in a master list and all were considered exogenous or external. Therefore, beginning with the 2011 GRPS, the author introduced the concept of a "Center of Gravity" for each of the five categories of global risks in the survey (e.g. economic, geopolitical, societal, environmental and technological).

The process of identifying the center of gravity within a risk category followed the assessment of the likelihood and impact of each global risk in the five categories. GRPS respondents were asked to select the one risk they thought was the systemically most important among the ten global risks listed together under one category. It is critical to understand in this regard that center of gravity should not be the risk considered to have the highest impact and the highest likelihood of occurrence. Such a framing is what conventional risk management methods tend to reinforce but such criteria are irrelevant if the intent is to introduce systems thinking into the selection process (i.e., the notion that small events can have big outcomes and vice versa). The tables below present the results to the center of gravity question for each of the five risk categories from the 2012 GRPS (Figures 36 thru 39).

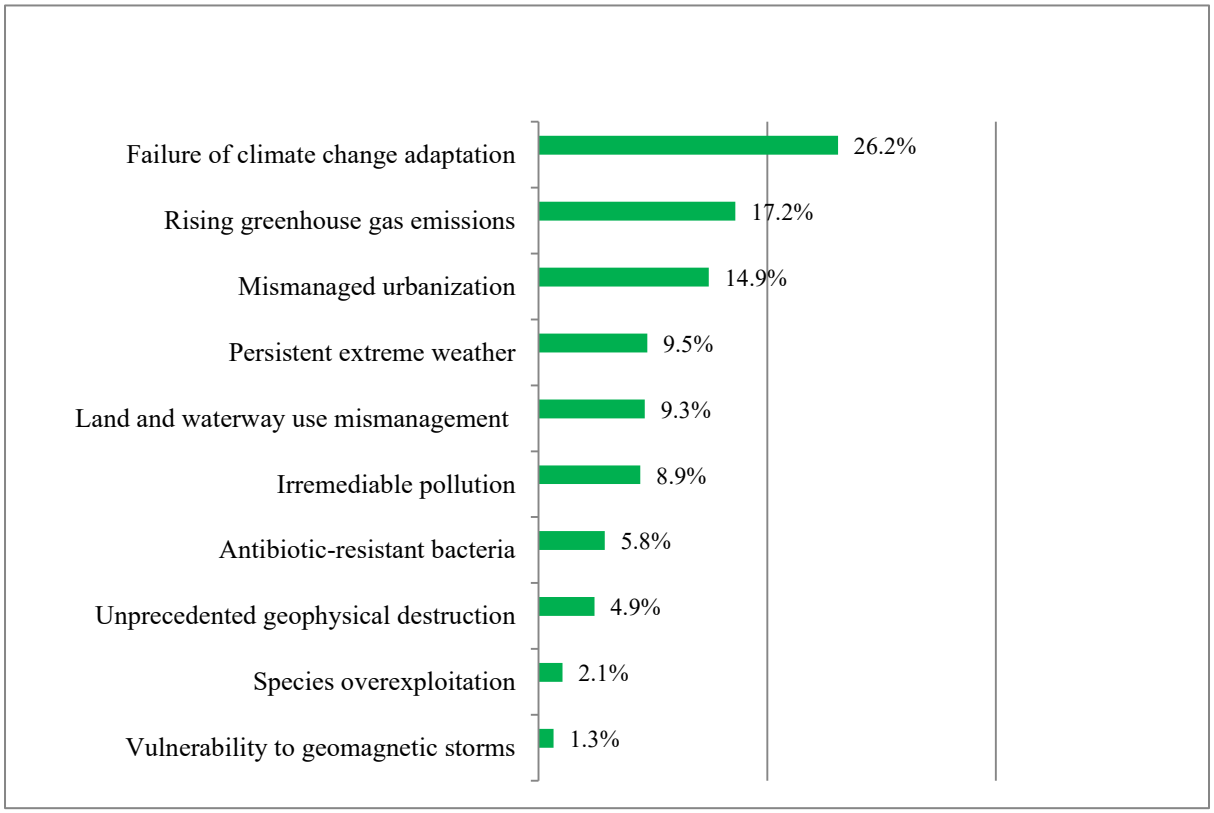
[497] Kalia, V., & Müller, R. (2007: 63).

Figure 36: Center of Gravity (Economic Global Risks)



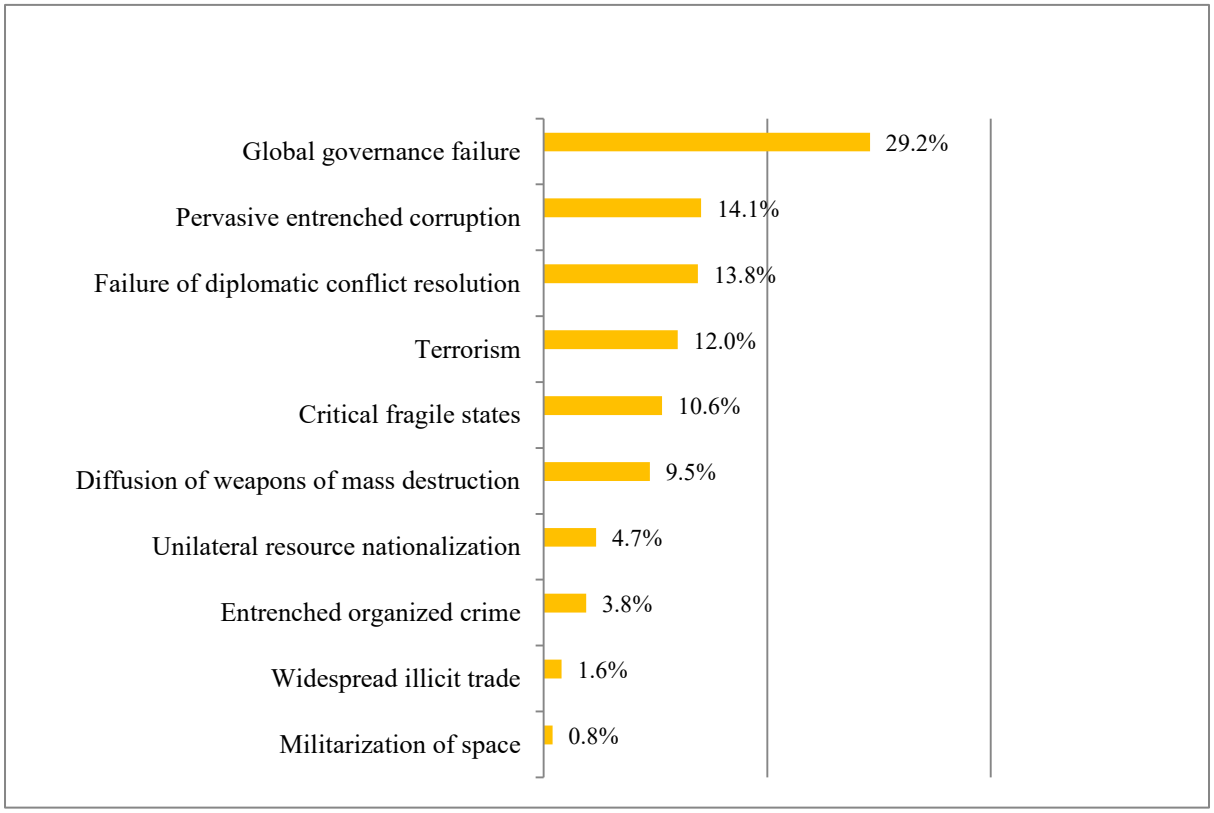
Source: Adapted from WEF, Figure 36 (2013: 52).

Figure 37: Center of Gravity (Environmental Global Risks)



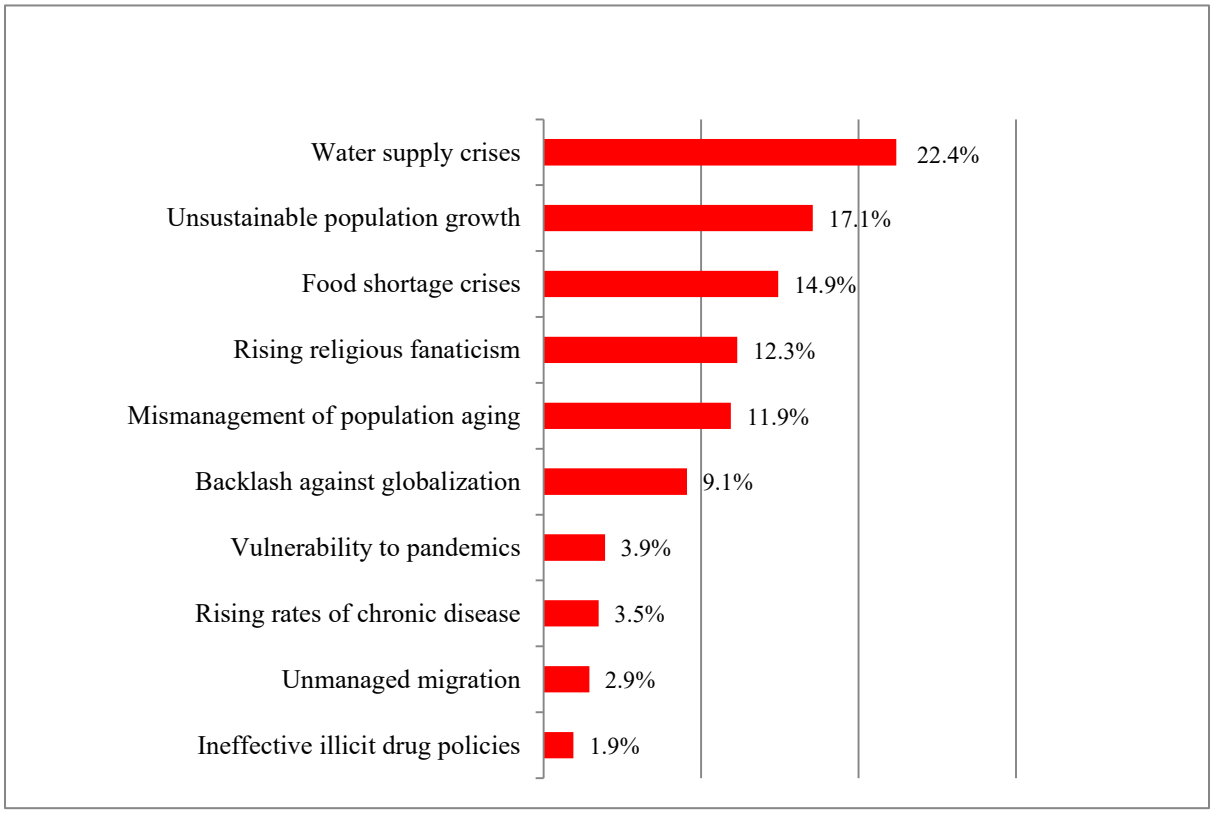
Source: Adapted from WEF, Figure 36 (2013: 52).

Figure 38: Center of Gravity (Geopolitical Global Risks)



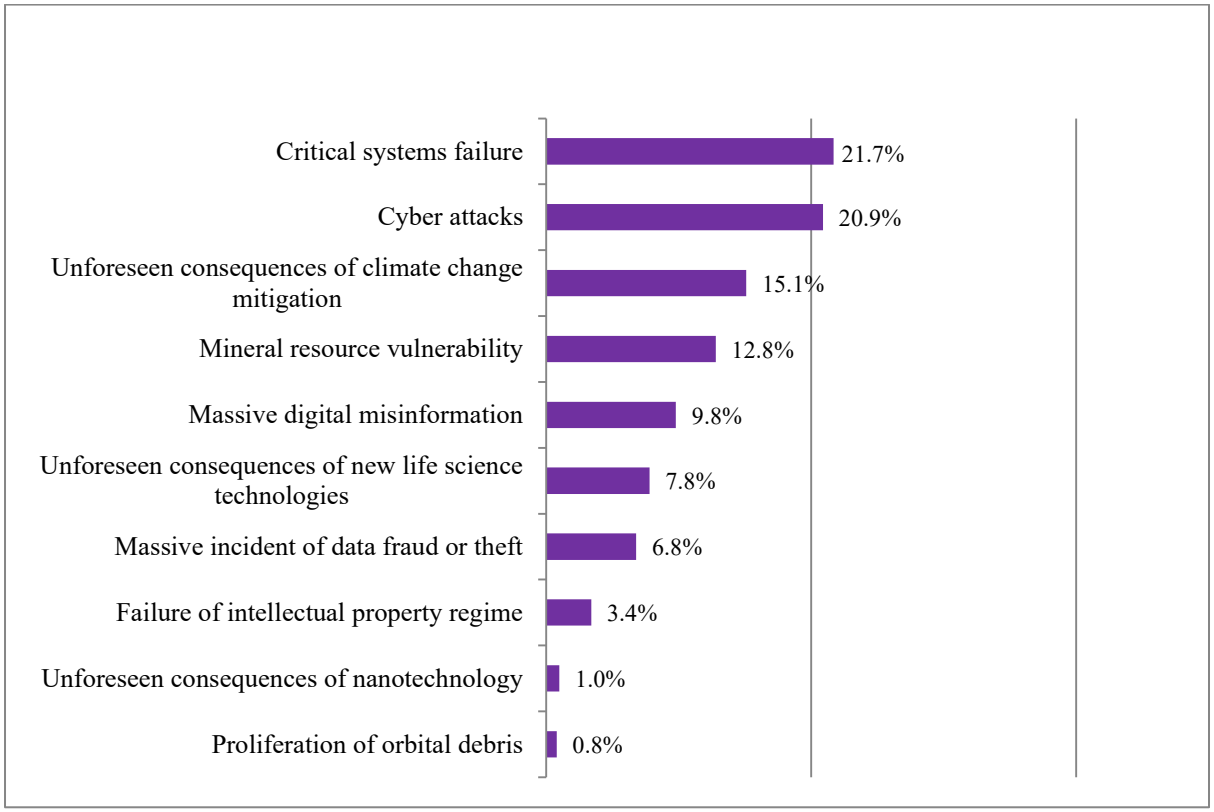
Source: Adapted from WEF, Figure 36 (2013: 52).

Table 39: Center of Gravity (Societal Global Risks)



Source: Adapted from WEF, Figure 36 (2013: 52).

Figure 40: Center of Gravity (Technological Global Risks)



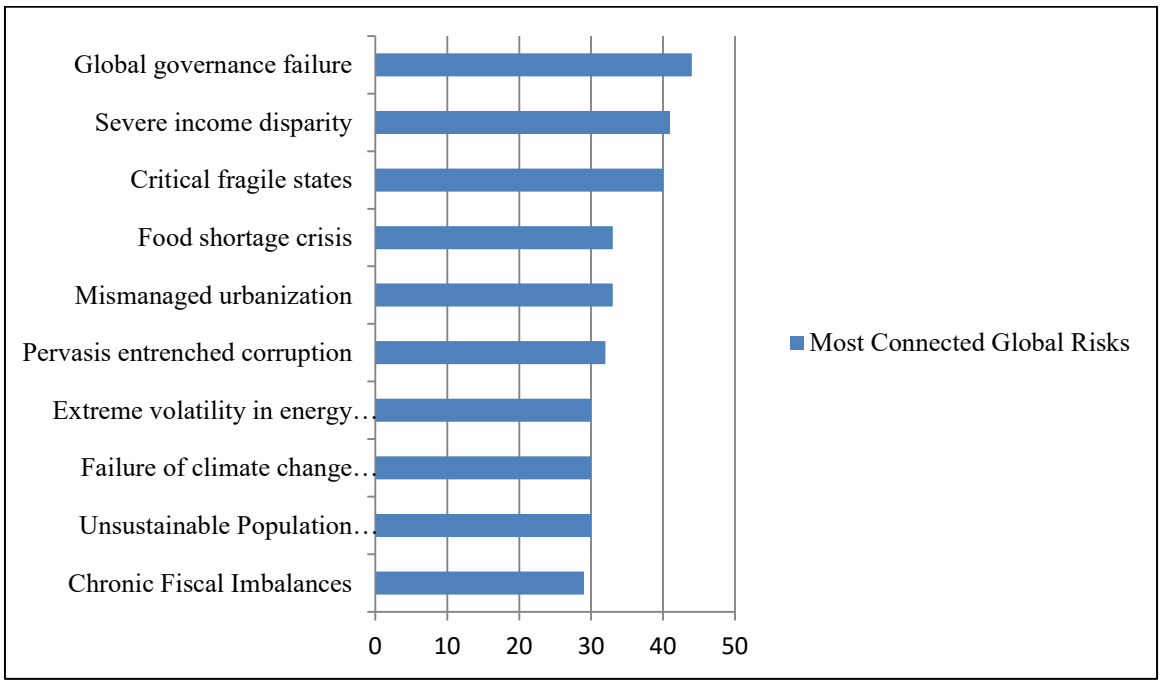
Source: Adapted from WEF, Figure 36 (2013: 52).

The global risks that ranked the highest as the centers of gravity from the charts shown above are as follows:

- major systemic financial failure (economic)
- failure of climate change adaptation (environmental)
- global governance failure (geopolitical)
- water supply crises (societal)
- critical systems failure (technological)

What is revealing is that despite these risks being designated as the center of gravity for their respective risk category, they were not the most connected risks when evaluating the interconnectivity of the entire portfolio of 50 global risks (Figure 41). The most connected risks were determined by asking GRPS respondents to choose pairs of risks which they considered strongly interconnected (i.e., some type of correlation is believed to exist although causal direction cannot be deduced). Respondents were asked to pick a minimum of three and a maximum of ten such pairings using a drop down menu.

Figure 41: Top 10 Connected Global Risks (2012 GRPS)



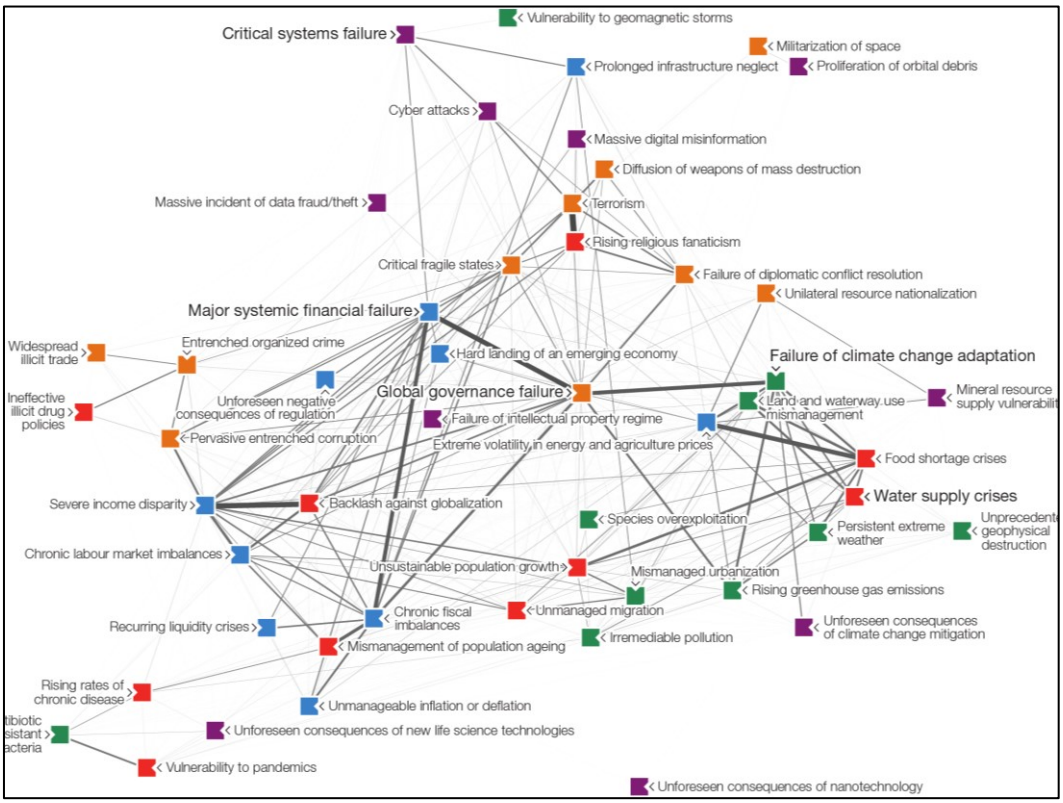
Source: Adapted from WEF, Figure 39 (2013: 53).

An important practical and conceptual conclusion to be drawn is that the identification of the most systemically important risk (i.e., the center of gravity) from among a list of risks (arranged by group or category) is not the same as determining which risk is linked to the most others on the list (i.e. risk interconnectivity). Therefore a BoD must make every effort to avoid conflating the two concepts as the former process is straightforward to implement (center of gravity) as it integrates easily into existing ERM processes. The latter process is more time intensive and technically distinct as discussed in the section that follows.

2. Risk Interconnection Mapping

The above mentioned pairing exercise for the 2012 GRPS resulted in 529 connections out of a theoretical maximum of 1225 possible combinations. The visualization of all of the chosen pairs resulted in a network diagram – the so-called Risk Interconnection Map (RIM) which is featured prominently in the WEF 2013 Global Risks report (Figure 42). As noted in part two, network analysis is based on mapping relationships or linkages among constituents in systems; the risk management aim is to identify configurations (or constellations) that appear particularly fragile (or very stable).

Figure 42: Risk Interconnection Map 2013



Source: Adapted from WEF, Figure 37 (2013: 53).

An obvious shortcoming with a visualization such as the above RIM is that permutations (i.e., the act of rearranging all the members of a set into some sequence or order) of two, three, four, five or more risks are incomprehensible for most people. The reaction of many observers of such a diagram is simply that everything seems to be connected somehow; this is hardly the desired basis from which to start a risk envisioning dialogue or analytical exercise at the board level.

A visual distillation (i.e., filtering out the weakest correlations) of the network connections is therefore required in order: 1) to identify and isolate the strongest correlations; 2) to assess

the coherence of the connections and 3) to determine the uncertainties that emerge. In the case of the Global Risks 2013 report, the result was a schematic or rather a "constellation of risks" that represented possible future scenarios involving the interplay of a tightly correlated cluster of risks. The term "constellation" was chosen deliberately by the author to evoke the word's origins in ancient astrology (when asterism was used to predict human events) and its later modern usage in astronomy (the specific area of the celestial sphere as defined by the International Astronomical Union). It is perhaps a fitting metaphor on the current state of our early understanding of the interconnectivity of global risks.

The Global Risks 2013 report distilled three compelling constellations of risks that were presented as three potential risks cases (Figure 43). The three cases in brief were:

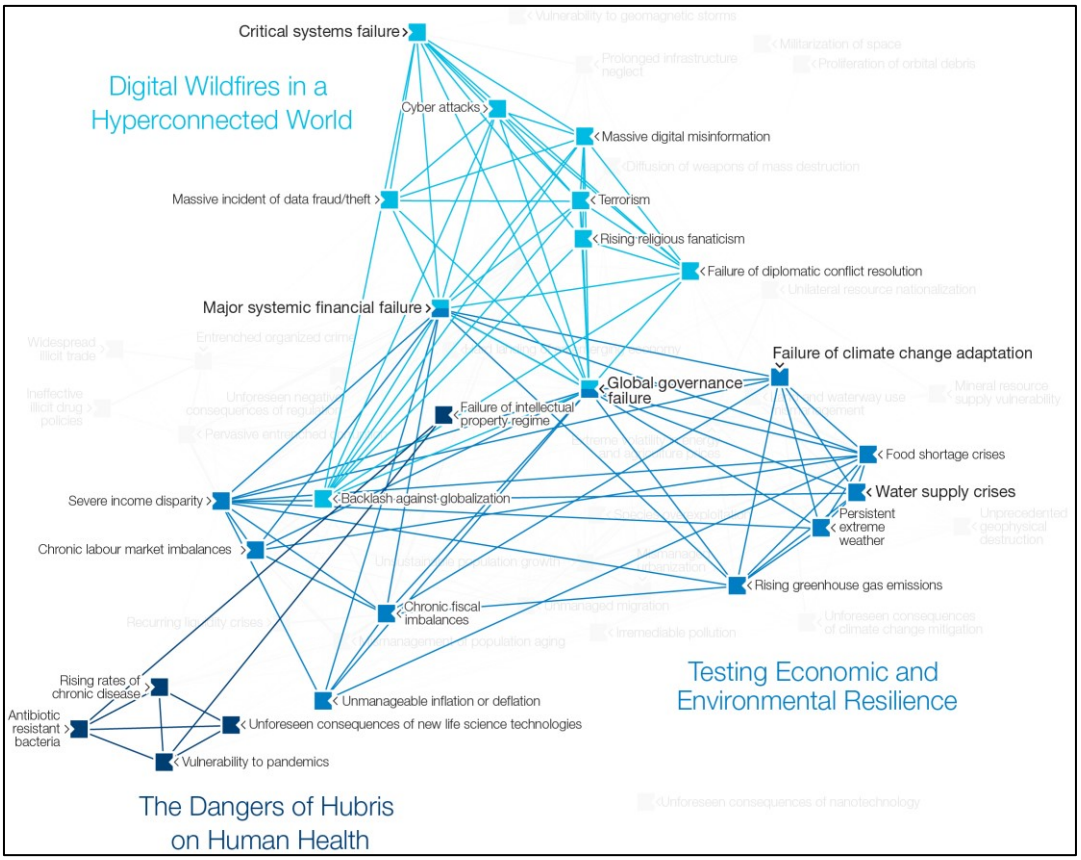
- "Testing Economic and Environmental Resilience"[498]
- "Digital Wildfires in a Hyperconnected World"[499]
- "The Dangers of Hubris on Human Health"[500]

498 "Continued stress on the global economic systems is positioned to absorb the attention of leaders for the foreseeable future. Meanwhile, the Earth's environmental system is simultaneously under increasing stress. Future simultaneous shocks to both systems could trigger the 'perfect global storm', with potentially insurmountable consequences. " WEF (2013: 11).

499 "In 1938, thousands of Americans confused a radio adaption of the H.G. Wells novel *The War of the Worlds* with an official news broadcast and panicked, in the belief that the United States had been invaded by Martians. Is it possible that the Internet could be the source of a comparable wave of panic, but with severe geopolitical consequences? Social media allow information to spread around the world at breakneck speed in an open system where norms and rules are starting to emerge but have yet to be defined." WEF (2013: 11).

500 "Health is a critical system that is constantly being challenged, be it by emerging pandemics or chronic illnesses. Scientific discoveries and emerging technologies allow us to face such challenges, but the medical successes of the past century may also be creating a false sense of security." WEF (2013: 11).

Figure 43: Global Risks Map 2013



Source: Adapted from WEF, Figure 3 (2013: 6).

Such a method of envisioning exogenous risks by creating "what if" type scenarios based on risk interconnectivity appears compelling in theory. Indeed the practical challenge remains in establishing a straightforward process that allows an organization to expand their thinking with regard to uncontrollable risks that considers the possible interconnectivity of such risks. However the qualitative research that follows will show that the integrated process illustrated above (beginning from risk pairing and ending in a distilled network diagram) may be too burdensome and time consuming for a BoD to adopt despite their clear recognition of the need to engage in greater risk envisioning dialogue. Yet it is worth noting that the process illustrated above is still far less time and resource intensive (and less method bound) in comparison to the steps required for the construction a full-fledged scenario to support strategic decision-making (Table 27).

Table 27: Steps in Scenario Construction

1. Define the issues you wish to understand better in terms of time frame, scope and decision variables (e.g., prices of natural gas over the next 5 years in the Far East). Review the past to get a feel for degrees of uncertainty and volatility.
2. Identify the major stakeholders or actors who would have an interest in these issues, both those who may be affected by it and those who could influence matters appreciably. Identify their current roles, interests and power positions.
3. Make a list of current trends or predetermined elements that will affect the variable(s) of interest. Briefly explain each, including how and why it exerts an influence. Constructing a diagram may be helpful to show interlinkages and causal relationships.
4. Identify key uncertainties whose resolution will significantly affect the variables of interest to you. Briefly explain why these uncertain events matter, as well as how they interrelate.
5. Construct two forced scenarios by placing all positive outcomes of key uncertainties in one scenario and all negative outcomes in the other. Add selected trends and predetermined element to these extreme scenarios.
6. Next assess the internal consistency and plausibility of these artificial scenarios. Identify where and why these forced scenarios.
7. Eliminate combinations that are not credible or impossible, and create new scenarios (two or more) until you have achieved internal inconsistency. Make sure these new scenarios bracket a wide range of outcomes.
8. Assess the revised scenarios in terms of how the key stakeholders would behave in them. Where appropriate, identify topics for further study that would provide stronger support for your scenarios, or might lead to revisions of these learning scenarios.
9. After completing additional research, re-examine the internal consistencies of the learning scenarios and assess whether certain interactions should be formalized via a quantitative model. If so, use this model to run some Monte Carlo simulations after obtaining subjective uncertainty ranges (or entire distributions) for key independent variables.
10. Finally, reassess the ranges of uncertainty of the dependent (i.e., target) variables of interest, and retrace Steps 1 through 9 to arrive at decision scenarios that might be given to others to enhance their decision making under uncertainty.

Source: Adapted from Schoemaker, P.J.H, Table 2 (1993: 197).

With regard to risk management at the board level, any attempt at envisioning uncontrollable risk must therefore be simple but not simplistic. This sentiment is an important consideration if the insights from this study are to benefit small and medium sized companies which do not have the internal and external resources available to them as does a multinational corporation.

The qualitative research will show that any risk envisioning exercise will also need to integrate or acknowledge an organization's existing master risk list (risk register) at the outset to stimulate a risk dialogue. However such a risk register should not set the boundaries for the discussion. In this regard, the identification of the center(s) of gravity from among the risks listed categories (if any) is an innovation worth considering at the board level given its simplicity to comprehend but also to stimulate dialogue. This study asserts what is important in the context of uncontrollable risk is to create natural opportunities to introduce complexity science (i.e., systems thinking) by not only acknowledging their possible interconnectivity but also underscoring the notion that small events can have big consequences and vice versa.

IV. Qualitative Analysis

Findings from formal and informal interviews of current members of a BoD form the basis of the qualitative research for this study. Drawing from the preliminary insights gathered from the analysis of the quantitative research related to the Global Risk Perception Survey (GRPS), the qualitative research approach was designed to identify and to compare current practices at the board level related to uncontrollable risks.

A. Interview Approach and Objectives

Formal interviews were scheduled between January and April of 2015 and targeted mainly board members from corporations affiliated with the World Economic Forum (WEF). This affiliation did not influence the responses of those interviewed but did increase the likelihood of their participation in this research given their familiarity of the WEF's work on global risks. In many instances, the author initially met with the interview subject in person to introduce the research topic and then followed to schedule a formal interview by telephone. In two instances, the responses were submitted digitally via a secure Internet link (all respondents were given this option).[501] In some instances an additional informal discussion took place at at the 2nd annual retreat of the WEF's Community of Chairman that took place

[501] An account was created on www.surveymonkey.com for those contacted for a formal internview that featured seven questions and allowed for a confidential reply.

from 18-19 April 2015 in Villars-sur-Ollon, Switzerland. All the interviews and discussions cited above were confidential and not for attribution publicly.

It is worth noting the field observation of Kaplan and Mikes that external risks require their own approach, particularly because "companies cannot prevent such events from occurring, their management must focus on identification (they tend to be obvious in hindsight) and mitigation of their impact."[502] Therefore the qualitative research approach of this study focuses specifically on the inter-related challenges of:

- Improving the ex ante identification of uncontrollable risks through risk envisioning dialogue and adopting practical approaches to risk mapping that integrates risk interconnectivity (i.e., intersecting vulnerabilities and cascading consequences).

The qualitative research approach focuses on the later element of risk interconnectivity. It examines how a BoD approaches the challenge of identifying and analyzing the interconnected risks (especially the exogenous risks considered unlikely to materialize in terms of their probability). As noted earlier in the theoretical review (part two), contemporary of risk management suggests that significant performance improvements at the board level are possible in this regard despite the current dearth of practical guidance available. Qualitative research in this study aims to test this performance assumption by interviewing board members from the most sophisticated multinational corporations at the forefront of this issue. In this regard, the seven questions below (Table 28) were presented in advance of the interview.

[502] Kaplan, R.S. & Mikes, A. (2012:5).

Table 28: Interview Questions on Risk

Q1	Does your board(s) have a process, framework or tools to identify specific external or exogenous risks such as natural disasters, geopolitical conflicts or global pandemics? If so, please elaborate further. If not, why?
Q2	Does your board(s) discuss the likelihood or probability of occurrence of such external or exogenous risks? If so, in what context? If not, why?
Q3	Does your board(s) distinguish between the improbable from the unpredictable when assessing the probability of the occurrence of an external or exogenous risk?
Q4	When discussing external or exogenous risks, does your board(s) discuss the likely time horizon to detect its occurrence and the necessary time horizon for the board or management to respond effectively (i.e. "risk clockspeed")?
Q5	Does your board(s) discuss or analyse how various risks are or could be related. If so, please elaborate further on when and how this is done. If not, why?
Q6	Does your board(s) discuss the compounding effects of related and unrelated risks (i.e. the notion that one or more adverse consequences could be triggered by one risk event)? If so, please elaborate further on when and how this is done. If not, why?
Q7	If having examined the inter-connectivity of risks and/or their compounding effect, does your board(s) re-analysis or re-categorize those risks? If so, please elaborate further on when and how this is done. If not, why?

Source: Author.

In almost every instance, the formal interview itself allowed for additional questions or open comments given the researcher's familiarity with both the respondent and their familiarity with the topic of inquiry.

B. Profiles of Companies and Board Members Interviewed

The individuals selected were a member of at least two corporate boards to allow for a more robust comparison of industry approaches, board behaviors or cultural differences relevant to uncontrollable risks. In this regard, those interviewed were mainly from multinational corporations (MNCs) with significant experience and sophistication in operating across different regions and economies as well as working with different stakeholders and industries (Table 29).

Table 29: Profiles of the Corporations Discussed

Executive Headquarters	Active Industries	Company Structure
Canada	Financial Services	Publicly listed company
Denmark	Financial Services	Anpartsselskab (ApS) (private limited company)
Germany	Insurance	Societas Europaea (SE) (publicly listed company)
Germany	Enterprise Software	Societas Europaea (SE) (publicly listed company)
Germany	Multinational Conglomerate (Energy, Transportation, Medical)	Aktiengesellschaft (AG) (public limited company)
India	Multinational Conglomerate (Transportation, Insurance)	Family owned Holding Company
Indonesia	Multinational Conglomerate (Retail, Banking, Real Estate)	Family owned Holding Company
Ireland	Medical Equipment	Publicly listed company
Netherlands	Chemical, Life Science	Naamloze vennootschap (NV) (publicly listed company)
Sweden	Electric Utility	State Owned Enterprise (SOE)
Sweden	Financial Services	Aktiebolag (AB) (public limited company)
Switzerland	Insurance	Aktiengesellschaft (AG) (public limited company)
Switzerland	Commodities, Metals and Mining	Public Limited Company (PLC)
Switzerland	Food and Beverage, Health	Société Anonyme (SA) (public limited company)
United Kingdom	Pharmaceutical, Biotechnology	Public limited company (PLC)
California, USA	Telecommunications, Semiconductor	Publicly listed company
Connecticut, USA	Multinational Conglomerate (Aviation, Energy, Medical)	Publicly listed company
New York, USA	Cosmetics, Personal Care	Publicly listed company
New York, USA	Financial Services, Mass Media	Limited partnership (LP)
New York, USA	Mass Media, Entertainment	Publicly listed company
Tennessee, USA	Transportation, Logistics	Publicly listed company
Washington, USA	Food and Beverage	Publicly listed company

Source: Author.[503]

[503] Although each person interviewed served on at least two boards, the 22 companies profiled in the table include only those that were specifically referenced in the context of the formal interview.

The research objective however was to identify new approaches and practices at the board level that would also be relevant, applicable and accessible to small and medium enterprises. Learnings that are dependent upon resources or technologies only available or accessible to only large MNCs were noted as such and therefore were not integrated into the study's findings and recommendations.

As noted earlier, given the sensitive nature of the research topic from both a competitive and liability perspective, the formal interviews were conducted confidentially. Therefore all responses cited in this study are not attributed directly to an individual or a company. However each person interviewed formally were either already known by the author in his professional capacity or were introduced to him by a common acquaintance familiar with the research topic. The matrix below is a distribution of the official board roles and gender profiles of the 15 formal interviews conducted (4 women and 11 men serving on more than one corporate BoD) of which 7 are European, 5 North American and 3 are Asian (Table 30).

Table 30: Roles Matrix of Board Members Interviewed

	Chair of the Board of Directors	Chair of Risk or Audit Committees	Member of Risk or Audit Committees	Chair of Other Board Committees
Male	6	1	3	1
Female		1	4	2

Source: Author.[504]

Each interview was documented by the author but were not transcribed or recorded given the confidential nature of the discussion (the exceptions are those responses submitted via the online survey link).

C. Presentation of Qualitative Findings

Qualitative analysis is useful to researchers as well practioners because it describes the settings (i.e., board meetings) in which decisions will be made or implemented related to the research topic (i.e., uncontrollable risks). Moreover it involves finding, analyzing, and interpreting data that are not easily reduced to numbers, can be found only in a particular social setting and produce outcomes (or behaviors) only by the people within that setting. A qualitative research approach was therefore required to address the second element of the principal research question of this study:

[504] As each person interviewed served on two or more boards, some served as board committee chairs on one of their companies while serving as a committee member on another. Therefore the maxtrix figure (18) is greater than the number of board members interviewed (15).

What are uncontrollable risks and how do they affect the role of the board of directors and what can be done to address those effects?

The main qualitative findings are presented in a manner that addresses various facets of the principal research question by integrating the responses to the initial seven interview questions as well as other relevant insights shared with the author during the interview. The qualitative findings of those interviewed are presented as:

- Reflecting the entirety of viewpoints (all respondents)
- Reflecting a majority of viewpoints (more than half of respondents)
- Representing a minority of viewpoints (less than half or not a plurality)
- Representing a plurality of viewpoints (most numerous but not a majority)
- Unattributed but "direct quotation" from an interview

The interview findings have been sorted into the two broad areas of inquiry (external risks and risk interconnectivity) for presentation and discussion purposes (Tables 31 & 32) and a third and fourth on other areas of board level insight on risk management (Table 33 & 34).

1. Findings Related to External Risks

The interviews tend to confirm that terms such as Black Swan Events (BSE), catastrophic risk and systemic risk have entered the lexicon of business around the world and are understood (or treated) as external or exogenous risk. However the understanding and importance of external risks within a company and at the board level appear highly contextual as examples cited during the interviews would range from natural disasters to cyber-attacks. The difference between a risk and uncertainty were clearly understood by those interviewed but there was a propensity to focus on risks because their probabilities are known or knowable. From all the interviews, it was clear that a board neither has the time nor the remit for conjecture related to risks. Moreover they do not have the conditions for creative work (e.g., the diversity of thinking or informal settings).

Table 31: Summary of Principal Findings on External Risks

Topics of Inquiry	Summary of Interview Findings

Conceptual Understanding of External Risks	• Majority referenced a "Black Swan Event" but often framed in conventional risk management terms such as a "high impact, low probability" event.
	• Small minority however considered a "Black Swan Event" as truly "unknown unknown" type of event.
	  ○ Interview: "Vastness of the unknown is the uncontrollable."
	  ○ Interview: "Risk management is not about a predictive model, it is about understanding the possibilities of mistakes or the improbable."

Company Identification of External of Risks	• Entirety acknowledged the identification of external risks by their companies.
	• Significant variance however in why they are identified
	  ○ Such risks are in the scope of business of the company (insurance, finance)
	  ○ Concern with system integrity of various operations of the company
	  ○ Material impact on regulatory compliance or intellectual property
	  ○ Interview: "If not impacting the core business but if such a risk still impacts the bottom line then attention will be given to it."

Board Approach to External Risks	• Majority have a risk review process in place that accounts for external risks.
	• Plurality are presented the external risks in a regular and structured manner:
	  ○ Included in a risk register, a risk map or a risk matrix for discussion
	  ○ Focus of discussion in all formats of presentation is mainly on probability and consequences
	• Minority have other or additional means to discuss external risks:
	  ○ Tradition of raising one risk topic each month for informal board discussion
	  ○ Reflection by the board while discussing strategy on what would be "existential" risk for the company
	  ○ May look at an external or systemic risk from a corporate social responsibility perspective if material to the industry overall (e.g., geopolitical or environmental challenges on extractive industries)
	  ○ Other specialized committees may consider them such as Public Policy or Science and Technology Committees
	• Interview: "The role of the board is not the active management of those risks but passive observation to plan for 'in case of'" its occurrence."
	• Interview: "A Black Swan by definition cannot be recognized and would lead to endless debate at the board."
	• Interview: "Organizations typically do one thing well but do not have the talent to handle new exogenous risks."

Source: Author.

2. Findings Related to Risk Interconnectivity

The interviews were revealing as to the interest and effort taken by a BoD in identifying and analyzing risk interconnectivity generally as well as in the context of external risks. As noted earlier in the theoretical review (part two), contemporary research suggests that significant performance improvements at the board level are possible in this regard and the findings seem to support this conclusion. The interviews were also an effort to test whether the boards of multinational corporations enjoyed significant advantages in terms of knowledge or practice but the findings tend to demonstrate that this is not the case.

Table 32: Summary of Principal Findings on Risk Interconnectivity

Topics of Inquiry	Summary of Interview Findings

Understanding of Risk Interconnectivity	• Entirety expressed an awareness of the relevance of considering how risks are interrelated or interconnected.
	• Majority considered it as an increasingly important element of risk management but still under-developed as a practice:
	  ○ Interview: "Not enough focus is given to intersecting vulnerabilities and cascading consequences."
	  ○ Interview: "Last financial crisis was about lots of things people thought were unconnected coming together at the same time."
	  ○ Interview: "Systems thinking is needed but often missing on boards."

Company Identification of Risk Interconnectivity	• Majority describe a method or process of doing such with variance on how:
	  ○ Connections are addressed either in terms of critical technology linkages or a supply chain or logistical context or recognized by type of risk.
	• Companies where core business is risk management (insurance, banking) use their risk map to look at interconnectivity by focusing on the impact of occurrence of one risk to another but do not assess the probability.
	• Plurality state connectivity is driven by the recognition of one risk category (operational) possibly impacting another (reputation):
	  ○ Interview: "Risks are generally put into buckets. If one sits in a particular bucket but it has a perceived direct impact on another then the likelihood or probability will be discussed by the board."

Board Approach to Risk Interconnectivity	• Entirety recognized that discussing the connection of a discrete risk with another (or multiple others) is rare at the board level:
	  ○ Interview: "Interconnectivity is a strategic temperament and is actually very rare even in the technology sector."
	  ○ Interview" "This is a new talent for boards as they try to optimize the current situation of the company and to its competitors and threats based on current logic regarding their business model."
	  ○ Interview: "As an organization gets connected to new markets or products it can lead to breakdowns and so huge firms have re-engineered themselves."
	• In one instance, the risk committee brainstorms about interconnections but there is no mandate to charge executives.

Source: Author.

3. Related Insights on Risk Management at the Board Level

As noted earlier, the qualitative research was based on formal and informal interviews of supervisory board members. This section presents relevant insight from both the formal and informal interviews in order to:

- Expand the practical understanding of why uncontrollable risks may or may not enter into board discussions (Table 33).
- Test the preliminary understanding of uncontrollable risk by providing new ways of framing and understanding the issue and ideas for future research (Table 34).

Table 33: Summary of Findings on Related Board Concerns

Area of Insight	Summary of Interview Findings

Time Considerations	• Large majority cited that time pressure was the reason why boards do no enter into risk envisioning dialogues to address external risks:
	  ○ Much of the board's time on risk management is focused on compliance related risk topics, particularly in the United States.
	  ○ Although a conversation may be risk related such a board committee or full board setting does not allow for creativity or conjecture.
	  ▪ Interview: "The brain drifts into a different mode if focused on regulatory requirements versus creative thinking."
	  ▪ Interview: "Risk management has failed to pick up the secondary and tertiary impact of something that adds to the impact or likelihood of risks."

Regulatory Mandates	• In some industries(banking) in major markets (USA, UK) the notion of interconnectivity is driving the regulatory interest in stress-test scenarios:
	  ○ Regulator mandated scenarios (stress tests of financial institutions) create their own risks.
	  ▪ Regulators decide on the stress test scenario and they be missing key risks.
	  ▪ Discussions at the board on general scenarios are crowded out by mandated ones.
	  ▪ Relevance for an industry does not mean the mandated stress test is meaningful for a particular company (e.g., Chinese economic collapse) and so they should be more targeted.

Board Meeting Environment	• Large majority cited that a board meeting environment is generally not conducive for creative thinking or conjecture (e.g., formal, heavy documentation, compliance focused, strict agenda, and size of board).
	  ○ Boards need to program informal discussions on serious topics:
	  ▪ Board dinners with guest experts
	  ▪ Off-site or away days with important but informal presentations to the board (e.g. Chief Risk Officer gives a "state of the world" update)
	  ▪ Create board traditions such as inviting members to select one a new risk topic each month for informal (undocumented) discussion by the full board or committee

Source: Author.

Table 34: Summary of Findings on Emerging Risks

Area of Insight	Summary of Interview Findings
Business Model Disruption	• There are new categories of risk emerging from either new technologies or the novel application of those technologies (e.g., the impact of Uber on taxi services or Apple Pay on payment systems). ○ Interview: "What is new is the notion that an entire business model could change very rapidly there is indeed more volatility in prices but what is new is the speed of disruption."

Cyber-risk	• Large majority of board members interviewed were increasingly concerned over cyber issues related to their company's digital strategy as well as their dependence on Information Technology (IT):
	  ○ Cyber risks are now shared beyond the boundaries of a single firm due to the use of cloud-based software services or mobile applications which is making risk management in this area exponentially difficult.
	  ○ Boards are increasingly expected to understand the company's cyber security system including its rapid-response and decision escalation processes.
	  ○ Board expertise sought traditionally was in accounting, finance and law but need is greatest with information technology.
	  ○ A company must have IT security expertise internally but a board in its supervisory role will increasingly need external advice (auditor) for assurance.
	  ▪ Such specialized firms are small and the demand for board's to know what is best practice in this area is increasing.
	  ▪ Boards are creating new committees dedicated to IT as well as science and technology issues.
	  • .Interview: "Cybersecurity is a race without a finish line."
	  ▪ Need to make an effort to understand the particular motivation of hackers to target your firm.
	  • Interview: "We still think the biggest vulnerability is human error internally."
	  ▪ In the near future, all services provided in IT will have some type of security certification so that the level of security provided is known to the board.
	  • Today such certification is not available and levels of insecurity are unknown and that is what concerns many boards.
	  • Interview: "Cybersecurity is truly unknowable."

Source: Author.

V. Summary of Part Three

The definition of an uncontrollable risk for this study as presented in part one (Introduction) is:

> *An uncontrollable risk is a critical uncertainty whose nature and causality may be known or knowable but the means to predict or prevent its occurrence are not yet available.*

The second part of this study (Theoretical Review) introduced the theories and analytical concepts relevant for examining the primary research question of:

> *What are uncontrollable risks and how do they affect the role of the board of directors and what can be done to address those effects?*

This third part of the study (Empirical Analysis) addresses elements of the primary research question through quantitative and qualitative research methods. The empirical aim of the quantitative analysis was to determine if diversity in terms of gender, age, organization, region and expertise impacts the following theoretical concern:

> *Does diversity (or its absence) within a Board of Directors (BoD) impact its ability to perceive uncontrollable risks differently?*

The question was explored by an extensive analysis of perceptions about global risks which are characterized typically as both exogenous and uncontrollable. This was enabled by the action research conducted at the World Economic Forum (WEF). The quantitative findings based on the data analysis of the Global Risks Perception Survey (GRPS) revealed not only the expected difference of perceptions across regions and national cultures but also a wide range of statistically significant differences based on age, expertise and gender. Given target population and the sample surveyed, this study asserts that results support the promotion of "targeted diversity" of a BoD as elaborated by Martin Hilb in the framework of New Corporate Governance (NCG).

The empirical aim of the qualitative analysis was to determine from a practical perspective the following conceptual concern:

> *Do boards engage in risk envisioning dialogue about external risks and do they analyze risk interconnectivity?*

The interviews conducted with members of the BoD demonstrate that the understanding and importance of external risks within a company and at the board level appear highly contextual as examples cited during the interviews ranged from natural disasters to cyber-attacks. The difference between a risk and uncertainty are understood but there is strong propensity with a

BoD to focus on risks because their probabilities are known or knowable. It also appears that most BoD do not have the time or the remit to explore conjectural risks. Moreover most often lack the enabling conditions (informal setting and diversity of thinking) to do so in any event. Despite such constraints, a method of envisioning uncontrollable risks by creating “what if” type scenarios is needed. The practical challenge remains in establishing a straightforward process that allows an organization to expand their thinking with regard to uncontrollable risks. It must also consider the possible interconnectivity of such risks: therefore any such process must be simple but not simplistic. Most risk management methods in this regard are too time consuming and resource intensive for a BoD.

Part Four: Summary and Recommendations

I. Conclusion

A. Introduction

This final part of the study summarizes the quantitative and qualitative findings in the context of their implications for both practice and theory. It begins with a summary of the conceptual and theoretical considerations that influenced the empirical research and that support the practical recommendations. It then develops a list of recommendations including necessary conceptual changes and board practices for addressing the challenges related to uncontrollable risk. It also highlights relevant issues for further and future research based on both the limitations of this study and its preliminary or ancillary findings. The fourth part of this study (Summary and Recommendations) will integrate the quantitative and qualitative research findings to suggest:

- How a Board of Directors (BoD) can introduce a risk envisioning dialogue or other means to address concerns regarding the ex ante identification of uncontrollable risks.

This section begins with a summary of the conceptual and theoretical considerations that underpin the practical recommendations followed by a recent external assessment of board performance. It then summarizes the relevant empirical findings (quantitative and qualitative) before moving to the sections with recommendations for a BoD.

B. Summary of Conceptual and Theoretical Considerations

The conceptual and theoretical findings that form the basis of the recommendations from this study are summarized below. They are presented in their general order of appearance in the study but more importantly in the context of their relationship to another conceptual or theoretical point relevant to uncontrollable risk.

Black Swan Events (BSE) and systemic risk have entered the lexicon of business around the world, largely as a result of major shocks such as the global financial crisis in 2008, the global H1N1 influenza pandemic in 2009 and the Great East Japan Earthquake in 2011. In the wake of such global shocks, the OECD warns of shortcomings in risk management methods that rely on questionable probability assumptions and that fail to put enough attention on the ex ante identification of risks.

Although such global shocks can be characterized as either global, catastrophic, exogenous or external risks, their primary (and shared) attribute is that they are perceived as beyond the "control" of any single institution and therefore outside of the enterprise risk management remit of most corporations. This study frames the phenomena under the rubric of uncontrollable risk which is a critical uncertainty whose nature and causality may be known or knowable but the means to predict or prevent its occurrence are not yet available. Similar risk are broadly categorized as either external or exogenous in various risk management structures; academic research, industry studies and Enterprise Risk Management (ERM) frameworks all recommend that companies engage in risk envisioning dialogue about such external risks. It is also recommended to evaluate risk interconnectivity to understand the cascading consequences. Many scholars and practioners consider ERM most effective when it is contingent on the organization's context and circumstances. The appeal of a contingency approach to ERM is that instead of searching for a universal risk management system that should be applied in all circumstances, the focus is on the specific circumstance for using an appropriate risk management system for a particular firm. Although Enterprise Risk Management (ERM) and Corporate Risk Management (CRM) are often used interchangeably in research literature, CRM is the preferred framework for studying uncontrollable risk at the board level as the term "corporate" underscores the nexus between governance, risk management and compliance (GRC).

The phenomena of uncontrollable risk is linked to an unprecedented increase in global connectivity (e.g., exponential flows of goods, capital, people and information across international borders). Rising connectivity drives higher levels of complexity and uncertainty that introduce systemic risk across industries (via supply chains or digitally) with cascading consequences. The discipline advanced in the study of uncertainties within a complex system is complexity science. Among its precepts is that complex system dynamics result in small changes having big effects or vice versa. Normal Accident Theory is premised on the notion that a system's susceptibility to accidents can be determined by examining two of its dimensions: interactive complexity and tight versus loose coupling.

Uncontrollable risks are similar to the "known unknowns" in risk parlance, but also encompass "unknown unknowns" because their probability and mode of occurrence are indeterminable. However behavioral science cautions that when presented with a choice, human beings are averse to ambiguity and therefore will prefer a probabilistic outcome over an outcome where the probabilities are unknown or unknowable. There are other cognitive biases related to decision-making and uncertainty, notably among them is hindsight bias because major external risks events (Black Swans) tend to be obvious in hindsight. The danger lies with reducing a convoluted and complex reality into a simple linear context and this does not help to build resilience to future shocks.

Decision-making in a complex circumstances requires situation awareness. Situation Awareness Theory examines how a person's state of knowledge develops in a dynamic environment. Situation awareness involves highly complex cognitive tasks with increasing frequency and benefits. It clearly benefits from an understanding of complexity science and behavioral science. The specifics of a situation will determine the adoption of the appropriate mental model that triggers the choice of strategy. That choice is difficult in the context of uncontrollable risk and the role of a Board of Directors (BoD). In this regard, Adaptive Leadership Theory posits that the biggest failure of leadership is to treat adaptive challenges like technical problems. A technical problem is one where it is defined, the solution known and the implementation is orderly. An adaptive challenge requires a novel solution and new learning. Adaptive change requires the collective intelligence of employees at all levels to learn their way towards solutions. A Positive Deviance approach to behavioral and social change is therefore worth consideration. It is premised on the notion that however intractable a problem may appear to be, an answer may present itself if communities are invited in to address it and to self-organize their own solution.

The locus of decision-making for study is the BoD and this study asserts that New Corporate Governance (NCG) is the most appropriate governance model for uncontrollable risk given its "glocal" orientation. Glocal refers to something that is "characterized by both local and global considerations. The NCG framework integrates the strength of the 'market-based' and 'relationship-based' models of corporate governance and promotes glocal approach. For a MNC such a model reinforces the notion that a world-class company must nonetheless engage all its stakeholders locally to remain more innovative than its local competitors. The NCG framework also is advantageous at the board level as it promotes better board and management team alignment in the context of foreign subsidiaries. The salient consideration is that all enterprises operate within national borders but most now have commercial interests that cross national borders as a result of increasing global flows.

ERM and Business Continuity Management (BCM) are premised on some degree of state involvement when a major risk event occurs as all such events occur in a national context. Uncontrollable risks are often systemic and therefore impacting systems that are maintained or regulated by the public sector (e.g. transportation, telecommunication, and banking). Therefore it is helpful to conceptualize a country as a complex system itself which integrates critical national and sub-national systems (also integrated into regional and global systems). Conceptualized as a system, a resilient country should be capable of adapting to changing contexts, withstanding sudden shocks and recovering affected systems. The World Economic Forum's concept of National Resilience builds further on this conceptualization identifying the critical national sub-systems and evaluating them against various factors of resilience. These factors are also applicable at the organizational level in the context of uncontrollable risk. At both levels (national and organizational), they also relate to the notion that a system's susceptibility to accidents can be determined by examining two of its dimensions: interactive complexity and tight versus loose coupling (Normal Accident Theory).

C. Summary of Relevant Empirical Findings

The quantitative and qualitative empirical findings that form the basis of the recommendations from this study are summarized below. They are presented in their general order of appearance in the study but also in the context of related research that support or challenge these findings.

The theoretical review introduced the theories and analytical concepts relevant for examining the primary research question of: "what are uncontrollable risks and how do they affect the role of the board of directors and what can be done to address those effects?" The empirical analysis addresses key elements of the question through quantitative and qualitative research methods.

The empirical aim of the quantitative analysis was to determine if diversity of gender, age, organization, region and expertise impacts the following theoretical concern: "does diversity (or its absence) within a BoD impact its ability to perceive uncontrollable risks differently?" The question was explored by an extensive analysis of perceptions about global risks. Global risks are characterized typically as both exogenous and uncontrollable. The survey was enabled by the action research conducted at the World Economic Forum (WEF) and the findings were based on the data analysis of its Global Risks Perception Survey (GRPS) The findings revealed the expected difference of perceptions across regions and national cultures but also a wide range of statistically significant differences based on age, expertise and gender. Given target population and the sample surveyed, the results support the promotion of "targeted diversity" of a BoD as elaborated in the New Corporate Governance (NCG) model.

The empirical aim of the qualitative analysis was to determine from a practical perspective if corporate boards engage in risk envisioning dialogue about external risks. It also examined whether boards analyze risk interconnectivity. Both activities are recommended by academic and ERM frameworks. Interviews conducted with supervisory board members from various industries and countries highlighted awareness of external risks within a company and at the board level. This awareness appears highly contextual as examples cited during the interviews ranged from natural disasters to cyber-attacks. The difference between a risk and uncertainty are understood but there is strong propensity to focus on risks because their probabilities are known or knowable. It also appears that most BoD do not have the time or the remit to explore conjectural risks. Risk assessment methods (quantitative and qualitative) are indeed numerous and varied in actual business practice (Table 35).

Table 35: Various Risk Assessment Techniques

Risk Analysis Methods		
Qualitative - Assessment based on experience, description and scales	**Semi-Quantitative** - Qualitative scales are given values	**Quantitative** - Analysis based on mathematical formulas
None mathematical subjective determination	*Deterministic (non-random)*	*Probabilistic*
- Brainstorming - Interview - Intuition - Questionnaire - Assumption analysis - Hierarchical Holographic modelling - Nominal groups Technique - Soft system Methodology - Risk matrix chart - Probability – impact tables - Risk mapping - Risk registers - Prompt lists - Checklists - Failure modes and Effects Criticality - Analysis (FMECA) - Hazard and operability studies (HAZOP) - Interviews	- Sensitivity analysis dependency - Spider diagrams/plots - Confidence envelope (probability contours) - Decision tree analysis - Non-dependency - Tornado diagrams - Networking scheduling - Programme Evaluation and Review Technique (PERT) Controlled Conversion Matrix (CCM) - Critical Path Method (CPM)	Random: - Monte Carlo - Latin hyper cube - Artificial neural networks Stochastic (dynamic) - Markovian logic - Network scheduling Conditional probability - Baye's theorem - Bayesian networks (risk maps)

Source: Adapted from Merna & Al-Thani, Table 4.2 (2008: 86).

Although most risk management methods in this regard may appear time consuming and resource intensive for a BoD but research has shown that high-impact boards often employ more rigorous practices than others (Table 36).

Table 36: Characteristics of High Performing Boards

Example: Strategy practices		Low-impact boards	Moderate-impact boards	High-impact boards
Rigorous … Basic	Reducing decision biases	▲	○	▲
	Evaluating resource reallocation	○	○	●
	Assessing value drivers	○	○	●
	Debating strategic alternatives	○	▲	●
	Assessing portfolio synergies	○	○	●
	Adjusting strategy, based on changing conditions	○	●	●
	Assessing whether strategy stays ahead of trends	○	●	●
	Engaging on innovation	●	●	●
	Assessing portfolio diversification	●	●	●
	▲ = Biggest aspiration ● = Practiced by majority ○ = Practiced by minority			

Source: Adapted from McKinsey Quarterly, Exhibit 1 (2014: 86).[505]

505 Baghat, C. & Conor, K. (April 2014). High-performing boards: What's on their agenda ? *McKinsey Quarterly*. Retrieved from http://www.mckinsey.com/insights/strategy/high-performing_boards_whats_on_their_agenda (last visited on 14 May 2015). Results based on April 2013 McKinsey Global Survey of 772 corporate directors on board practices.

D. Recommendations for the Board of Directors

The recommendations presented below rely upon the theoretical and conceptual guidance presented in this study and are buttressed by the most relevant findings from the quantitative and qualitative research related to uncontrollable risk. The presentation below is premised on the following practical limitations faced by a Board of Directors (BoD):

- Most boards often lack the enabling conditions (informal setting, unstructured time and diversity of thinking) for creative or innovative practices in the normal course of their board activities.

- A method of envisioning uncontrollable risks is sorely need and desired by board members.

- The practical challenge remains in establishing an straightforward process that allows an organization to expand their thinking with regard to uncontrollable risks that considers the possible interconnectivity of such risks: it therefore must be simple but not simplistic.

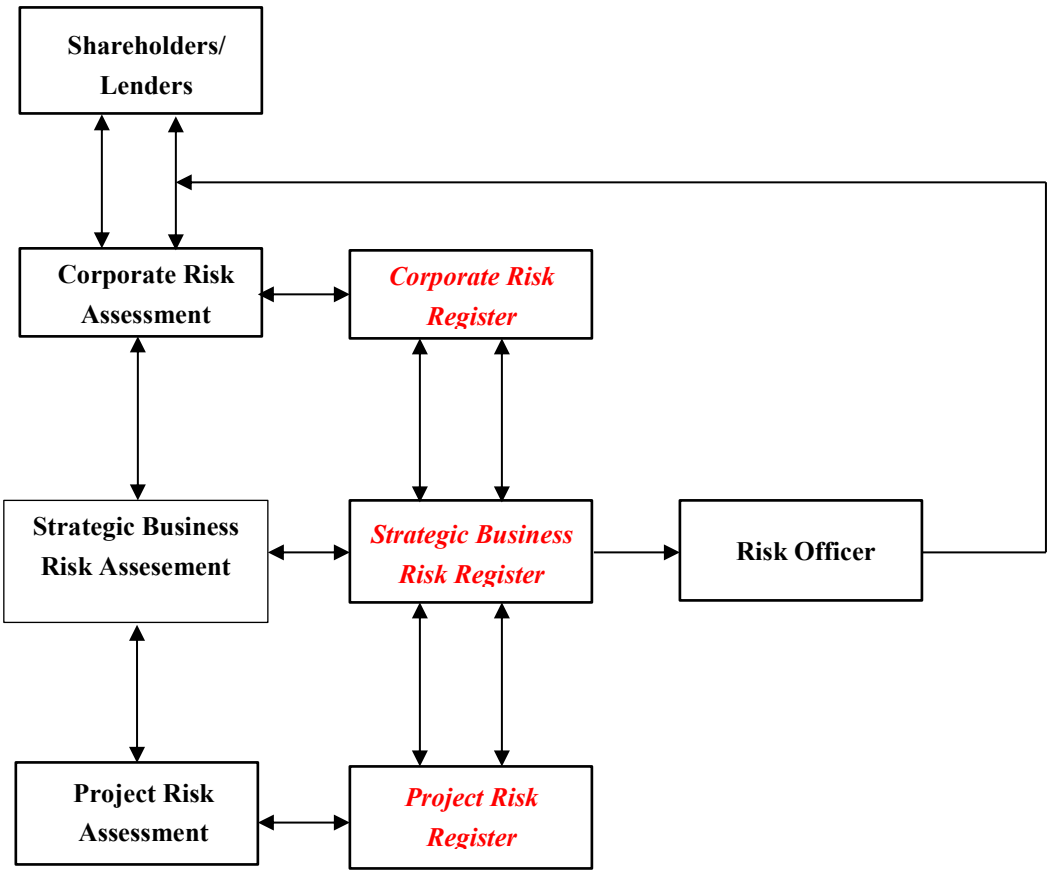
- Recent research has shown that high-impact boards often employ more rigorous practices than others.

The recommendations below are presented in a "micro" manner that the allows for the introduction of innovation into standard board procedures or commonly accepted board practices regardless of the size of the corporation.

1. Recommendations on the Ex Ante Identification of Risk

The following recommendations focus primarily on how a Board of Directors (BoD) can introduce a risk envisioning dialogue or other means to address concerns regarding the ex ante identification of uncontrollable risks. It assumes the following the risk management model or a variant as illustrated below (Figure 44). The salient consideration is with the production and dissemination of the risk register or master risk list in the context of a risk envisioning dialogue process that does separate categories of risk (e.g., corporate from strategic and strategic from operational risks) but presents an integrated and holistic list.

Figure 44: Company Risk Management Model



Source: Adapted from Merna & Al-Thani, Figure 10.8 (2008: 266)

- **Recommendation 1:** The BoD should review a consolidated or integrated master or key risk list (register) that integrates the chief risk concerns from every level of the organization (i.e., avoiding the separation of strategic from project risks). The size of risk list should be contingent on the complexity of the company's organization and operation but should range between 20-50. The BoD should also inquire about their categorization presented in such a manner (Table 37). The number of principal risk categories should be limited allowing for clusters of risks to be more easily identified under each category.

- .**Recommendation 2:** The BoD should inquire as to the composition of the core risk management teams that led the risk identification, risk categorization and risk assessment efforts to produce the master risk list presented. The inquiry should focus simply on the demographics of the responsible team members (age, gender, national

origin and expertise). Homogenous demographic attributes within a team should be considered a red flag and the BoD should reflect on possible judgement biases or common heuristics that could have influenced its composition such as ambiguity aversion or hindsight bias. The BoD should understand that improving their situation awareness is contingent on eliminating such biases that impact key information systems.

Table 37: Example of Key Risk List

Rank	Risk Category	Risk Subcategory	Risk Division	Risk
1	Strategic	Legislative/regulatory	Product/services-related	Product Y impacted by new regulation
2	Strategic	Economic	Economic risk	U.S economic downturn
3	Strategic	Supplier	Supplier failure	Supplier partial failure
4	*Operational*	Human resources	Talent Management	Loss of critical employees
5	Strategic	Strategic relationships	Joint ventures and alliances risk	Joint venture risk
6	Strategic	Execution	M&A risk	International M&A risk
7	Strategic	Execution	Product execution risk	Product quality risk
8	Strategic	Competitor	Struggling competitor(s)	Price war
9	Strategic	Supplier	Supplier relationships	Cost of goods/services increase
10	Strategic	Strategy	Channel strategy risk	Change in performance of intermediaries
11	Strategic	Competitor	Innovation	Competitor introduces new features
12	*Operational*	Human resources	Performance	Research & development (R&D) risk
13	*Operational*	Human resources	Talent Management	Labor relations risk
14	*Operational*	Disaster	Environmental damage	Environmental damage at Site X
15	*Operational*	Litigation	Litigation risk	Class action lawsuit
16	Strategic	Supplier	Supplier relationships	Change in status of regulatory licenses
17	Strategic	Strategy	Channel strategy risk	Distribution channel risk
18	*Operational*	Technology	Data security and privacy	External attack
19	*Operational*	Human resources	Talent Management	Inability to recruit enough to support growth plans
20	Financial	Credit	Counterparty risk	Change in creditworthiness of counterparties

Source: Adapted from Segal, Table 4.11 (2011: 152).

- **Recommendation 3:** The BoD should review the master risk list from a systems thinking perspective keeping in mind various fundamental principles regarding complexity such as emergence, non-linearity and phase transitions. The notion that small changes might have large effects and vice versa (non-linearity) is among the most important when reviewing the master list. The BoD should examine the entire master list from a network analyses perspective; seeking to identify relationships or linkages among the listed risks that appear as particularly fragile "risk constellations." Once such a risk constellation is identified, the BoD should attempt to understand the interdependence of various risk pairings at a subsequent meeting.

- **Recommendation 4:** If a BoD is constrained (e.g. board time, management resources, etc.) from engaging in a structure review of risk interconnectivity then they should review the master risk list from a systems standpoint and seek to identify the "center of gravity" (i.e. the most systemically influential risk) from among the risks clustered in a specific category (Table 38).

Table 38: Risk Categorization by Cluster

Risk Category	Risk Subcategory	Risk Division	Risk	Definition
Operational	Human Resources	Talent Management	Ability to recruit of retain	Ability to recruit or retain staff not matching expectations
Operational	Human Resources	Talent Management	Succession planning	Ability to develop next leadership not matching expectations
Operational	Human Resources	Talent Management	Critical employee(s)	Unexpected loss of employee(s) with critical and rare knowledge or skills
Operational	Human Resources	Talent Management	Labor or producer relations	Employees or producers take unexpected action against the company (e.g., union strike)
Operational	Technology	Data Security and Privacy	External attack	External attack (e.g., phishing) steals company or customer data, including privacy data, and/or destroys programs or data
Operational	Technology	Data Security and Privacy	Internal attack	Internal attack steals company or customer data, including privacy data, and/or destroys programs or data
Operational	Technology	Data Security and Privacy	Accidental breach	Employee accidentally exposes company or customer data, including privacy data, and/or destroys programs or data

Source: Adapted from Sigal, Table 4.1 (2011: 115).

- **Recommendation 5:** If one or more risk constellations or the centers of gravity from among the various risk categories are identified, then the BoD should consider organizing an informal risk dialogue about them outside of prescribed board activities such as board dinners or off-site retreats. The BoD could also designate one of the risk constellations or a center of gravity as an undocumented board topic for brainstorming on a monthly basis. If permissible, the BoD may consider a risk constellation or a center of gravity for a scenario type activity such as stress test exercise (Table 39).

Table 39: Stress Test Strengths and Weaknesses

Strength	Weakness
Uses more than one analysis tools to evaluate risk	Uses relatively weak financial model in that only single point assumptions are used
Seeks to challenge assumptions by brainstorming methods	Relies on individual groups to come up with point assumptions
Reasonably simple to use with minimal inputs required to generate an output	Being simple to use, brings with it a lack of robustness that more advanced techniques possess
Full breadth of risks analyzed even though outliers may not be overly realistic	Dos not, typically, take into account interdependence of input variables
	As with Monte Carlo relies on historical subjective date for variances from base.
	Risks tend to be overestimated to ensure a high degree of comfort
	Does not output a formal document identifying risk owner or mitigating actions

Source: Merna & Al-Thani, Table 4.4 (2008: 96).

The BoD may also request executive management to analyze the consequences of a particular constellation or risks or a center of gravity identified from a risk cluster (Table 40).

Table 40: Analysis of Center of Gravity Consequences

Risk Cluster	Severity	Likelihood	Risk Clockspeed	Inability to Mitigate
Financial				
Failure to attain bank covenant level performance	Very High	Moderate	Very Fast	High
Failure to renew current loan facilities	Very High	Low	Very Fast	High
Change in lender and loan policies and practices	Very High	Moderate	Fast	High
Reliance on shorter-term debt to support growth	High	High	Fast	High
Insufficient availability under current loan arrangement	High	Moderate	Fast	Moderate

Source: Adapted from Caldwell (2012: 45).

II. Contributions

A. Practical Contributions

The impact of uncontrollable risks on governance, risk management and compliance (GRC) are significant. Therefore the following conceptual framework is for a BoD to consider with regard to monitoring, managing and mitigating uncontrollable risk – the so-called three lines of defense. Each line must entail an inter-disciplinary approach that relies upon concepts and methods developed from emerging disciplines: complexity science and behavioral science. It also requires bridging functions such as Enterprise Risk Management (ERM) and Business Continuity Management (BCM) to develop a more holistic approach at the board level. Therefore in practice a BoD should consider the following three lines of defense in response to the challenge of uncontrollable risks:

- **First line of defense is Board Diversity**

  The first inquiry the BoD should make is whether there is a "diversity of thinking" within its own membership to mitigate against judgment biases. Perceptions of risk and control can vary not only based on academic training or professional experience but also on gender, geographic and generational differences.

- **Second line of defense is Risk Mapping**

  The first action the BoD should consider is to review the company's master risk list and their distribution across the company's risk map (typically the x-axis measures the probability of occurrence and the y-axis measure impact). The BoD should then consider the following four lines of inquiry (checklist) during the board's review:

  Q1: How are these risks possibly related to each other and are there intersecting vulnerabilities?

  Q2: If there are such connections, are there cascading consequences to consider?

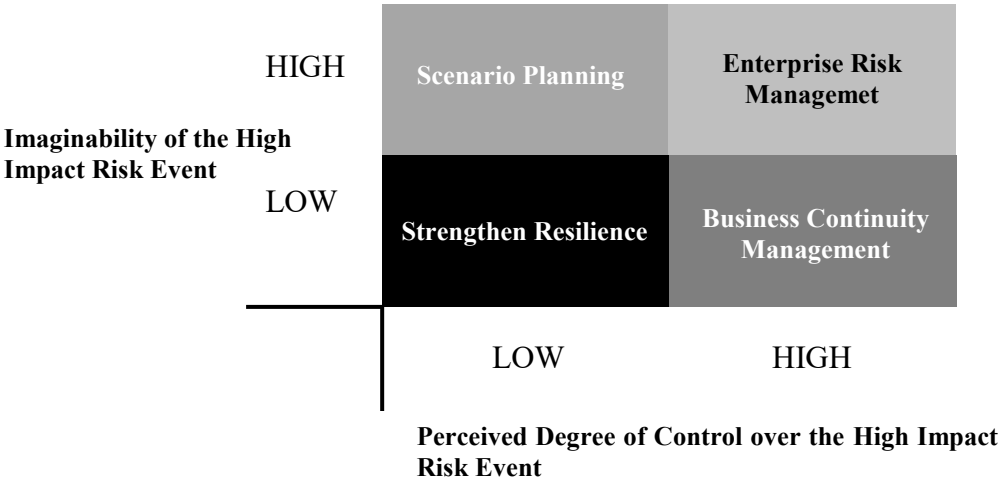
  Q3: What is missing from the from the risk map? And why?

  Q4: Are they not listed because they are not plausible – i.e. unimaginable in the current context?

  Q5. Are they not listed because they are exogenous or systemic and beyond the company's control?

  If clear examples are provided in response to Q4 and Q5 then the BoD should consider the framework below (Figure 45) to identify the appropriate means to address that particular example.

Figure 45: Uncontrollable Risks: A Response Framework for Boards

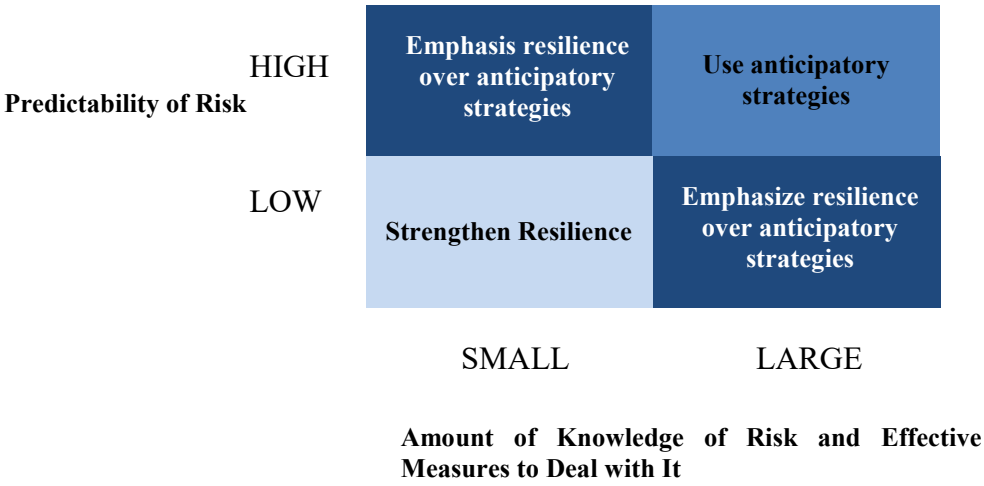


Source: Author.

- **Third line of defense is Organizational Resilience**

In addition to supervision of the company's risk management, the BoD should on an annual basis review their company's organizational resilience if a Black Swan Event were to occur. The first step of the review should be to identify those risks where the ability to predict it is very low and the amount of knowledge about the risk (including mitigation measures) is also very low – for those identified the company should consider measures to strengthen organizational resilience rather than attempting to predict or prevent the occurrence of the risk event (Figure 46).

Figure 46: Board Framework on Resilience



Source: Adapted from WEF, Figure 21 (2013; 37).[506]

[506] Adapted from Comfort, L.K., Boin, A., & Demchak, C.C. (2010). *The Rise of Resilience.* Pittsburg: University of Pittsburg Press.

In attempting to assess the company's organizational resilience, the BoD should determine if the company is a hierarchical or networked organization by evaluating the following criteria (Table 41):

Table 41: Assessing Organizational Resilience

Attributes of the Organization	Hierarchical Attributes	Networked Attributes
Leadership Style	Centralized	Distributed
Interdependence of Business Units	Tightly Coupled	Loosely Coupled
Workforce Location	Concentrated	Dispersed
Talent Recruitment	Specialists	Cross-trained Generalists
Control & Direction	Policy and procedure driven	Guided by simple yet flexible rules

Sources: Adapted from WEF, Figure 25 (2012: 33).[507]

B. Theoretical Contributions

The theoretical contributions are integrated into the summary of the theoretical review and empirical analysis as well as in this section on the theoretical and conceptual considerations for this study. An additional theoretical contribution to consider from this research is with regard to the future utility of the fundamental distinction between risk and uncertainty that emerged in the early 20th century. Whereby a risk is a measurable uncertainty whereas a true uncertainty cannot be measured and therefore cannot be characterized as a risk; yet this study posits the existence and prevalence of uncontrollable risk in what the author hopes has been done in a convincing manner.

As noted earlier in the paper, Larry Epstein and Tan Wang make the further distinction that risk entails decision-making where probabilities are available to guide choice and uncertainty is when information is too imprecise to be summarized by probabilities. Moreover there are also two types of uncertainties: aleatory uncertainty and epistemic uncertainty.

Therefore the recognition of measureable and an unmeasurable uncertainty will continue to influence the meaning and use of the term risk. This study posits that a BoD will have to consider a risk management framework for unmeasurable uncertainties (i.e., uncontrollable

507 Adapted from Nohria, N., The Organization: Survival of the Adaptive, Harvard Business Review. Retrieved from https://hbr.org/2006/05/preparing-for-a-pandemic-2 (last visited on 14 May 2015)

risks) along with those for measurable risks. The ISO 31000 (2009) therefore appropriately defines risk succinctly as the effect of uncertainty on objectives.

This study poses the theoretical question of where to direct the attention of a Board of Directors with regard to the risk and uncertainty continuum (Table 42) and where it should increase its inquiry and engagement. The findings thus far suggest that a BoD may need to also contemplate a firm's uncertainty appetite along with its supervisory role in determining a company's risk appetite.

Table 42: The Risk-Uncertainty Continuum

RISK		UNCERTAINTY
Quantifiable	→	Non-quantifiable
Statistical Assessment	→	Subjective Probability
Hard Data	→	Informed Opinion

Source: Merna & Al-Thani, Table 2.1 (2008: 15). [508]

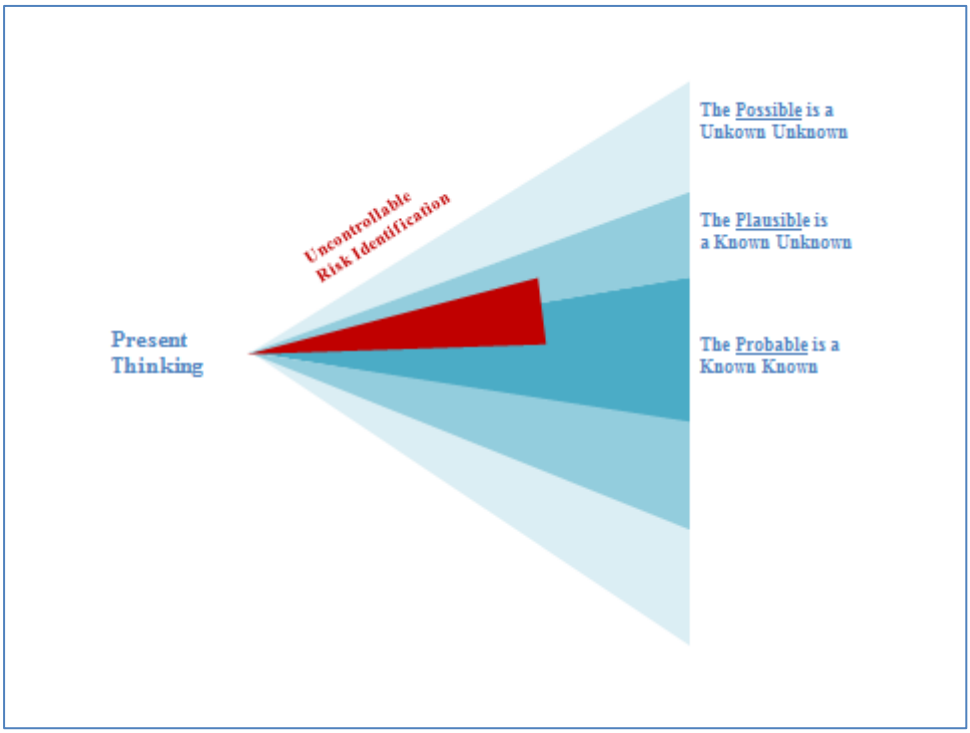
C. Limitations

The study of uncontrollable risk is an unenviable and limiting task when considering its definition as a critical uncertainty whose nature and causality may be known or knowable but the means to predict or prevent its occurrence are not yet available. The study of uncontrollable risk therefore requires contextual intelligence, which is the ability to understand the limits of our knowledge and to adapt that knowledge to an environment different from the one in which it was developed. Beyond such epistemological limits, the study of uncontrollable risks has to consider the contingent nature of risk management itself. The field of risk management remains very dynamic and is increasingly inter-disciplinary and as such the prospective issues clearly outpace the availability of new social science tools, metrics and benchmarks. Uncontrollable risk is a new construct and its observation and measurement can only provide preliminary states of correlation such as those attempted via quantitative analysis of the Global Risks Perception Survey of the World Economic Forum. Its study will continue to demand other new constructs as well as provisional theoretical relationships that rely upon additional relevant insights from more advanced qualitative research. The limitation is also conceptual as the phenomenon of uncontrollable risk is future

[508] Adapted from Rafferty, J. (1994), *Risk Analysis in Project Management*, E&FN Spon, London.

oriented and requires speculation as what is knowable and unknowable from our current state of understanding (Figure 47).

Figure 47: Range of Risk Futures



Source: Adapted from Dunne & Raby (2013: 4).

D. Future Research

The study began by highlighting the OECD's criticism of boards for failing to put sufficient emphasis on catastrophic risks as well performing poorly in the ex ante identification of risks. Other BoD shortcomings include an over-reliance on questionable probability assumptions, neglecting to study intersecting vulnerabilities across risks and risk categories as well as their cascading consequences across stakeholders. Those weaknesses in corporate governance and risk management still persist and may arguably worsen as uncertainty and complexity reshaping the business environment. Decision-making in the face of uncertainty and complexity requires much deeper study as this paper posits that both will increase driven by exponential flows of goods, services, capital, people and data. Moreover, we are at tipping point whereby efforts to curb or curtail any one of those flows would have network effects that we cannot predict in terms of their impact. Prospective research is therefore required that can integrate advanced learnings from complexity science and behavioral science, to improve risk management at all levels of an organization with regard to uncontrollable risk. The integration of these two emerging disciplines would have a powerful impact on risk

management but its prospect is as elusive and tantalizing as the search for a unified field theory in physics. Yet the faster we can arrive at a robust descriptive theory of uncontrollable risk, the sooner we can test it with the goal of introducing a normative theory – it is a race against time.

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APPENDICES

Appendix 1: Board "Process" Checklist

- ✓ Board reviews an integrated master risk list (risk register) that consolidates all critical risks regardless of risk type (corporate, strategic, project, etc.).

- ✓ Board inquires about the categorization of the risks with aim to reduce the categorizes of risk versus their actual number on the list itself.

- ✓ Board inquires about the source of the master risk list and inquire about the demographic and professional background of the team that compiled it – diversity of the group (in terms of age, gender, regional background and expertise) should be considered in the positive in terms of mitigating common cognitive biases such as ambiguity bias.

- ✓ Board reviews the master risk list from a systems perspective (as a risk map) keeping in mind fundamental principles of complexity such as emergence, non-linearity and phase transitions. The notion that small changes might have large effects and vice versa (non-linearity) should be top of mind.

- ✓ Board examines the master risk list from a network analyses perspective seeking to identify relationships or linkages that appear as particularly worrisome "risk constellations."

- ✓ Board identifies the most systemically important risk if there is a large cluster of risks under one particular category.

Appendix 2: Board "Mental" Checklist

- ✓ Board should reflect about unmeasurable but critical uncertainties (i.e., that are not included in the corporate risk appetite statement).

- ✓ Board should reflect on the composition of its membership in terms of diversity of thinking.

- ✓ Board should reflect on what is the best setting (formal or informal) to discuss external risks and risk interconnectivity in the context of a highly interactive risk dialogue.

- ✓ Board should reflect on notions of risk interdependence along with risk interconnectivity during such a dialogue.

- ✓ Board should then consider if a particular constellation of risks or a center of gravity risk should be explored further by executive management.

- ✓ Board should consider an informal but regular review of the company's risk map to discuss if a high impact risk is missing from the map and why? If the imaginability (plausibility) of the risk event is low and perceived degree of control is low then the board should reflect on the organization's resilience as a thought exercise.

- ✓ The Board should think about those risks where the ability to predict its occurrence is very low and the amount of knowledge about it is also very low – such a risk should stimulate thinking about organizational resilience rather than attempting to predict or prevent the occurrence of that risk event.

Appendix 3: Risk Descriptions & Descriptive Statistics

Economic Global Risks (2012 Survey)

1	Chronic fiscal imbalances	Failure to redress excessive government debt obligations
2	Chronic labour market imbalance	A sustained high level of underemployment and unemployment that is structural rather than cyclical in nature.
3	Extreme volatility in energy and agriculture prices	Severe price fluctuations make critical commodities unaffordable, slow growth, provoke public protest and increase geopolitical tension.
4	Hard landing of an emerging economy	The abrupt slowdown of a critical emerging economy.
5	Major systemic financial failure	A financial institution or currency regime of systemic importance collapses with implications throughout the global financial system.
6	Prolonged infrastructure neglect	Chronic failure to adequately invest in, upgrade and secure infrastructure networks.
7	Recurring liquidity crises	Recurring shortages of financial resources from banks and capital markets.
8	Severe income disparity	Widening gaps between the richest and poorest citizens.
9	Unforeseen negative consequences of regulation	Regulations which do not achieve the desired effect, and instead negatively impact industry structures, capital flows and market competition.
10	Unmanageable inflation or deflation	Failure to redress extreme rise or fall in the value of money relative to prices and wages.

Likelihood Comparisons (Economic Risks) between Groups

Global Risk	Region of Residence	Stakeholder	Age Under 40 Over 40	Gender Male Female	Expertise Expert Non-Expert
Chronic fiscal imbalance	**NthA** > All other regions	-	-	-	**4.2** > 3.91
Chronic labour market imbalances	**NthA, SSA** > E, LatAm	-	-	3.65 < **3,79**	-
Extreme volatility in energy and agriculture prices	-	-	-	-	-
Hard landing of an emerging economy	**NthA** > E, LatAM, MENA, SSA **As** > MENA	-	-	-	-
Mayjor systemic financial failure	-	-	-	-	-
Prolonged infrastructure neglect	**NthA** > All other regions	-	3.24 < **3.38**		
Recurring liquidity crises	**NthA, E, MENA** > LatAm	-	-	-	-
Severe income disparity	**NthA** > As, E, LatAm	**NGO** > G	-	4.19 < **4.31**	4.15 < **4.29**
Unforeseen negative consequences of regulation	**NthA** > LatAm	**B** > NGO, Ac, G, IO	-	-	3.41 > 3.21
Unmanageable inflation or deflation	**As** > NthA, E, LatAm SSA > LatAm	-	**3.25** > 3.11	-	3.12 < **3.24**

Table Legends

Region of Residence		Stakeholder	
As	Asia	Ac	Academia
E	Europe	B	Business
LatAm	Latin America	G	Government
NthA	North America	IO	International Organization
MENA	Middle East/North Africa	N	NGO
SSA	Sub-Saharan Africa	Other	Other

- An analysis of variance (ANOVA) tested whether or not the means of sub-groups were all equal. For those risks where they were not all equal, a Sidak post-hoc test established which of the pair-wise difference between groups were significant at the 5% level.

- Only statistically significant differences are noted; otherwise the table cell is empty.

Impact Comparisons (Economic Risks) across Groups

Global Risk	Region of Residence	Stakeholder	Age Under 40 Over 40	Gender Male Female	Expertise Expert Non-Expert
Chronic fiscal imbalance	-	-	-	-	**4.03** > 3.92
Chronic labour market imbalances	-	-	**3.86** > 3.62	3.68 < **3.88**	-
Extreme volatility in energy and agriculture prices	-	-	-	3.84 < **3.98**	-
Hard landing of an emerging economy	-	**B, Ac** > G	-	-	-
Major systemic financial failure	-	-	**4.1** > 4	-	-
Prolonged infrastructure neglect	**NthA** > E	-	-	3.15 < **3.29**	-
Recurring liquidity crises	-	-	**3.71** > 3.61	3.62 < **3.75**	-
Severe income disparity	**SSA** > As, E	**Ac, NGO, Other** > B	-	3.71 < **4.06**	3.72 < **3.89**
Unforeseen negative consequences of regulation	**SSA** > E, NthA **As** > E	**Other** > Ac, IO	**3.24** > 3.13	3.12 < **3.33**	**3.25** > 3.11
Unmanageable inflation or deflation	-	-	**3.63** > 3.52	-	-

Table Legends

Region of Residence		Stakeholder	
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Environmental Global Risks (2012 Survey)

1	Antibiotic-resistant bacteria	Growing resistance of deadly bacteria to known antibiotics.
2	Failure of climate change adaptation	Governments and business fail to enforce or enact effective measures to protect populations and transition businesses impacted by climate change.
3	Irremediable pollution	Air, water or land permanently contaminated to a degree that threatens ecosystems, social stability, health outcomes and economic development.
4	Land and waterway use mismanagement	Deforestation, waterway diversion, mineral extraction and other environment modifying projects with devastating impacts on ecosystems and associated industries.
5	Mismanaged urbanization	Poorly planned cities, urban sprawl and associated infrastructure that amplify drivers of environmental degradation and cope ineffectively with rural exodus.
6	Persistent extreme weather	Increasing damage linked to greater concentration of property in risk zones, urbanization or increased frequency of extreme weather events.
7	Rising greenhouse gas emissions	Governments, businesses and consumers fail to reduce greenhouse gas emissions and expand carbon sinks.
8	Species overexploitation	Threat of irreversible biodiversity loss through species extinction or ecosystem collapse.
9	Unprecedented geophysical destruction	Existing precautions and preparedness measures fail in the face of geophysical disasters of unparalleled magnitude such as earthquakes, volcanic activity, landslides or tsunamis.
10	Vulnerability to geomagnetic storms	Critical communication and navigation systems disabled by effects from colossal solar flares.

Likelihood Comparisons (Environmental Risks) across Groups

Global Risk	Region of Residence	Stakeholder	Age Under 40 Over 40	Gender Male Female	Expertise Expert Non-Expert
Antibiotic-resistant bacteria	**NthA** > As, LatAm **E** > LatAm	**Other** > IO	-	-	**3.67** > 3.36
Failure of climate change adaption	**NthA** > As, E, MENA	**NGO** > G	3.69 < **3.81**	3.71 < **3.89**	**4.04** > 3.69
Irremediable pollution	-	-	**3.48** > 3.24	3.25 < **3.6**	**3.62** > 3.28
Land and waterway use mismanagement	**NthA** > As, E, MENA	**NGO** > IO	-	3.54 < **3.77**	**3.91** > 3.53
Mismanaged urbanization	**NthA** > As, E, MENA	-	-	**3.64** < 3.8	**3.9** > 3.64
Persistent extreme weather	**NthA** > As, E, MENA	NGO > B	-	3.64 < **3.85**	**4.07** > 3.61
Rising greenhouse gas emissions	**NthA** > All other regions	-	3.87 < **4**	-	**4.28** > 3.86
Species overexploitation	**NthA** > MENA	NGO > G	-	-	**4** > 3.6
Unprecedented geophysical destrution	**As** > E, MENA **NthA** > E	-	**3.24** > 3.11	3.06 < **3.47**	-
Vulnerability to geomagnetic storms	**As** > E, MENA	-	-	2.53 < **2.75**	-

Table Legends

Region of Residence		Stakeholder	
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MENA	Middle East/North Africa	N	NGO
SSA	Sub-Saharan Africa	Other	Other

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- Only statistically significant differences are noted; otherwise the table cell is empty.

Impact Comparisons (Environmental Risks) across Groups

Global Risk	Region of Residence	Stakeholder	Age Under 40 Over 40	Gender Male Female	Expertise Expert Non-Expert
Antibiotic-resistant bacteria	-	-	**3.63** > 3.51	-	-
Failure of climate change adaption	-	**NGO** > B	-	3.8 < **4.16**	**4.17** > 3.84
Irremediable pollution	**LatAm** > E, NthA	-	**3.82** > 3.5	3.55 < **3.92**	-
Land and waterway use mismanagement	**LatAm** > As, E	**NGO** > Ac, B	**3.66** > 3.5	3.47 < **3.83**	**3.72** > 3.54
Mismanaged urbanization	**LatAm** > E	**NGO, Other** > B	-	3.31 < **3.59**	**3.6** > 3.33
Persistent extreme weather	**NthA, LatAm** > E	**NGO** > B	-	3.56 < **3.87**	**3.95** > 3.57
Rising greenhouse gas emissions	**NthA** > As	**NGO** > B,G	-	3.82 < **4.04**	**4.23** > 3.8
Species overexploitation	-	**NGO** > B	-	3.29 < **3.55**	**3.72** > 3.27
Unprecedented geophysical destrution	**NthA, LatAm, As** > E	-	**3.45** > 3.24	3.25 < **3.55**	-
Vulnerability to geomagnetic storms	**LatAm** > NthA, E, As	-	-	-	-

Table Legends

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Geopolitical Global Risks (2012)

1	Critical fragile states	A weak state of high economic and geopolitical importance that faces strong likelihood of collapse.
2	Diffusion of weapons of mass destruction	The availability of nuclear, chemical, biological and radiological technologies and materials leads to crises.
3	Entrenched organized crime	Highly organized and very agile global networks committing criminal offences.
4	Failure of diplomatic conflict resolution	The escalation of international disputes into armed conflicts.
5	Global governance failure	Weak or inadequate global institutions, agreements or networks, combined with competing national and political interests, impede attempts to cooperate on addressing global risks.
6	Militarization of space	Targeting of commercial, civil and military space assets and related ground systems that can precipitate or escalate an armed conflict.
7	Pervasive entrenched corruption	The widespread and deep-rooted abuse of entrusted power for private gain.
8	Terrorism	Individuals or a non-state group successfully inflict large-scale human or material damage.
9	Unilateral resource nationalization	Unilateral moves by states to ban exports of key commodities, stockpile reserves and expropriate natural resources.
10	Widespread illicit trade	Unchecked spread of illegal trafficking of goods and people throughout the global economy.

Likelihood Comparisons (Geopolitical Risks) across Groups

Global Risk	Region of Residence	Stakeholder	Age Under 40 Over 40	Gender Male Female	Expertise Expert Non-Expert
Critical fragile states	**NthA** > As, LatAm	-	-	-	-
Diffusion of wapons of mass destruction	**NthA** > All other regions	-	3.14 < **3.3**	-	**3.34** > 3.18
Entrenched organized crime	**NthA, LatAm** > As, E	-	-	3.4 < **3.61**	**3.57** > 3.41
Failure of diplomatic conflict resolution	**NthA** > As, E, LatAm, SSA **NthA** > As, LatAM	**All other stakeholders** > G	-	-	-
Global governance failure	**E** > As	-	-	-	-
Militarization of space	**As** > LatAm	-	-	2.75 < **2.95**	-
Pervasive entrenched corruption	**NthA** > As, E	-	-	3.69 < **3.87**	-
Terrorism	**NthA** > As, LatAm, E	-	-	-	-
Unilateral resource nationalization	**NthA** > MENA, LatAm, SSA	-	-	-	-
Widespread Illicit trade	**NthA** > As, E, LatAm	-	-	3.38 < **3.57**	-

Table Legends

Region of Residence		Stakeholder	
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Impact Comparisons (Geopolitical Risks) across Groups

Global Risk	Region of Residence	Stakeholder	Age Under 40 Over 40	Gender Male Female	Expertise Expert Non-Expert
Critical fragile states	-	-	**3.61** > 3.46	3.5 < **3.63**	-
Diffusion of weapons of mass destruction	**NthA** > As	-	-	3.86 < **4.07**	-
Entrenched organized crime	**LatAm** > As, E, NthA	**IO, NGO** > B	**3.3** > 3.13	3.09 < **3.52**	-
Failure of diplomatic conflict resolution	-	-	-	3.64 < **3.81**	-
Global governance failure	-	**Other** > B	-	3.74 < **3.92**	-
Militarization of space	-	-	**3.24** > 3.1	3.1 < **3.33**	-
Pervasive entrenched corruption	**LatAm >** As, E **SSA >** E	**NGO** > Ac, B, G **Other** > B	**3.57** > 3.38	3.38 < **3.69**	-
Terrorism	**NthA As, MENA** > E	-	**3.67** > 3.52	3.5 < **3.82**	-
Unilateral resource nationalization	**-**	**NGO** > IO-	-	3.36 < **3.53**	-
Widespread Illicit trade	**MENA >** As, E, NthA **LatAm >** As, E **SSA >** E	**NGO** > Ac, B	-	2.91 < **3.33**	-

Table Legends

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Societal Global Risks (2012)

1	Backlash against globalization	Resistance to further increased cross-border mobility of labour, goods and capital.
2	Food shortage crises	Inadequate or unreliable access to appropriate quantities and quality of food and nutrition.
3	Ineffective illicit drug policies	Continued support for policies that do not abate illegal drug use but do embolden criminal organizations, stigmatize drug users and exhaust public resources.
4	Mismanagement of population ageing	Failure to address both the rising costs and social challenges associated with population ageing.
5	Rising rates of chronic disease	Increasing burden of illness and long-term costs of treatment threaten recent societal gains in life expectancy and quality.
6	Rising religious fanaticism	Uncompromising sectarian views that polarize societies and exacerbate regional tensions.
7	Unmanaged migration	Mass migration driven by resource scarcity, environmental degradation and lack of opportunity, security or societal stability.
8	Unsustainable population growth	Unsustainably low or high population growth rates and sizes, creating intense and rising pressure on resources, public institutions and social stability
9	Vulnerability to pandemics	Inadequate disease surveillance systems, failed international coordination and the lack of vaccine production capacity.
10	Water supply crises	Decline in the quality and quantity of fresh water combine with increased competition among resource-intensive systems,

Table Legends

Region of Residence		**Stakeholder**	
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Likelihood Comparisons (Societal Risks) across Groups

Global Risk	Region of Residence	Stakeholder	Age	Gender	Expertise
			Under 40 **Over 40**	**Male** **Female**	**Expert** **Non-Expert**
Backlash against globalization	**NthA** > LatAm	-	-	**3.18** > 3.04	
Food shortage crises	**NthA** > As, LatAm			3.55 < **3.71**	**3.69** > 3.52
Ineffective illicit drug policies	**LatAm, NthA** > As, E, SSA E > As	-	-	-	-
Mismanagement of population ageing	**NthA, E** > As, LatAM, SSA, MENA	**NGO** > G	-	-	-
Rising rages of chronic disease	**NthA** > As, E, MENA, LatAm	-	-	3.37 < **3.57**	**3.52** > 3.36
Rising religious fanaticsm	**NthA** > As, E, LatAm	-	-	-	3.59 < **3.71**
Unmanaged migration	**NthA, E** > As	**NGO** > G	-	3.34 < **3.63**	**3.5** > 3.36
Unsustainable population growth	-	-	**3.52** > 3.38	3.39 < **3.6**	**3.53** > 3.37
Vulnerability to pandemics	**NthA** > E, MENA, LatAm **As** > E	-	-	-	-
Water supply crises	-	-	-	3.78 < **4.01**	-

Table Legends

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SSA	Sub-Saharan Africa	Other	Other

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Impact Comparisons (Societal Risks) across Groups

Global Risk	Region of Residence	Stakeholder	Age Under 40 Over 40	Gender Male Female	Expertise Expert Non-Expert
Backlash against globalization	-	-	-	-	-
Food shortage crises	-	-	-	**3.94** > 3.73	**3.69** > 3.52
Ineffective illicit drug policies	**LatAm** > All other regions	**NGO** > B	-	2.95 < **3.25**	**3.14** > 2.94
Mismanagement of population ageing	-	**NGO, B** > G	-	-	-
Rising rages of chronic disease	**LatAm, NthA >** E	-	**3.42** > 3.28	3.25 < **3.58**	**3.44** > 3.27
Rising religious fanaticsm	**NthA** > E, As	-	-	3.59 < **3.76**	-
Unmanaged migration		**NGO** > B	-	3.27 < **3.69**	**3.49** > 3.3
Unsustainable population growth	-	-	**3.78** > 3.64	3.63 < **3.91**	**3.8** > 3.63
Vulnerability to pandemics	**NthA** > E	-	**3.68** > 3.54	3.56 < **3.71**	
Water supply crises	**LatAm** > E, As	-	3.12 > **3.87**	3.89 < **4.22**	**4.05** > 3.93

Table Legends

Region of Residence		Stakeholder	
As	Asia	Ac	Academia
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Technological Global Risks (2012)

1	Critical systems failure	Single-point system vulnerabilities trigger cascading failure of critical information infrastructure and networks.
2	Cyber attacks	State-sponsored, state-affiliated, criminal or terrorist cyber-attacks.
3	Failure of intellectual property regime	The loss of the international intellectual property regime as an effective system for stimulating innovation and investment.
4	Massive digital misinformation	Deliberately provocative, misleading or incomplete information disseminates rapidly and extensively with dangerous consequences.
5	Massive incident of data fraud/theft	Criminal or wrongful exploitation of private data on an unprecedented scale.
6	Mineral resource supply vulnerability	Growing dependence of industries on minerals that are not widely sourced with long extraction-to-market time lag for new sources.
7	Proliferation of orbital debris	Rapidly accumulating debris in high-traffic geocentric orbits jeopardizes critical satellite infrastructure.
8	Unforeseen consequences of climate change mitigation	Attempts at geoengineering or renewable energy development result in new complex challenges.
9	Unforeseen consequences of nanotechnology	The manipulation of matter on an atomic and molecular level raises concern on nanomaterial toxicity
10	Unforeseen consequences of new life science technologies	Advances in genetics and synthetic biology produce unintended consequences, mishaps or are used as weapons.

Likelihood Comparisons (Technological Risks) across Groups

Global Risk	Region of Residence	Stakeholder	Age Under 40 & Over 40	Gender Male & Female	Expertise Expert & Non-Expert
Critical systems failure	**NthA**, E, As, SSA > LatAm	**Ac, Other** > IO, NGO	-	-	-
Cyber attacks	**NthA** > All other regions E > SSA	**Ac, B, NGO** > IO	-	-	**4.01** > 3.75
Failure of intellectual property regime	**As, E, NthA** > MENA	**B** > G	-	-	**3.13** > 2.96
Massive digital misinformaton	**As** > LatAm	-	-	-	-
Massive incident of data fraud/theft	**NthA** > As, E, LatAm	**B** > IO	-	-	**3.68** > 3.46
Mineral resource supply vulnerability	**E** > LatAM, MENA **As** > MENA	**NGO, B** > IO	-	-	-
Proliferation of orbital debris	-	**Ac** > IO	-	-	**2.97** > 2.83
Unforeseen consequences of climate change mitigation	**NthA** > E	**Other** > IO	-	3.17 < **3.36**	-
Unforeseen consequences of nanotechnology	-	-	-	2.71 < **3**	2.69 < **2.83**
Unforeseen consequences of new life science technologies	-	-	-	3.08 < **3.22**	-

Table Legends

Region of Residence		Stakeholder	
As	Asia	Ac	Academia
E	Europe	B	Business
LatAm	Latin America	G	Government
NthA	North America	IO	International Organization
MENA	Middle East/North Africa	N	NGO
SSA	Sub-Saharan Africa	Other	Other

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Impact Comparisons (Technological Risks) across Groups

Global Risk	Region of Residence	Stakeholder	Age Under 40 Over 40	Gender Male Female	Expertise Expert &Non-Expert
Critical systems failure	-	-	**3.74** > 3.52	-	-
Cyber attacks	-	-	-	3.47 < **3.63**	-
Failure of intellectual property regime	-	-	**3.05** > 2.94	-	-
Massive digital misinformaton	**MENA** > E, NthA	-	**3.36** > 3.15	3.15 < **3.48**	-
Massive incident of data fraud/theft	**MENA**, LatAm > E	-	**3.34** > 3.21	3.2 < **3.46**	-
Mineral resource supply vulerability	**E** > NthA	**NGO** > IO	-	-	-
Proliferation of orbital debris	**LatAm, As** > NthA	**NGO** > B, IO **Other** > IO	-	2.73 < **2.96**	-
Unforeseen consequences of climate change mitigation	-	**Other** > B	-	3.27 < **3.57**	
Unforeseen consequences of nanotechnology	-	**NGO** > B, IO	**3.09** > 2.91	2.9 < **3.53**	2.84 < **3.04**
Unforeseen consequences of new life science technologies	-	**NGO** > IO	**3.43** > 3.3	3.29 < **3.53**	-

Table Legends

Region of Residence		Stakeholder	
As	Asia	Ac	Academia
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LatAm	Latin America	G	Government
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MENA	Middle East/North Africa	N	NGO
SSA	Sub-Saharan Africa	Other	Other

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Average Likelihood and Impact Scores and their Margin of Error

Global Risk Economic	Likelihood Score (Average) & Margin of Error	Impact Score (Average) & Margin of Error
Chronic fiscal imbalances	3.97 +/- 0.05	3.97 +/- 0.05
Chronic labour market imbalances	3.69 +/- 0.05	3.73 +/- 0.05
Extreme volatility in energy and agriculture prices	3.71 +/- 0.05	3.88 +/- 0.05
Hard landing of an emerging economy	3.46 +/- 0.05	3.49 +/- 0.05
Major systemic financial failure	3.44 +/- 0.06	4.04 +/- 0.05
Prolonged infrastructure neglect	3.32 +/- 0.06	3.19 +/- 0.05
Recurring liquidity crises	3.36 +/- 0.05	3.66 +/- 0.05
Severe income disparity	4.22 +/- 0.05	3.8 +/- 0.05
Unforeseen negative consequences of regulation	3.31 +/- 0.06	3.18 +/- 0.06
Unmanageable inflation or deflation	3.18 +/- 0.05	3.57 +/- 0.05

Global Risk Environmental	Likelihood Score (Average) & Margin of Error	Impact Score (Average) & Margin of Error
Antibiotic-resistant bacteria	3.42 +/- 0.06	3.57 +/- 0.06
Failure of climate change adaptation	3.76 +/- 0.06	3.9 +/- 0.06
Irremediable pollution	3.35 +/- 0.06	3.65 +/- 0.06
Land and waterway use mismanagement	3.61 +/- 0.06	3.57 +/- 0.05
Mismanaged urbanization	3.69 +/- 0.06	3.39 +/- 0.06
Persistent extreme weather	3.7 +/- 0.06	3.65 +/- 0.06
Rising greenhouse gas emissions	3.94 +/- 0.05	3.88 +/- 0.05
Species overexploitation	3.68 +/- 0.06	3.36 +/- 0.06
Unprecedented geophysical destruction	3.17 +/- 0.06	3.33 +/- 0.06
Vulnerability to geomagnetic storms	2.59 +/- 0.06	3.16 +/- 0.06

The tables above show the average likelihood and impact scores and their margins of error (based on a 95% confidence level). The larger the margin of error, the lower the confidence that the result is close to the "true" figure of the entire survey populations.

Global Risk Geopolitical	Likelihood Score (Average) & Margin of Error	Impact Score (Average) & Margin of Error
Critical fragile states	3.38 +/- 0.06	3.53 +/- 0.05
Diffusion of weapons of mass destruction	3.23 +/- 0.06	3.92 +/- 0.06
Entrenched organized crime	3.46 +/- 0.06	3.21 +/- 0.06
Failure of diplomatic conflict resolution	3.58 +/- 0.06	3.69 +/- 0.05
Global governance failure	3.69 +/- 0.06	3.79 +/- 0.05
Militarization of space	2.81 +/- 0.06	3.16 +/- 0.06
Pervasive entrenched corruption	3.74 +/- 0.06	3.47 +/- 0.06
Terrorism	3.64 +/- 0.06	3.59 +/- 0.06
Unilateral resource nationalization	3.35 +/- 0.06	3.4 +/- 0.06
Widespread illicit trade	3.43 +/- 0.06	3.03 +/- 0.06

Global Risk Societal	Likelihood Score (Average) & Margin of Error	Impact Score (Average) & Margin of Error
Backlash against globalization	3.14 +/- 0.06	3.34 +/- 0.06
Food shortage crises	3.6 +/- 0.06	3.83 +/- 0.06
Ineffective illicit drug policies	3.41 +/- 0.06	3.03 +/- 0.06
Mismanagement of population ageing	3.83 +/- 0.05	3.67 +/- 0.05
Rising rates of chronic disease	3.43 +/- 0.06	3.35 +/- 0.05
Rising religious fanaticism	3.66 +/- 0.06	3.64 +/- 0.06
Unmanaged migration	3.42 +/- 0.06	3.39 +/- 0.06
Unsustainable population growth	3.45 +/- 0.06	3.71 +/- 0.06
Vulnerability to pandemics	3.2 +/- 0.06	3.6 +/- 0.06
Water supply crises	3.85 +/- 0.05	3.98 +/- 0.05

The tables above show the average likelihood and impact scores and their margins of error (based on a 95% confidence level). The larger the margin of error, the lower the confidence that the result is close to the "true" figure of the entire survey populations.

Global Risk Technological	Likelihood Score (Average) & Margin of Error	Impact Score (Average) & Margin of Error
Critical systems failure	2.96 +/- 0.06	3.62 +/- 0.06
Cyber attacks	3.82 +/- 0.06	3.52 +/- 0.06
Failure of intellectual property regime	3 +/- 0.06	2.99 +/- 0.06
Massive digital misinformation	3.36 +/- 0.07	3.24 +/- 0.06
Massive incident of data fraud/theft	3.52 +/- 0.06	3.27 +/- 0.06
Mineral resource supply vulnerability	3.42 +/- 0.06	3.45 +/- 0.06
Proliferation of orbital debris	2.87 +/- 0.06	2.8 +/- 0.06
Unforeseen consequences of climate change mitigation	3.23 +/- 0.06	3.35 +/- 0.06
Unforeseen consequences of nanotechnology	2.79 +/- 0.06	2.99 +/- 0.06
Unforeseen consequences of new life science technologies	3.11 +/- 0.06	3.36 +/- 0.06

The table above shows the average likelihood and impact scores and their margins of error (based on a 95% confidence level). The larger the margin of error, the lower the confidence that the result is close to the "true" figure of the entire survey populations.

Appendix 4: World Economic Forum Community of Chairmen Retreat Participants

Villars-sur-Ollon, Switzerland, 17-19 April 2015

Svein Aaser	Chairman of the Board	Telenor ASA	Norway
Thomas Thune Andersen	Chairman of the Board of Directors	DONG Energy	Denmark
Rahul Bajaj	Chairman	Bajaj Auto Ltd	India
Peter Babeck-Letmathe	Chairman of the Board	Nestlé SA	Switzerland
Chen Feng	Chairman of the Board	HNA Group Co. Ltd	People's Republic of China
David Cruickshank	Global Chairman Elect	Deloitte LLP	United Kingdom
Michel Demaré	Chairman; Non-Executive Director	Syngenta International AG	Switzerland
Augie K. Fabela II	Co-Founder and Chairman Emeritus	VimpelCom Ltd	Netherlands
Olav Fjell	Chair of the Board of Directors	Statkraft AS	Norway
Orit Gadiesh	Chairman	Bain & Company Inc.	USA
Peter T. Grauer	Chairman	Bloomberg LP	USA
Richard Haythornthwaite	Chairman	MasterCard	USA
Paul Manduca	Chairman	Prudential Plc	United Kingdom
Robert S. Miller	Chairman of the Board	American International Group Inc. (AIG)	USA
Patrice Motsepe	Founder and Executive Chairman	African Rainbow Minerals	South Africa
Lars G. Nordström	Chairman of the Board	Vattenfall AB	Sweden
Damien O'Brien	Chairman	Egon Zehnder	United Kingdom
Patrick O'Sullivan	Chairman	Old Mutual Plc	United Kingdom
Sheila Penrose	Chairman of the Board	JLL	USA
Svein Rennemo	Chairman, Board of Directors	Statoil ASA	Norway
Jim Hagemann Snabe	Chairman, Centre for Global Industries	World Economic Forum	Switzerland
Tom de Swaan	Chairman of the Board of Directors	Zurich Insurance Group	Switzerland
Robert W. Swannell	Chairman	Marks & Spencer Plc	United Kingdom
Jeroen van der Veer	Chairman, Supervisory Board	ING Group	Netherlands

Appendix 5: The Risk Response Network Community (RRN)

The World Economic Forum's Risk Response Network (RRN) was launched in January 2011 to provide private and public sector leadership with an independent platform to better monitor, prepare for, respond to and mitigate global and systemic risks and was disbanded in September of 2013.

Community Members on July 2011 (Organizations Only)

Private Sector

ABB	Deloitte	The Olayan Group
Abraaj Capital Limited	Deutsche Bank AG	Omnicom Group Inc.
Accel Partners	DuPont	PepsiCo Inc.
Accenture	Ernst & Young	PwC
Aetna Inc.	Eskom	Publicis Groupe SA
Agility	Fluor Corporation	Siemens AG
Alcoa	Heidrick & Struggles	Swiss Reinsurance Company Ltd.
Apax Partners LLP	Deloitte	System Capital Management
ArcelorMittal	Deutsche Bank AG	Troika Dialog Group
Bahrain Mumtalakat Holding Company	HIS	Thomson Reuters
Bombardier Inc.	Infosys Technologies Ltd	UBS
The Boston Consulting Group	KPMG	Vision 3
CA Technologies	Kudelski Group	Wipro
Clifford Chance LLP	Marsh & McLennan Companies Inc.	WPP Plc
Credit Suisse	Nomura Holdings Inc.	Zurich Financial Services

Public Sector

Europol	Federation of the Red Cross	Government of Canada
Government of Colombia	Government of Japan	Government of Mexico
Government of Nigeria	Government of Singapore	Government of South Korea
Government of Thailand	Government of the United Kingdom	The Nature Conservancy
United Nations	US Department of Homeland Security	World Bank
World Wide Fund for Nature		

CURRICULUM VITAE

William Lee Howell

Professional Experience

2009 - Present
World Economic Forum, Managing Director, Member of the Managing Board
2004 - 2009
World Economic Forum, Senior Director, Head of Asia
2002 - 2004
United States Agency for International Development, Senior Policy Advisor
2000 - 2002
World Economic Forum, Director of the Annual Meeting Programme
2000
United Nations High Commissioner for Refugees, Consultant (Executive Office)
1996 - 1999
Japan Society, Deputy Director
1993 - 1996
Center for Strategic and International Studies, Fellow
1991
Law Offices of Ortner Poch Foramitti, Legal Intern
1989 - 1990
The Jefferson Hotel, Assistant Manager and Concierge

Educational Background

2009 - 2015
Universität St.Gallen - Hochschule für Wirtschafts-, Rechts- und Sozialwissenschaften sowie Internationale Beziehungen (HSG)
PhD Candidate , Law
1994 - 1995
American University, Washington College of Law
Master of Laws (LLM), International Law
1990 - 1993
Widener University School of Law
Juris Doctor (J.D.)
1986 - 1990
University of Maryland in College Park
Bachelor of Arts (BA) , Economics
1985 - 1989
University of Maryland in College Park
Bachelor of Arts (BA) , East Asian Languages & Literature