DEVELOPING A NET-CENTRIC FORESIGHT MODEL FOR THE MANAGEMENT OF EMERGING RISKS

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A thesis submitted in fulfilment of the
requirements for the award of the degree of
Doctor of Philosophy (Policy Studies)

Razak Faculty of Technology and Informatics
Universiti Teknologi Malaysia

MARCH 2019

DEDICATION

Dedicated to the late Prof Philip M. Taylor, my former thesis supervisor and personal tutor at the University of Leeds, United Kingdom, who played a role in some of the most momentous events of the late 20th century. Cursum Perficio.

ACKNOWLEDGEMENT

ABSTRACT

With global risks increasing in magnitude, speed and cross-sectoral complexity, there is a critical need to foresee disruptive developments in an accurate, expeditious and cost-effective manner. Scholars concur that emerging risks may overwhelm the global capacity to contain them due to large-scale systems interdependencies and increasing risk propagation pathways. Therefore, this qualitative study developed a whole-system based Strategic Foresight Model (SFM) that can rapidly identify and manage emerging transboundary risks. There were two consecutive methodological phases in this thesis: the first involved an instrumentalist approach to develop the SFM while the latter entailed a cross-comparative study to validate the new model. The instrumentalist approach plugged critical gaps in the traditional foresight process by incorporating elements such as a net-centric foresight platform; open source environmental scanning; and a specifically-designed Cone of Risk for the diagnosis stage of the foresight process. Instrumentalism aided the SFM's development by situating the new model within the ephemeralization-complex adaptive system theoretical paradigm; identifying key components of the Cone of Risk diagnosis tool; and subjecting the SFM to random case studies and an individual instrument test. Since The SFM had also posited itself as a net-centric alternative to closed-door, protracted and resource-intensive traditional Delphi studies, the World Economic Forum (WEF)'s annual global risk reports, particularly for the years 2016 and 2017, were used as comparative benchmarks. A group survey comprising 34 key respondents drawn from a think tank, risk-savvy professionals and post-graduate students managed to pre-emptively identify 49 global risks via the SFM – including all 30 risks subsequently published by the WEF for the year 2017. Research validation was achieved through qualitative comparative analysis which, in turn, was facilitated by standardizing risk descriptions and taxonomy used by the WEF. The SFM will significantly impact the application of rapid risk foresight, open governance, and national policy planning, amongst others, as it can seamlessly integrate the emergent quadruple helix model into a single net-centric matrix – one that will be economical, robust and highly-adaptable for users.

ABSTRAK

Ekoran risiko global yang semakin meningkat dari segi kerumitan, kelajuan dan penyebaran rentas sektoral, terdapat keperluan kritikal untuk meramalkan risiko yang tepat, cepat dan kos efektif. Para ilmuwan menyimpulkan bahawa risiko masa hadapan mungkin akan mengatasi keupayaan global untuk mengawalnya disebabkan oleh sistem berskala besar yang saling ketergantung dan pelebaran jalur penyebaran risiko. Oleh itu, kajian kualitatif ini membangunkan *Strategic Foresight Model* (SFM) berdasarkan sistem keseluruhan yang boleh mengenal pasti dan mengawal risiko lintas batas dengan cepat. Terdapat dua fasa metodologi berturut-turut dalam tesis ini: yang pertama melibatkan pendekatan instrumentalis untuk membangunkan SFM sementara fasa seterusnya melibatkan kajian silang-perbandingan untuk mengesahkan model baru. Pendekatan instrumentalis mengisi jurang kritikal dalam proses ramalan tradisional dengan menggabungkan elemen-elemen seperti platform ramalan maya; pengimbasan maklumat sumber terbuka; dan *Cone of Risk* yang direka khusus untuk peringkat diagnosis dalam proses ramalan. Instrumentalis membantu pembangunan SFM dengan menempatkan model baru dalam paradigma teori sistem penyesuaian-pelarasan kompleks; mengenal pasti komponen utama alat diagnosis *Cone of Risk*; dan meggunakan SFM untuk kajian kes rawak dan ujian instrumen individu. Memandangkan SFM telah meletakkan dirinya sebagai alternatif maya untuk kajian Delphi tradisional yang terhad, berlarutan dan sumber intensif, laporan risiko global tahunan Forum Ekonomi Dunia (WEF) – khususnya untuk tahun 2016 dan 2017 – digunakan sebagai penanda aras perbandingan. Satu tinjauan berkumpulan yang terdiri daripada 34 responden utama yang diambil dari golongan pemikir, profesional yang berfahaman hal-hal risiko dan pelajar pasca siswazah berjaya mengenal pasti 49 risiko global melalui SFM – termasuk semua 30 risiko global yang diterbitkan oleh WEF untuk tahun 2017. Pengesahan dicapai melalui analisis perbandingan kualitatif dengan cara menyeragamkan penerangan risiko dan taksonomi yang digunakan oleh WEF. SFM akan memberi kesan yang ketara kepada aplikasi ramalan jauh yang tangkas, pengurusan kerajaan terbuka, dan perancangan dasar negara antara lain mengintegrasikan model *helix kuadruple* ke dalam satu matriks berpadu maya yang berekonomi, teguh dan sangat mudah digunakan untuk pengguna.

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LIST OF ABBREVIATIONS

AI	-	Artificial Intelligence
ASCE	-	American Society of Civil Engineers
ATM	-	Automated Teller Machine
Brexit	-	Portmanteau of "British Exit" from the European Union
CAS	-	Complex Adaptive System
CIFS	-	Copenhagen Institute of Future Studies (CIFS).
DCDC	-	Development, Concepts and Doctrine Centre (UK)
DEFRA	-	Department for Environment, Food and Rural Affairs (Australia)
DoD	-	Department of Defence (US)
EC	-	European Commission
EEA	-	European Environmental Agency
EEGST	-	Economic, Environmental, Geopolitical, Societal and Technological
ELE	-	Extinction Level Event
EFSA	-	European Food Safety Authority
EROI	-	Energy Return on Investment
ESRC	-	Economic and Social Research Council (UK)
ETA	-	Event Tree Analysis
EU	-	European Union
FAO	-	Food and Agricultural Organization
GPO	-	Government Printing Office (US)
GRPS	-	Global Risks Perception Survey
GSN	-	Global Scanning Network
Infoscape	-	Portmanteau of Information and Landscape
Infotainment	-	Portmanteau of Information and Entertainment
IGP	-	Inspector General of Police (Malaysia)
IMF	-	International Monetary Fund
IP	-	Internet Protocol
IP	-	Intellectual Property
JIT	-	Just-in-Time

JSF	-	Joint Strike Fighter
KPI	-	Key Performance Index
LCA	-	Light Combat Aircraft
MAD	-	Mutually Assured Destruction
MENA	-	Middle East and North Africa region
MESRA	-	Malaysian Environmental Scanning, Research and Analysis (hypothetical agency unveiled in thesis)
MNC	-	Multinational Corporation
MOD	-	Ministry of Defence (UK)
NAS	-	National Academy of Sciences (US)
NATO	-	North Atlantic Treaty Organization
NGO	-	Non-Governmental Organization
NUS	-	National University of Singapore
ODB	-	Open Data Barometer
OD4D	-	Open Data for Development network
ODI	-	Overseas Development Institute (UK)
Op-Ed	-	Opinion Editorial
OSINF	-	Open Source Information
OSINT	-	Open Source Intelligence
OTEC	-	Ocean Thermal Energy Conversion
PDRM	-	Polis DiRaja Malaysia
PESTEL	-	Political, Economic, Social, Technological, Environmental and Legal
PSD	-	Public Service Division (Singapore)
RIAC	-	Russian International Affairs Council
ROI	-	Return on Investment
RTD	-	Real-Time Delphi
SRI	-	Romanian Intelligence Service (Serviciul Român de Informații)
STEEP	-	Social, Technological, Economic, Environmental and Political analysis
SFM	-	Strategic Foresight Model
UN	-	United Nations

USSR	-	United Nations Development Programme
UTM	-	Universiti Teknologi Malaysia
WG	-	Whole of government
WEF	-	World Economic Forum
WWI	-	World War 1
WWII	-	World War 2

LIST OF SYMBOLS

$\sum$	-	Sigma denoting sum or mean average
i	-	Impact or Likelihood
Ni	-	Number of Respondents for Risk "i" or Likelihood "i"

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CHAPTER 1

INTRODUCTION

1.1   Introduction

This thesis began by examining the need for a new and rapidly-executable risk foresight model for laymen and experts alike. Ideally, such a model should be universally applicable to engage all manner of emerging risks. Global risks, unrestrained by boundaries and speed of propagation, pose the ultimate litmus test for any such model. This thesis therefore studied how global risks were identified and analysed today, before exploring and developing an alternate model that could expedite the risk foresight process. This area of research is particularly critical as ongoing global volatility reveal a pattern of causation and interconnections that presage an overload of emerging risks that are increasing in quantity, speed and cross-sectoral complexity (Homer-Dixon et al, 2015).

It is becoming more evident by the day that national and organizational foresight processes need to be synced with rapidly changing global developments. Additional focus is needed on approaches that factor in complexities, uncertainties and risks. Foresight should focus not only on the long-term, but also on near-term issues, and should be flexible enough to respond to rapid changes and turbulences (Gavigan & Scapolo, 2001).

Chapter 1 outlines the research questions, research objectives, research scope and the anticipated contributions of this thesis to the field of foresight. The risk

foresight model unveiled in this thesis was premised to be versatile enough for cross-sectoral and cross-organizational execution, down to the smallest organizational unit i.e. the individual. It was also designed to be a useful tool to expedite national policy-planning through a Web 2.0 "open government" approach. Web 2.0 is the current Internet paradigm which involves multiple forms of borderless interactivity; typified by the evolving social media (O'Reilly & Dougherty, 2004).

1.2   Study Background

Emerging global risks can emerge in any variety of ways, but they often originate from smaller crises within particular systems and organizations. Substrate-neutral developments may unexpectedly evolve into risks that can transcend socioeconomic, political, environmental, and technological systems; necessitating researchers to subsume emerging threats under a consolidated analytical framework (Homer-Dixon et al, 2015; Lee & Preston, 2012).

A consolidated foresight framework is now possible due to revolutions in Open Source Intelligence (OSINT) and Web 2.0. According to the field's pioneer Robert D. Steele (2012), OSINT is the only universal platform that can operate across all boundaries. It can be rapidly scaled from the local to global levels without traditional restrictions in space, time and resources. Former US Central Command head General Anthony Zinni even attested that during his military command tenure, only four per cent of relevant intelligence was obtained from secret sources while the rest were extracted from evidence-based open source methods (Ahmed, 2014; Steele, 2012).

Even before the advent of Web 2.0, actionable intelligence was primarily extracted from open source materials such as newspapers, magazines, government

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documents, and libraries as well as radio and television broadcasts (Taylor, 1990; 1996). While OSINT and crowdsourcing is being rapidly adopted in knowledge-intensive activities ranging from the encyclopaedic Wikipedia to Real-Time Delphi (RTD) collaborations (Hartman & Baldwin, 1995; Monguet et al, 2010), no model has yet emerged to treat emerging global risks through a consolidated foresight model. Emerging risks were either studied on a sectoral basis by relevant organizations or on a global scale by institutions such as the World Economic Forum (WEF).

The WEF represents the institutional capstone of global risk studies undertaken by various governments, institutions and experts over the past few decades. Its tributaries include the US Federal Reserve; the United Nations and its capillary agencies; International Monetary Fund; World Bank and anchor elements of emerging geo-economic blocs such as China's Belt and Road Initiative (BRI), amongst many others. Endowed with such stakeholder synergies, the WEF is the only global agency capable of undertaking uninterrupted global risk studies on an annual basis, representing the golden yardstick for any new risk foresight model (Evans, Allan & Cantle, 2017).

Annual WEF global risk reports are published in early January after a year-long process that peaks during the second half of each preceding year i.e. global risks projected for 2016 are studied and finalized by late 2015 before being published in early January 2016. The Global Risks Report 2016 (11th edition), for instance, was published on Jan 14, 2016 and was primarily based on the Global Risks Perception Survey (GRPS) in 2015 which involved 742 representatives of the WEF's multi-stakeholder community. This is a resource-intensive process involving key respondents from the global business, academia, civil society and public sectors. Apart from exploring the risk landscape, WEF reports sometimes include deep-dive discussions into anticipated mid-term risks. Examples include risks posed by technology-disempowered citizens who are being alienated by national policies (WEF, 2016).   Understanding such critical policy-related gaps was crucial to the development of this thesis as any risk foresight model of the future should

incorporate public needs, aspirations, participation and feedback.

The WEF categorizes global risks into the Economic, Environmental, Geopolitical, Societal and Technological taxonomy – a spectrum that was perfected over the course of a decade (Coburn et al, 2013). These have been acronymized into EEGST for brevity in this thesis.

Other global risk studies were also investigated during the literature review stage. These studies were discovered to be generally concentrated on specific topics, regions or nations and were often not as encompassing as the EEGST taxonomy. The OECD's Global Future Shocks study in 2011, for example, sought domain-level expertise to identify risks in the following areas: pandemic; critical infrastructure disruption from a cyber-attack; financial crisis; geomagnetic storm; and social unrest (Coburn et al, 2013). Unlike the WEF, the OECD does not publish annual or regular reports on global threats presumably due to the costs, logistics and the nature of specific risks studied.

Emerging risks are usually identified and value-attributed (i.e. given impact-likelihood values) via a qualitative methodological process incorporating environmental scanning, surveys, questionnaires and Delphi (WEF, 2016; OECD, 2011). For example, the "Risk of Complexity in a Digital Economy" study by the MIT Forum for Supply Chain Innovation and Infosys Global Risk Advisory Group (Sheppard, 2016) entailed the Delphic participation of 70 global experts from the manufacturing, financial services and retail sectors.

The methodology employed by the UK Ministry of Defence (MOD) for its Global Strategic Trends Programme was also explored. The Strategic Trends 2007-2036 report, compiled by the MOD's Development, Concepts and Doctrine Centre (DCDC), notably focussed on social risks arising from a disempowered global middle class (DCDC, 2007). Social instability was coincidentally singled out as a

high impact emerging global risk in consecutive WEF reports.

Although the UK MOD report had accurately foreseen the possibility of global social instability stoked by a disaffected middle class, it nevertheless relegated its likelihood to a more distant period i.e. 20 to 30 years from the date of publication in 2007 (DCDC, 2007). This relatively sanguine timeline can now be considered questionable by events which have since transpired. Salient social inflection points in this regard include the 2008 Great Recession; Occupy Wall Street (2011) protests; surging youth unemployment in the Developed World; worker riots in Europe; fallouts from the Arab Spring (2010); and growing fissures in the European Union (EU) bloc. The middle class everywhere was already rebelling against the established order (Maavak, 2012) – a phenomenon that was later mirrored by Malaysia's electoral tsunami on May 9, 2018.

The 2007 UK MOD report palpably avoided academic rigidity by resorting to "an analytical approach" to distil "probable outcomes" (DCDC, 2007; pp IV- XI); expert discussions; as well as internal and external surveys which reflected a twin outside-in and inside-out Delphic approach (Chesbrough, 2003; Botterhuis et al, 2009; Bonazzi & Zilber, 2014). Although the methodology employed was manifestly Delphic, the term "Delphi" was notably omitted from the MOD report. Instead, the MOD methodology was described as an "appropriate balance of judgement and risks… to inform Defence decisions, without being constrained by the latest good idea, fashionable trend or received wisdom" (DCDC, 2007, pX). This critical injunction, as well as the omission of rigid academic approaches – including hermeneutical traps – guided the philosophical approach of the MOD's study. Yin (2011, p.3) likewise recommends qualitative research to be guided by "real world happenings" and the "contextuality of settings." The science of intelligence gathering and risk foresight cannot be constrained by narrow quantitative-type approaches. The nature of contemporary global risks necessitates a flexible approach to risk prospecting, which, will be explored in subsequent chapters.

The Global Strategic Trends Programme, despite its demonstrated percipience, is military and security-oriented and is focused on UK security. The WEF, on the other hand, focuses on emerging global issues, including risks. There are several definitions for emerging risks; primarily due to scholars and institutions defining them through organizational and global lenses. The most salient definitions recognized by the European Union (EC, 2016, p.5) are:

i. A new manifestation of risk, of a type which has never before been experienced (Locklear, 2011).

ii. The likelihood of a new material causing harm in a manner that is not apparent, assessable or manageable based on current approaches to risk assessment and management (Maynard, 2011).

iii. The likelihood of loss, i.e. the probability of a certain consequence to occur in specific time and space under specified or insufficiently specified conditions (Aven & Vinnem, 2007).

iv. A risk resulting from a newly identified hazard to which a significant exposure may occur, or from an unexpected new or increased significant exposure and/or susceptibility to a known hazard (EFSA, 2007).

v. A risk that is new; or a familiar risk that becomes apparent in new or unfamiliar conditions (IRGC, 2010).

Almost all emerging risk definitions outlined above contain the word "new". All of them imply the element of novelty, thereby implicitly conceding that a new methodological approach may likewise be needed to identify and manage emerging global risks. The virulent nature of future risks can no longer be ignored and managing them should involve an approach that is global, comprehensive and yet flexible. As Mendonça et al (2008, p.5) aptly warn: "Doom arises not from the absence of information but from the stiffness of mindsets filtering out relevant data, discounting the severity of the warning and aborting the production of alternatives

for changing the course of action."

Moreover, social sciences have generally lagged behind pure science disciplines in accepting new theoretical and methodological paradigms. Because of its relatively secondary position in the academia, scholars and students in these fields tend to be "conservative imitators" rather than innovators (Bogdan, 1990, p. xiii). This is a reason why no consolidated risk foresight model has emerged thus far.

1.3 Problem Statement

There is a critical need to identify and manage emerging global risks in an accurate, expeditious and economical manner, entailing a user-friendly and easily-executable methodology (Homer-Dixon et al, 2015, 2000; WEF, 2010, 2016; UNDP, 2014). This problem statement is borne by studies and conclusions drawn by various scholars and institutions as highlighted by the following subsection.

1.3.1 Nature and Pathways of Emerging Risks

A "risk" is not a binary variable (i.e. sudden harmful events that are either expected or unexpected) but a continuous variable drawn from several strands of developments (Homer-Dixon et al, 2015; Biggs et al, 2011). Our hyper-connected world facilitates the transmission of risks across organizational and national boundaries at rapid rates. Yet, while risks intersect and multiple rapidly, institutions remain reactive and slow-moving (WEF, 2017; 2010) despite the availability of real-time technology to monitor threats at the substrate levels. In line with this

development, one of humanity's looming predicaments has been characterized "as a race between the rapidly increasing severity and complexity of its problems and the improving but nonetheless uncertain ability to anticipate, proactively solve, and constructively respond to these problems" (Homer-Dixon et al, 2015, p.1).

Multiple, interconnected global stresses such as demographic pressures, climate change, resource scarcities, technological advances and economic volatility are increasing systemic risks worldwide, setting the stage for a perfect storm of simultaneous global crises in the near future (Beddington, 2009; OECD, 2011; WEF, 2012; Helbing, 2013; Pamlin & Armstrong, 2015; Ahmed 2011; Ehrlich & Ehrlich, 2013; Morgan, 2013). Governments and organizations need to be prepared for future tectonic events (OECD, 2011). Risks of the future are predicated to be more devastating in terms of impact, speed and costs as they will be forged by the conjunctional impacts of the following long-term and causally-linked global trends:

    i.   Resource depletion and the inability of natural systems to cope with burgeoning human demand (Steffen et al, 2007).

   ii.   Accelerating density, capacity and speed of transmission as well as widening pathways that can relay more material, energy, and information through the EEGST spectrum. This increases the likelihood of uncertain or volatile interactions which, in turn, can lead to the systemic spread of otherwise localized risks (Buldyrev et al, 2010; Harmon et al, 2010; Bashan et al, 2013; Helbing 2013; Perrow, 1999).

  iii. Increasing homogeneity, or declining diversity, of human cultures, institutions, practices, and technologies (Boli & Thomas, 1997; Meyer, 2000; Young et al, 2006). Increasing connectivity and homogeneity makes systems less adaptive and prone to systemic shifts, crashes or crises (Bodin & Norberg, 2005; Scheffer et al, 2012).

Risks also emerge from "synchronization" in complex systems (Strogatz, 2003; Biggs et al, 2011), where multiple risk-related elements and developments interact simultaneously. Any next-generation risk foresight model should therefore be endowed with a degree of synchronicity (i.e. near real-time ability) to identify and monitor risks at the incipient stages. Without near real-time risk foresight, organizations and nations will be vulnerable to "future shocks" (Toffler, 1970).

In a globalized world, extraneous developments may affect local components of a native EEGST ecosystem, leading to "glocal" risks (UNDP, 2014). The 2008 Great Recession, for example, began with the US subprime housing crisis and eventually wiped out $15 trillion from the global economy by early 2012 (Yoon, 2012). Emerging risks are gradually overwhelming nations and organizations due to the lack of an effective early warning system (Heylighen, 2002a; Botterhuis et al, 2009). The need for integrated real-time data and delivery channels in financial sectors alone is increasing by the year (West, 2011). Even knowledge across an encyclopaedic array of fields is being developed in near real-time through Web 2.0 collaborative portals. Wikipedia, for example, has notably surpassed the quantitative and qualitative outputs of the venerable Encyclopædia Britannica – to the point of forcing the latter to cease print in 2010 after being in business for 244 years (Giles, 2005; Levine & Prietula, 2014).

It is also ironic that many innovators in the ICT field had revolutionized knowledge creation and communications outside the confines of the academia. Prominent academic dropouts in this context include Steve Jobs (founder of Apple Inc.), Bill Gates (Microsoft), Michael Dell (Dell), Mark Zuckerberg (Facebook), Evan Williams (Twitter co-founder), Larry Ellison (Oracle), Jan Koum (WhatsApp), Travis Kalanick (Uber) and Julian Assange (Wikileaks) among others (Vital, 2014). The software tools developed by these innovators have revolutionized knowledge creation in all spheres, including in the area of risk treatment. As a broad corollary to this development, can future risks be identified and analysed through a Web 2.0-based foresight model?

Emerging global risks are too often studied in hindsight, although its evolving complexities and manifestations were foreseen by scholars such as Tofler (1970) and Fuller (1938) decades ago. Fuller (1938) had even coined the term "ephemeralization" to describe the productivity paradox where an increasingly ordered and connected world may become more vulnerable to entropy and unpredictability. As material and informational output accelerates with greater efficiency and at lower costs, it also creates problems characterized by increasing instability, complexity and reach of causal networks; thereby "decreasing controllability and predictability" (Heylighen, 2002a, p.1). Society is as strong as its support components. While ephemeralization lubricates the machinery of society through greater productivity and innovation, it also creates parallel efficiencies in systemic risks and harmful activities (Heylighen, 2002a).

Generally, all risk identification methodologies begin with environmental scanning, which is now easier in a digitized world. Web 2.0 is the new wellspring of Open Source Information (OSINF) which can be processed into Open Source Intelligence (OSINT) on any subject, including global risks (SRI, 2015). OSINT is defined by the US Department of Defense (DoD) as material "produced from publicly available information that is collected, exploited, and disseminated in a timely manner to an appropriate audience for the purpose of addressing a specific intelligence requirement" (GPO, 2006). This includes sources such as the traditional and social media, public records and Web 2.0 environmental scanning platforms such as the Global Scanning Network (GSN) hosted by the Copenhagen Institute of Future Studies (CIFS).

The WEF defines global risk as an uncertain event or condition that can negatively impact nations or industries over the next 10 years while a global trend is an extant long-term pattern that can amplify global risks (WEF, 2016). Any annual forecast of global risks should therefore extrapolate long-term trends, data and patterns. Risk triangulation cannot be conducted in a vacuum and must be based on a continuum, unless it involves a wildcard or Black Swan event (Taleb, 2007) such as an unforeseen asteroid strike.

Can risk continuums be captured and analysed within shorter time-spans; at negligible costs; and via a user-friendly model? This is indeed possible due to the rise of Web 2.0-facilitated data collation, collaboration and analytical tools. Timelines and events can now be virtually retraced and compressed to establish sectoral trends and patterns. It was the Internet that revolutionized OSINT and this thesis therefore adopted a Web 2.0 approach to formulate the new risk foresight model. Homer-Dixon et al (2015, p.6) also observed that "nearly all crises are anticipated by someone"; therefore such information should be retrievable from Web 2.0 which happens to be the richest and most accessible data repository today. Apart from offering a digital platform to analyse risks, Web 2.0 can also be used to investigate disparate methodologies and foresight philosophies, as well as identify key strands and common denominators from relevant theories, concepts and models that are needed to construct a new, integrated risk management approach.

1.4   Research Question

This thesis involves the theoretical conceptualization, structural development, testing and validation of a new risk foresight model that can satisfactorily emulate or surpass the WEF's annual global risk identification process. It is guided by the following research questions:

i.   Is there a critical need for a net-centric rapid risk foresight model?

ii. What are the key theories, concepts and pathways underpinning the new model i.e. Strategic Foresight Model (SFM)? How will its efficacy be gauged?

iii. How will the SFM be benchmarked for validation?

1.5   Research Objectives

The specific objectives of this thesis, congruent to the research questions, are outlined below:

   i.   To critically explore justifications for the new risk foresight model as well as identify the limits and gaps in existing models.

   ii. To identify key theoretical elements that can help conceptualize and develop the SFM before subjecting the new model to progressive tests.

   iii. To compare and contrast contemporaneous global risks identified by the SFM and WEF for purpose of validation. And additionally,

   iv. To explore the possibility of including the SFM as a vital tool in the national policy planning architecture.

The qualitative research approach in this thesis includes a combination of case study (Platt, 1992; Yin, 2009; 2011) and action research (Lewin, 1946; Small, 1995; Greenwood & Levin, 1998; Reason & Riley, 2009). While case study researches a phenomenon or "case" (i.e. emerging global risks) in its real-world context, action research necessitates the researcher's adoption of an action role in the study.

This thesis also adopts an interwoven inductive and iterative approach "whereby a qualitative study's purpose, research questions, conceptual context, methods, and concern for validity all continually interact" (Yin, 2011, p.77; Maxwell, 1996). This approach interlaces eclectic sources, academic disciplines, theory and praxis in a qualitative-based research (Yin, 2011) and is crucial for the development of a consolidated risk foresight model.

Quantitative approaches to risks analyses, on the other hand, are generally limited to industry-specific conditions. The Event Tree Analysis (ETA) method – originally conceived to simulate nuclear fallouts – is generally limited to disaster- and safety-related studies and is based on binary logic (Mosher & Keren, 2011). In certain instances, ISO risk standards can be applied to ETAs. Quantitative risk models, however, are ill-suited for universal cross-sectoral application on a global scale due to the nature of uncertainties and complexities involved. In fact, no such universal or trans-sectoral model exists to date, although Artificial Intelligence (AI) is expected to break new grounds in this area in the coming decades. Even then, scientists keep wondering whether AI itself will pose an existential risk in the long-run, and this meme has now become a staple and profitable genre in the movie industry. The popular Hollywood "Terminator" franchise, for instance, encapsulates such looming fears.

1.6   Research Scope

This thesis involved literature exploration across eclectic fields. Key theories and concepts were investigated to identify critical gaps in contemporary risk foresight approaches. Areas of study included foresight; OSINT; collective intelligence; crowdsourcing; ephemeralization; Web 2.0; Open Government or the more digitized Governance 4.0; organizational theory; systems theory; complex adaptive systems (CAS); tacit knowledge; and information overload, amongst others.   The Strategic Foresight Model (SFM) was ultimately constructed from common denominators and gaps in these fields so as to triangulate risks that could "compete" with corresponding WEF forecasts.

Select annual WEF global risk reports, particularly for the years 2010, 2015, 2016 and 2017 were studied to discern how its risk foresight process could be optimized via a Web 2.0 approach. WEF global risk reports for 2016 and 2017 were

used as benchmarks to validate, via comparison, global risks filtrated by the SFM for the same years across the same EEGST taxonomy. A typical Web 2.0-based foresight platform was also studied – through first-hand institutional internship – to compare its attributes and qualities with those of the SFM. The virtual internship was held at the Copenhagen Institute of Future Studies (CIFS) from September 2017 to January 2018.

1.7   Analytical Framework

Although the WEF and SFM used similar sources of information, the data collection pathways differed. While the WEF relied on a traditional qualitative process centred on surveys, Delphi and closed-door meetings, the SFM was designed to operate via Web 2.0.

Since mainstream risk reports are now digitized, the SFM managed the capture raw data easily. Certain risk reports are also hyperlinked or referenced to original expert institutional reports such as those published by the IMF, World Bank and United Nations (UN) etc. The emerging digital matrix endows Web 2.0 with superior ergonomic research qualities vis-a-vis traditional Delphi approaches. To validate the SFM, the analytical framework in this research involved the cross-case comparison of global risks identified by the SFM and WEF for the year 2017, as outlined on Figure 1.1.

DATA SOURCES

Institutions (UN, IMF, WTO etc.); Governments and Agencies; Domain Experts; Libraries; Conferences; Peer Journals; Academia; Think Tanks; Media; Industries; Internet; Discussion Groups; Social Media; Mailing Lists; Guilds etc.

Search Engine   Mass Media   ← *Primary Funnel Openings*

Pathway: Traditional

Characteristics: Physical Venue, Workshops; Committees, Closed-door discussions, Physical Delphi; Long Duration and Planning; Costly; Risk of Obsolescence

Duration: 1 YEAR (2016 & 2017)

EEGST

Pathway: Web 2.0 (Internet)

Characteristics: Real-time Delphi; 24/7 Continuity; Web 2.0; Speedy Execution; Negligent Costs

Rapid Delphi recalibration in the event of wildcard

Duration: 1 MONTH or Less (2016 & 2017)

WEF → **RISK FORESIGHT** ← **SFM**

Figure 1.1 Analytical Outline: Cross-case comparison of WEF and SFM

Via the SFM, key respondents managed to access the latest data in near-real time. As shown on Figure 1.1., these were analysed and funnelled down through an identical EEGST taxonomy. The WEF's one-year undertaking was therefore compressed into a one-month study in the SFM.

1.8   SFM Limitations

While the SFM was developed to be a speedy, accurate, cost-effective and layman-friendly risk foresight model, it has certain limitations under specific circumstances – much like any other model. Since scholarly and professional opinions differ on what constitutes real-time, the SFM is presented as a model that

operates in "near real-time" to avoid hermeneutical rigidity and scholarly dissension. The SFM is also a virtual analytical model that operates along Web 2.0 pathways. Without the Internet, the SFM cannot be operationalized. A prolonged Internet outage due to a massive and prolonged cyberattack would render the SFM inoperable. Fallouts from a massive solar flare such as a Carrington Event can take out both the electricity grid and the Internet simultaneously and thereby render the SFM inoperable as much as normal human modus vivendi itself.

1.9   Research Contributions and Significance

This thesis explored the nature of emerging risks as well as ways to reduce equivocality (Weick, 2006; 2009) through a consolidated risk foresight model. The primary outcome was the Strategic Foresight Model (SFM). The primary beneficiary is expected to be organizations, governments and individuals who need to undertake rapid risk foresight at a short notice. The primary contribution would be to the field of foresight. In a nutshell, this thesis makes significant contributions to the following areas:

i.   New knowledge in the field of foresight: This thesis will generate fresh inquiries into the area of foresight and related fields such as emerging risks, complex systems, organizational behaviour and Real-Time Delphi, amongst others.

ii. Rapid risk foresight praxis: Most foresight models probe mid-to-long term opportunities and risks through traditional Delphi. The SFM is posited to be malleable enough to rapidly identify risks and opportunities from immediate to long-term timelines. The SFM may also inform contingency planning during a wildcard event.

iii. Public inclusivity: The SFM's Web 2.0 platform necessitates public

participation in line with ongoing global shifts towards Open Innovation and Open Government paradigms. An SFM-type approach will also break down silo-type planning and facilitate greater inter-agency synergy by pooling resources, ideas and budgets into an integrated governance and foresight regimen.

iv. Risk foresight continuity: The SFM facilitates the electronic retrieval of data, discussions and analyses at any time to ensure continuity in risk foresight (Chesbrough, 2003; Lathrop & Ruma, 2010; Koch & Rapp, 2012; Jung, 2013; OECD, 2012). Traditional Delphi-based foresight often lacks seamless continuity due to cost and logistical factors involved in closed-door recalibration of findings.

v. Talent identification and brain-drain reversal: The SFM is particularly suited to unearth "native talents with native ideas and solutions for native problems." Local talent can be spotted through their participation in an SFM-based national risk foresight regimen as proposed in the concluding chapter of this thesis. This may help reverse the ongoing brain-drain haemorrhage in Malaysia.

vi. Cross-pollination of knowledge: The SFM will encourage the symbiotic exchange of knowledge and expertise due to a common focus on emerging risks across the multidisciplinary EEGST taxonomy. For example, a plant pathologist may need inputs from experts in international trade and transmigration to map out the impacts of an oil palm fungus discovered half the world away.

vii. Securitize the future: By focusing on emerging risks, the SFM can help securitize the future by buffering nations and organizations against future threats.

1.10   Study Motivation

As Merriam (2009, p.58) noted: "A crucial factor in deciding what topic you would like to research is to be genuinely curious and interested in finding the answers to your questions. This interest, even passion, will carry you through the process more than any other single factor." It is such a passion that motivated the researcher to undertake this thesis.

The SFM was also presaged by a prototypal Security Foresight Model (Maavak, 2011) during a presentation at the International Industrial Security Seminar from July 11-12, 2011 at the G Hotel, Penang, Malaysia. Titled "Emerging Threats: Creation of a Regional Foresight Matrix", the researcher unveiled elements of this model before international security experts and senior Polis DiRaja Malaysia (PDRM) officers, including the then Inspector General of Police (IGP). However, the quest for a methodical risk foresight model arguably began earlier when the researcher landed at Heathrow Airport, London, on the fateful day of Sept 11, 2001 to pursue his Masters studies at the University of Leeds. While at Leeds, the researcher studied crisis-related subjects under a foremost expert in the field – the now deceased Prof Philip M. Taylor (THE, 2011).

Another driving force behind this study was the researcher's own experience in using OSINT to become a globally-visible geostrategic analyst and commentator. After being repeatedly denied an opportunity to publish his views in the Malaysian media, the researcher began approaching Web 2.0-based publications abroad; and gradually built an international profile spanning 15 years. Nearly a decade after embarking on this journey, the researcher's opinions and essays began to appear in prominent media outlets such as CCTV (China), Sputnik News (Russia), Business Standard (India), Eurasia Review (US) and Modern Diplomacy (EU), among others. One particular interview of the researcher – as a "Malaysian scholar" no less – is now featured on the official website of the Prime Minister of the People's Republic of China. The researcher is referred to as "Mathew Maavak" (nom de plume) in all

media quotes, publications and scholastic works, including references in this thesis. The open source revolution is not only ushering in Industry 4.0 and Governance 4.0; it is also establishing the foundations of Media 4.0 as well as borderless meritocracy and recognition.

1.11   Research Organization

Since this thesis involved the formulation of a new risk foresight model, its conceptual constructs had to be underpinned by relevant literature. Upon the SFM's conceptualization, it was initially validated by random case studies as well as an individual instrument (Yin, 2011; Creswell, 2003; Barrett, 2007; Piantanida & Garman, 1999) test. These stages are described in Chapter 2, including a schematic representation of the SFM's development. Chapter 3 described the research methodology as well as the group survey and data collection parameters. Chapter 4 focused on key netnographic findings while Chapter 5 presented data analyses and interpretations as well as the validation for the Strategic Foresight Model (SFM). Chapter 6 has three primary sections: conclusions, implications and recommendations. It included an outline on how the SFM can be inducted as a Governance 4.0 testbed. The research organization is graphically summarized on Figure 1.2.
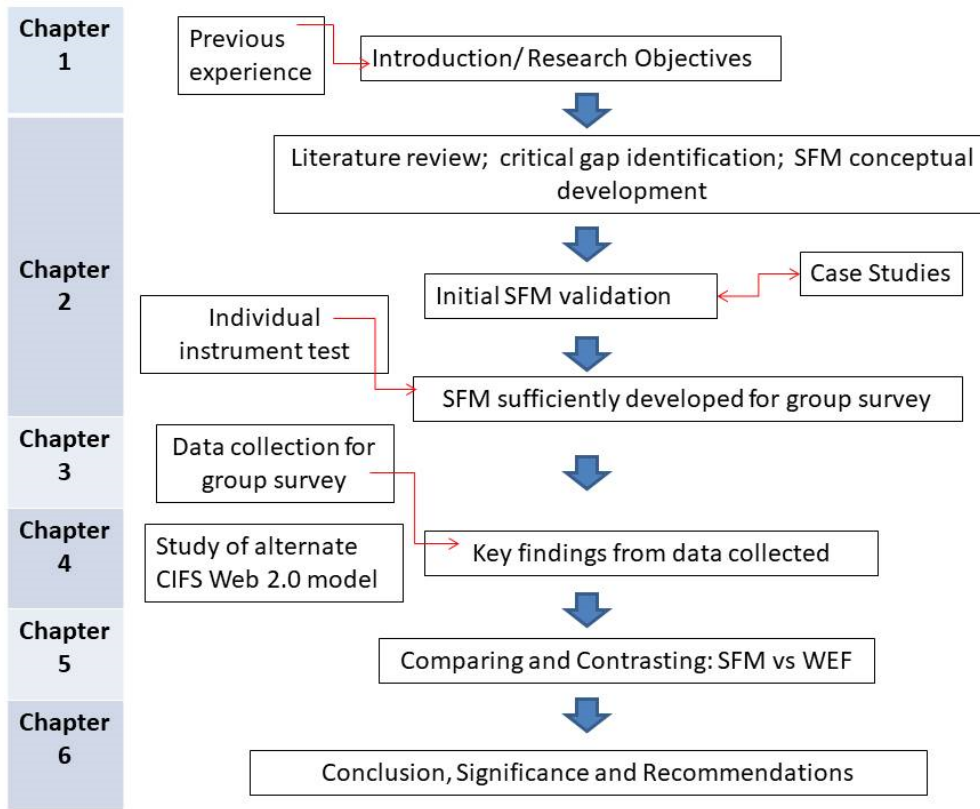
Figure 1.2 Research Organization

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LIST OF PUBLICATIONS

Journal with Impact Factor

1**.** Ariffin, ASH; **Maavak, M.**; & Miles, I. (2018**)** Managing Uncertainties via an Embedded Foresight Regimen in the National Policy Planning Architecture *International Journal of Engineering Technologies and Management Research.* Vol.5 (Iss.6): June 2018. DOI: 10.5281/zenodo.1304382 **(IF: 2.764)**

Indexed Journal

1. **Maavak, M**. & Ariffin, ASH (2018). Is Malaysia ready for the fourth industrial revolution?: The automotive sector as an i4.0 springboard. Chapter 3 In Brunet-Thornton, R., & Martinez, F. (2018). Analyzing the impacts of industry 4.0 in modern business environments, pp. 41-64. Hershey, PA: IGI Global. DOI: 10.4018/978-1-5225-3468-6.ch003 **(Indexed by SCOPUS)**

Non-indexed Journal

1. Ariffin, ASH; Yong, C.C.; & **Maavak, M.** (2015) The Challenges of Corporatization Policy for Government Research and Technology Organizations for Wealth Creation. Journal of Science, Technology and Innovation Policy (JOSTIP), Vol 1, No 1 (2015)

2. Ariffin, ASH; Sahid, M.L.I; **Maavak, M.** (2016). Factors Potentially Enhancing National Automotive Policy Goals and Industry Innovation. Journal of Science, Technology and Innovation Policy (JOSTIP), Vol 2, No 1 (2016)

Non-Indexed Conference Proceedings

1. **Maavak, M.** (2017). Can Bibliometric Data be used to Chart National Developmental Trajectory? STI Policy Research Seminar 2017, Nov 16-17, 2017. Dewan Seminar Menara Razak, UTM.

Note: Mathew Maavak is the nom de plume of Mathew Ferns Mathew (Matric No: PFF143012)

SFM GLOBAL RISK 2017 SURVEY KIT

Dear Respondent,

This survey is being held from Dec 10-31, 2016 to elicit your individual insights into likely Global Risks for the upcoming year 2017. It is conducted to test a new, simplified global risk identification mechanism – the Strategic Foresight Model (SFM) – as part of the researcher's doctoral thesis.   The outcome of this survey will be benchmarked against the World Economic Forum's (WEF) Global Risk Report 2017 which will be published during the second week of January, 2017.

For the year 2016, The WEF had identified 29 global risks across the Economic, Environmental, Geopolitical, Societal and Technological (EEGST) spectrum after a year-long, resource-intensive survey among its global network of stakeholders. Please see Page 10 for graphic reference.

In December 2015, the researcher's proprietary SFM had helped identify all 29 Global Risks listed by the WEF, in addition to 16 emerging global risks. See Page 7 for reference.

The SFM Global Risk 2017 Survey Form spans Pages 4-6. You can list down any global risk identified on your end, and ascribe a value of between 1 and 5 for its possible impact and likelihood. You can consult your peers in order to approximate global risks via the SFM Cone of Risk method (see Page 2)

You can identify global risks for the year 2017 via:

1)   Personal knowledge or "gut feeling" derived from open source material i.e. news, social media interactions, personal interactions, conferences attended, publications etc. The most common source of risk identification happens to be the global mainstream and social media.

2)   "Predictions for the Year 2017" and similar reports and news articles which are generally published throughout the month of December (2016) for the

upcoming year (2017). You can subject such predictions to the SFM Cone of Risk questionnaire. (See Page 2)

3)   Various risk studies, if any, that you are personally acquainted with.

4)   The WEF Impact-Likelihood Grid of 29 Identified Global Risks (See page 10). You can use these risks as a template as they were identified via long-running and intensively-studied trends. The WEF ascribes a validity of 10-years to their annual global risks identified.

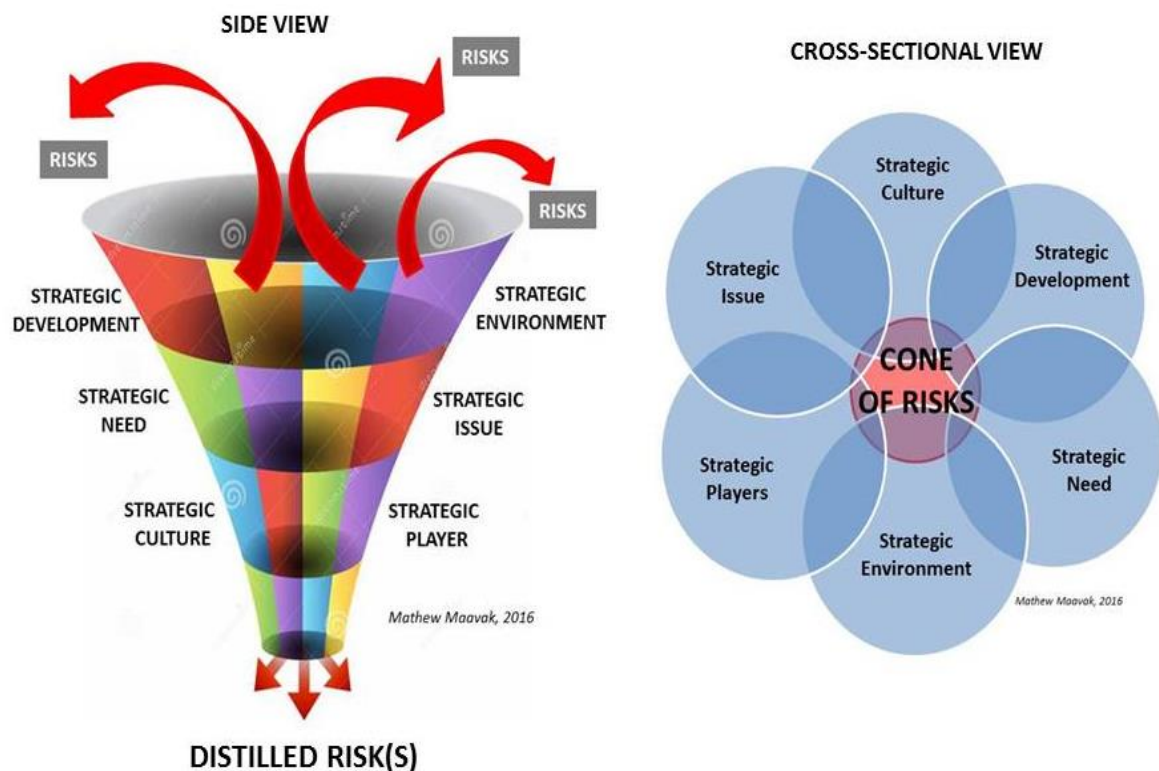5)   Peer consultation with those who study or are interested in global risks.

Pease email your completed survey (Pages 4-6) to mfmathew@yahoo.com on or before Dec 31, 2016. The SFM Global Risk 2017 Survey is intended to identify global *risks in a matter of days* as compared to the months of Delphic process used by the WEF.

SFM CONE OF RISK QUESTIONNAIRE EXPLAINED

All risks identified on your end – using online sources – should ideally be subjected to the "SFM Cone of Risks" questionnaire which consists of six questions. These act as a funnel to narrow down global risks. Please subject risks identified on your end to the following six questions before listing them in the SFM Global Risk 2017 Survey Form (Page 4-6)

1)   **Strategic Issue**: What is the issue at stake?

2)   **Strategic Need**: What exactly is so indispensable or urgent?

3)   **Strategic Development:** What new high-impact element or change has been introduced into the (risk) ecosystem?

4)   **Strategic Player:** Who are the major players determining the particular future scenario?

5)   **Strategic Environment**: What is the defining or strategic backdrop like?

6)   **Strategic Culture:** What are the collective or determining behavioural traits in question?

You can approach any question above without any prescribed order or sequence. Below is a graphical representation of the "SFM Cone of Risk." Not all six questions need be answered if a particular risk has been easily identified. The next page provides a few real-life examples of how the Cone of Risks can be employed.

SIDE VIEW — RISKS / RISKS / RISKS — STRATEGIC DEVELOPMENT — STRATEGIC ENVIRONMENT — STRATEGIC NEED — STRATEGIC ISSUE — STRATEGIC CULTURE — STRATEGIC PLAYER — Mathew Maavak, 2016 — DISTILLED RISK(S)

CROSS-SECTIONAL VIEW — Strategic Culture — Strategic Issue — Strategic Development — CONE OF RISKS — Strategic Players — Strategic Need — Strategic Environment — Mathew Maavak, 2016

EXAMPLE OF USING THE SFM CONE OF RISK

The SFM Cone of Risk is not a definitive "end-all be-all" methodology for risk distillation. It is geared to help the layman and budding risk analysts to approximate risks better in an environment of information overload. Current approaches in the field of foresight are getting overly turgid for rapid risk identification. The following are three examples on how risks can be narrowed down through the SFM Cone of Risk approach.

Example 1: There is an ongoing drop in global trade volumes borne out by rising corporate bankruptcies and continuing slides in global retail figures and the Baltic Dry Index (shipping volumes), amongst other related **Strategic Developments**.

This is bound to affect the global economy – the **Strategic Environment.** How will major economies – the **Strategic Players** – cope under these circumstances? What will be their most immediate **Strategic Need**? Is to prioritize social stability? If so, will the **Strategic Cultures** of these nations be sufficient to ensure social cohesion for the rough years ahead?

What are the **Strategic Issues** they have meet within their societies in order to ensure social stability?

Example 2: US President-Elect Donald Trump has publicly signalled his willingness to work with Russia in stabilizing Syria and ridding it of foreign terrorists. This constitutes a **Strategic Development**.

Trump quoted the **Strategic Need** to work with Russia and the Syrian Government to combat Daesh and other terrorist outfits in order to stabilize the Middle East – the **Strategic Environment** – and thereby prevent a global surge in terrorism.

However, some **Strategic Players** in the Strategic Environment such as the EU, Saudi Arabia, Qatar, Turkey and Israel may have other ideas.

What is the historically-borne **Strategic Culture** of these Strategic Players (EU, Saudi Arabia, Qatar, Turkey and Israel)? Are they generally amenable to peace and reconciliation, or is their history replete with relentless patterns of geopolitical escalation?

What is the **Strategic Issue** they have with regards to Syria? Does it herald continued hostility towards Damascus? Will this lead it to intensification in Interstate conflict with regional consequences[2]?

Example 3: There is a **Strategic Need** to finalize the long-overdue Israel-Palestinian peace treaty to stabilize the Middle East (**Strategic Environment**). However one needs to look at the **Strategic Culture** of the primary **Strategic Players** (US and EU) in the perennial peace process. How did their culture view Jews, Muslims and Eastern Christians for the past 2,000 years? Would **Strategic Developments** in renewable energy sources (i.e think of Tesla cars) goad the Strategic Players to promote peace or otherwise? What would likely be their **strategic Intent/Issue?**

Note: Example 1 was identified as potential global risks in both the WEF and SFM Global Risk reports for 2016.

THE SFM GLOBAL RISK 2017 SURVEY FORM

Please list down salient global risks that you anticipate for the year 2017 in the appropriate categories and ascribe a numeric value of 1 to 5 for both its impact and likelihood, where 1 represents the lowest value and 5 represent the highest.

Please do not be constrained by the number rows in the template form below. You can list as many risks as you have identified as long as they correspond to the category listed.

Please list the identified risk in the most concise manner possible. Refer to the WEF's Impact-Likelihood Grid of 29 Identified Global Risks (page 10) for guidance.

You will be provided email support from Dec 10 to Dec 31 to clarify any questions you have over the SFM Global Risk 2017 Survey and the SFM Cone of Risk questionnaire.

Name of Respondent:

Professional Designation of Respondent: (can include retired designations)

Contacts details of Respondent (address, email, and tel):

Nationality of Respondent:

ECONOMIC

Identified Global Risk for 2017	Likelihood	Impact
Global Fiscal Crisis	3	4

ENVIRONMENTAL

Identified Global Risk for 2017	Likelihood	Impact
Type your risk here and below.		
Manmade Natural Disasters	3	2

GEOPOLITICAL

Identified Global Risk for 2017	Likelihood	Impact
Type your risk here and below.		

SOCIETAL

Identified Global Risk for 2017	Likelihood	Impact
Type your risk here and below.		

TECHNOLOGICAL

Identified Global Risk for 2017	Likelihood	Impact
Type your risk here and below		

Thank you for identifying and value-attributing global risks anticipated on your end for the year 2017. The researcher would greatly appreciate it if you could spend a few extra minutes answering the following questions:

Q1. Where were your global risks sourced from? Pease limit answer to 50 words max.

Answer:

Q2: Did you resort to a peer group or a compatriot to help compile global risks for the year 2017 using the SFM Cone of Risk method? While seeking peer inputs is normal, can you briefly state who they were?

Answer:

Q3: How useful was the SFM Cone of Risks in helping narrow down your list of Global Risks for 2017? Please assign a numeric value of 1-5.

Answer: (Type your **numeric 1-5** answer here. Value 1 denotes least useful; 2 = somewhat useful; 3 = moderately useful; 4 = very useful; and 5 = exceptionally useful.)

Q4. Would you recommend the SFM Cone of Risks method for risk identification? Scale answer from 1 to 5

Answer: **(**Type your numeric 1-5 answer here. 1 represents the least likelihood of you recommending this method while 5 means you will highly recommend this method to your organization and peers)

Q5. Can you suggest ways to improve the SFM Global Risk survey process? Or the Cone of Risk distillation approach? Please limit answer to 100 words.

Answer:

Q6. Can you describe critical global risks that may impact your nation, your organization or yourself for the year 2017? Please limit answers to 150 words.

Answer:

Q7. Is there any other observation you would like to make with regards to this survey, its methodology or the general state of global risks compiled by various organizations today? Please limit answer to 100 words.

Answer:

--End of SFM Global Risk 2017 Questionnaire--

Pease email your completed questionnaire (Pages 4-6) to mfmathew@yahoo.com on or before Dec 31, 2016.

SURVEY GUIDE: WEF IMPACT-LIKELIHOOD GRID OF GLOBAL RISKS FOR 2016
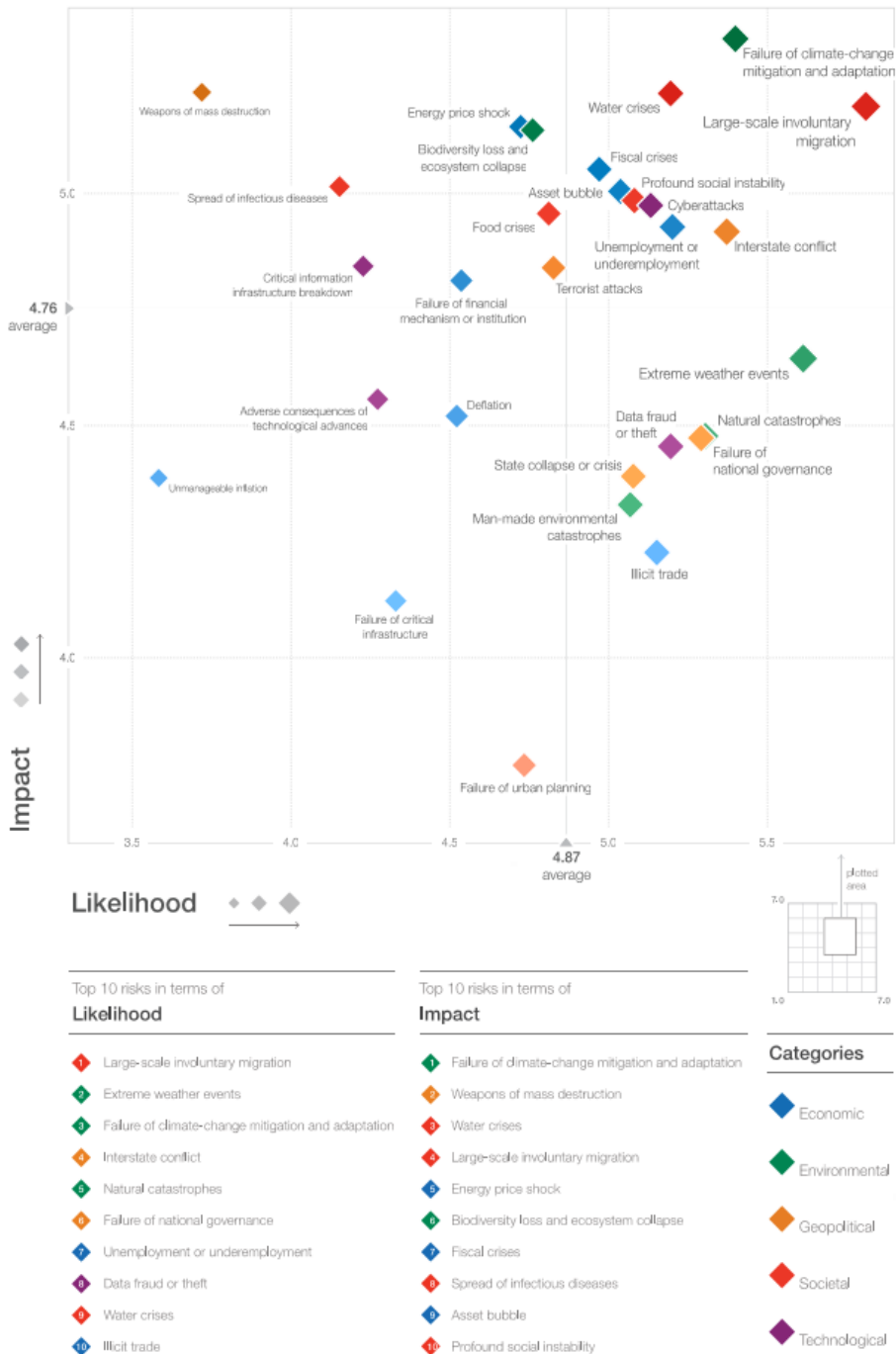
Source: Global Risks Perception Survey 2015.
Note: Survey respondents were asked to assess the likelihood and impact of the individual risks on a scale of 1 to 7, 1 representing a risk that is not likely to happen or have impact, and 7 a risk that is very likely to occur and have massive and devastating impacts. See Appendix B for more details. To ensure legibility, the names of the global risks are abbreviated; see Appendix A for the full name and description.

Please note that unlike the researcher's SFM approach, the World Economic Forum survey for 2016 adopted a **numeric parameter of 1 to 7** to situate all identified risks in the impact-likelihood grid, where 1 represents the lowest value and 7 represent the highest.

APPENDIX B

Key Respondents for the SFM Global Risk 2017 Group Survey

Utkal University Student Respondents (MBA, Batch 2016-2018)	Think Tank
K. K. J. (Gatekeeper)	A.K. (Gatekeeper) Director-General, Russian International Affairs Council (RIAC)
D.R.	
D.N.	
P.M.	**Professionals**
A.S	
S.M.	
D.P.	M.P. Senior Researcher, Political Science, Petrozavodsk State University, Russia.
A.B.S.B.	
B.D.	
C.S.	
S.A.	
Y.R.	
A.H	S.E.L Senior Editor, China Central Television (CCTV), China
P.K.	
B.S.	
S.A.L	
S.S.P.	T.M. Senior Editor, China National TV (CNTV) China
B.A.S.	
N.K.S.	
M.R.	
A.A.	

P.D. A.S. S. K. S. D.	Y.D. Director, GRATA Law Firm, Moscow, Russia
	E.B Columnist, Sputnik News, Russia
	S.C. Retired Financial Express Journalist, Ooty, India.
	S.M. Psychiatrist, Brisbane, Queensland Health Service, Australia
	G.K. Author/Commentator on Arab Affairs, Sunshine Coast, Queensland

APPENDIX C

Diploma from Copenhagen Institute for Future Studies (CIFS)

Copenhagen Institute for **Futures** Studies
Instituttet for Fremtidsforskning

6th of February 2018

Dear   .

This letter is to confirm that Mathew Maavak has successfully completed the Virtual Internship Programme with the Global Scanning Network (GSN) at the Copenhagen Institute for Futures Studies (CIFS) during the fall 2017 (September 2017 – January 2018).

Mathew was responsible for performing regular horizon scanning, submitting weekly reports analysing the impacts and consequences of weak signals and emerging issues, and lastly, authoring monthly discussion papers. He possesses strong analytical skills, and is particularly adept at identifying and grasping complex issues and communicating them in a clear and concise way. Mathew has demonstrated a strong understanding of applied foresight, and has developed the capacity to meaningfully use futures methods in a business and policy context. He has produced high quality work and maintained a strong work ethic throughout the duration of the programme.

Mathew has been a reliable member on our team with valued contributions. We offer the highest recommendations.
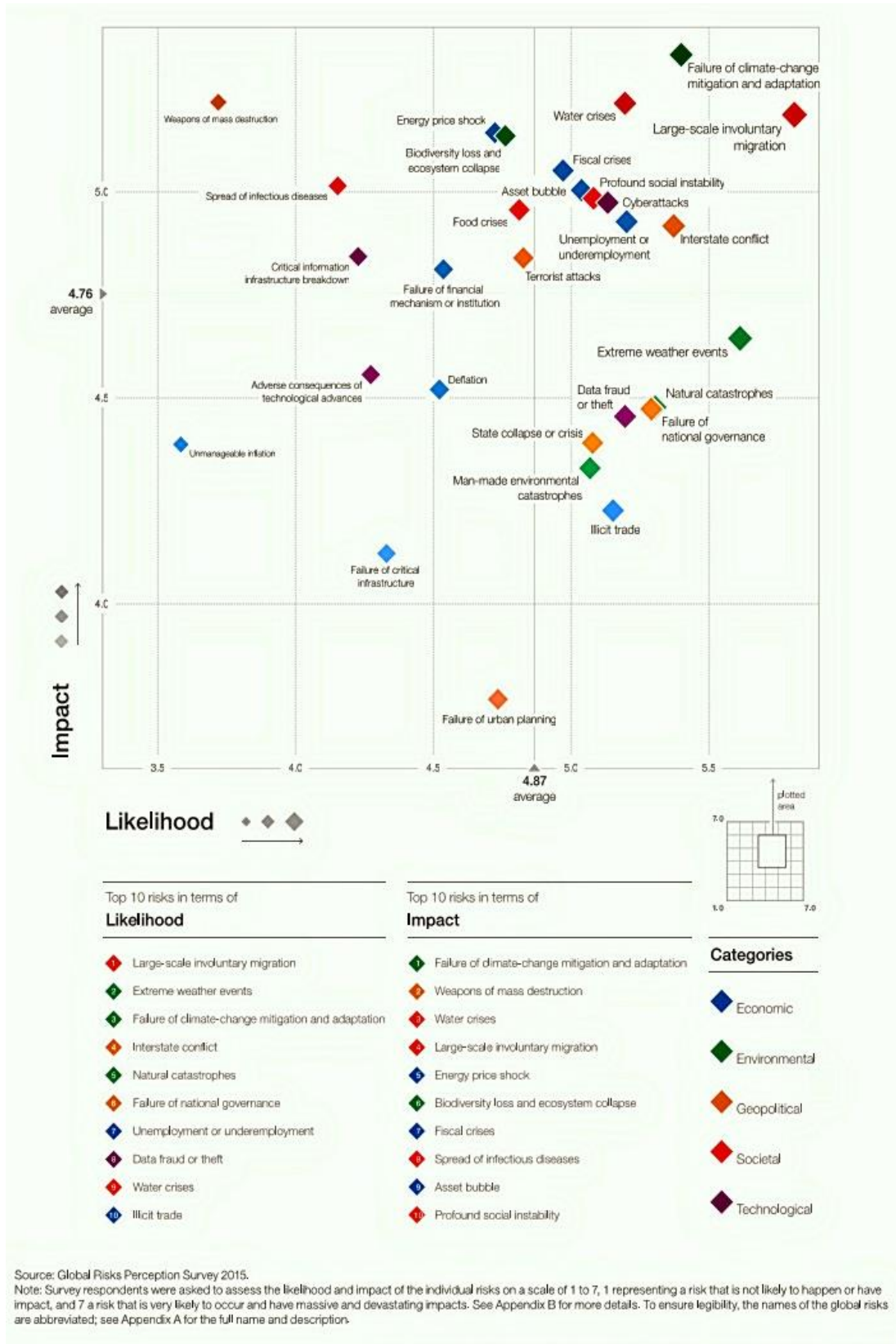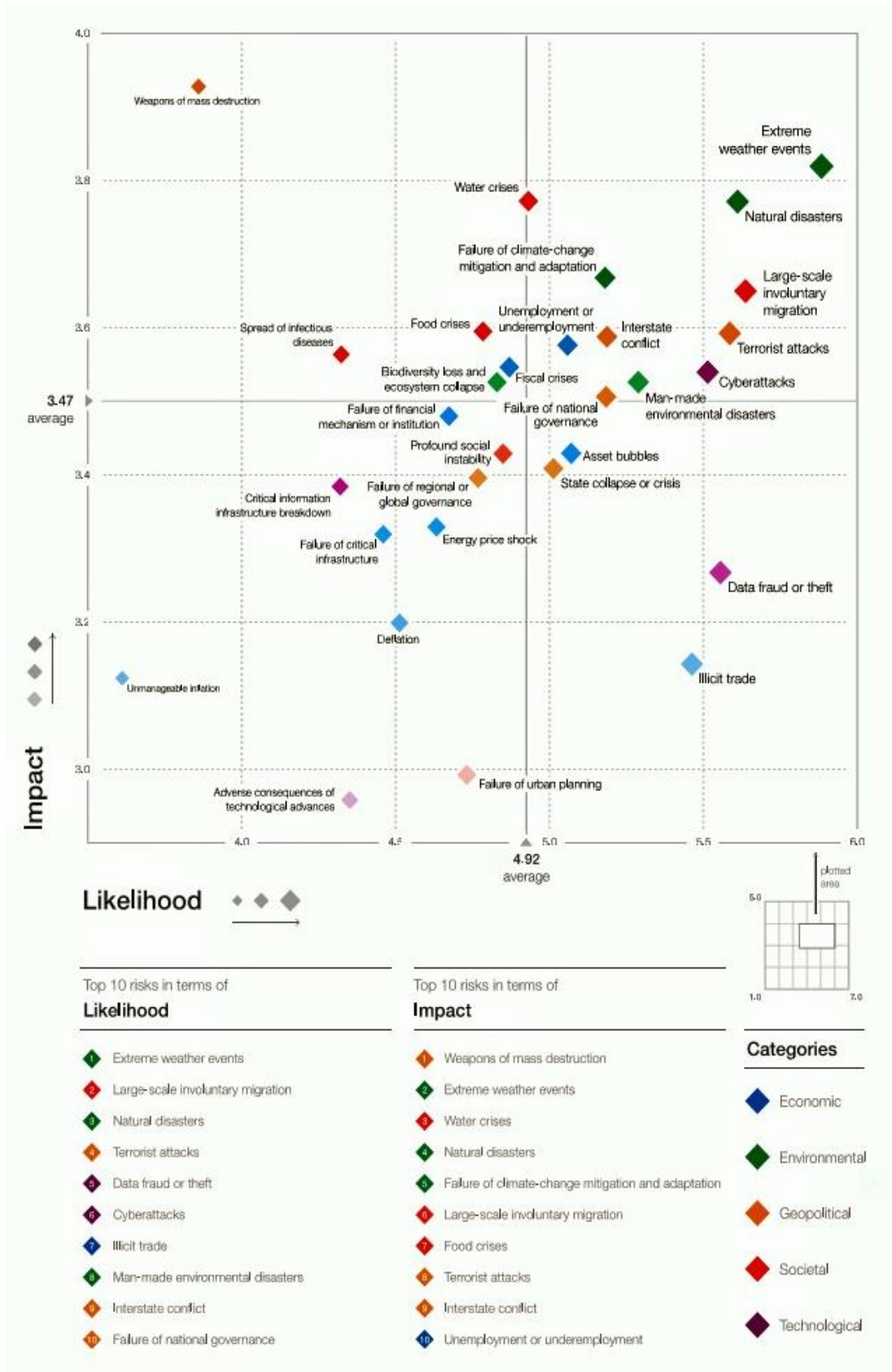
Best wishes,

Anne Dencker Bædkel

COPENHAGEN INSTITUTE FOR FUTURES STUDIES
AMALIEGADE 5C, DK-1256 COPENHAGEN

Source: WEF (2016)

Source: WEF (2017)