The Role of Knowledge Management in Fortifying Foresight

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EXECUTIVE SUMMARY

The knowledge management practices within the strategic foresight process are as varied as the foresight practitioners that apply them. If foresight as a discipline is to continue to lay stake as a strong and worthy practice in the realm of business and management, foresighters will need to bring consistency to their knowledge management practices. It is the purpose of this study to shed light on what tools are used for knowledge management throughout the strategic foresight process. Through our research using a literature review and 15 semistrucutred interviews of strategic foresight practitioners, we identified and noted the tools that are more commonly used and how they are applied for knowledge management within the strategic foresight process. By identifying the tools used and aligning them with knowledge management theory, we then illustrated the foresight process, the tools and the knowledge management process using a process map, giving way to the formulation of recommendations in an attempt to create a more efficient and robust strategic foresight process. These recommendations will be most useful to foresight practitioners used to working in teams as they focus on organisational and collaborative knowledge management challenges.

ABOUT THE AUTHORS

Martin Berry is a futurist, a carpenter and a dabbler in multiple art forms. With a background in set design and industrial design, Martin's interest in materials studies and problem solving led him to OCAD U's human-centred design foresight programme. While completing the Strategic Foresight and Innovation programme, he has decided to pursue a career in the field of foresight. This affords him with the opportunity to play with challenging ideas and interesting people full time.

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OCAD U & SFI

OCAD University (OCAD U) is Canada's largest and oldest art and design educational institution. Located in the heart of downtown Toronto, the school is known as a leader of art and design and is deeply integrated in both the surround community and global art and design industries.

The Master of Design in Strategic Foresight and Innovation program offered by OCAD U is a two year part-time or single year full-time Master of Design that emphasizes intimate, interdisciplinary, and co-creative approaches to tackling social and business challenges. As is indicative by the name, the program focuses on strategic foresight and innovation, combined with systems and design thinking to provide students an invaluable set of skills and tools to solve wicked problems.

This Major Research Project is the final outcome and deliverable for completion of the Master of Design in Strategic Foresight and Innovation.

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ACRONYMS

AI	Artificial Intelligence
DIKW	Data, Information, Knowledge, Wisdom
IC	Idea Couture Ltd.
MRP	Major Research Project
KM	Knowledge Management
OCAD U	Ontario College of Art and Design University
OPEC	Organization of Petroleum Exporting Countries
PHC	Policy Horizons Canada
SFI	Strategic Foresight and Innovation
STEEPV	Social, Technological, Economic, Environmental, Policy, Values

1.0 BACKGROUND

Consistent and formalized knowledge management practice throughout the strategic foresight process is currently highly susceptible to knowledge loss. This lost knowledge results in foresighters repeating work, losing valuable information, and lacking uniform conventions between various practitioners. This is a result of a multitude of factors, but primarily there is no dependable knowledge management structure and/or protocol to rely on between the phases of strategic foresight, nor between foresight projects. Moreover, knowledge management practice is vital to an organisations ability to utilize its gained knowledge for future work; also known as fortifying its organisational memory.

> In its most basic sense, organizational memory refers to stored information from an organization's history that can be brought to bear on present decisions.
> (Walsh and Ungson, 1991)

As foresight is a relatively young discipline (when compared to other professional management disciplines such as accounting, or traditional business administration) it is vital for foresight's future as a discipline to formalize its knowledge management practices. This would afford guidance to foresight organisations hoping to improve on their organisational memory.

In this study we take the first step towards helping foresight practitioners formalize their process, and ebb the loss of knowledge. We do this by reviewing the current knowledge management practices applied to the strategic foresight process, and then delivering recommendations on how this can be improved. The research we present here is highly relevant for any foresight practitioner and management professional who utilizes strategic foresight, so that they can in turn develop practices and tools which will formalize their own practice.

Foresight practitioners are often faced with the challenge of how to manage relevant gained knowledge, in an up-to-date and organized fashion. Having streamlined and efficient methodologies, processes and/or tools to manage this knowledge would be a valuable addition to the existing foresight process for any strategic foresight practitioner. Through our experience as strategic foresight practitioners and from the literature review research, we have come to realize that there is insufficient evidence supporting any single method of knowledge management for the foresight process. Likewise, we were unable to identify an agreed upon best practice for knowledge management throughout the strategic foresight process and its phases. This was reinforced with an initial discussion with colleagues practicing strategic foresight that revealed inconsistent knowledge management practices. We found practitioners often use an ad hoc assortment of personal tools such as software programs, Sticky notes, methods and/or personal memory. As a note of clarification, throughout this document,

when we refer to tools, we speak inclusively of all the methods, processes, techniques, software and tools that are applied to the strategic foresight process in some form of knowledge management effort.

With this in mind, our research has focused on using semi-structured interviews with a variety of strategic foresight practitioners from a variety of professional backgrounds and organisations to create a survey of the methods being applied for knowledge management within the foresight process. In doing this we have contributed to the general knowledge of strategic foresight, while shedding light on the knowledge management practices being used, and making recommendations that will help improve the process of strategic foresight.

1.1 Research Questions

Primary

What knowledge management tools are currently being applied within the strategic foresight process?

Secondary

Where might opportunities for improvement of KM within the foresight process exist?

By completing this review of the knowledge management practices within the strategic foresight process, we intend to shed light on exactly what foresight practitioners are doing and what tools they are using to complete their discipline. This will provide the benefit of contributing and aiding the understanding of knowledge management practices, paving the way for future improvements and knowledge sharing. It is our hope that future researchers will use the work presented here as foundational information in order to further develop knowledge management practices within the strategic foresight process.

2.0 INTRODUCTION

We investigated the management of data and knowledge during the foresight process through the engagement of several foresight organizations and practitioners. Generally, this data and knowledge includes the signals, trends, drivers, scenarios and insights that make up the phases of the foresight process; project framing, scanning, model crafting , scenario building and identifying implications. These five phases were identified by comparing the language commonly used by our interviewed experts with the foresight process proposed by Peter Schwartz in his book *The Art of the Long View*, a pioneering work in the field of foresight.

Table 1. Comparison of the language for the strategic foresight phases used in *The Art of The Long View* and throughout this MRP.

Language used in *The Art of the Long View* (Scwartz, 1991)	Our proposed phase titles
Refining a decision	Project Framing
Performing more research	Scanning
Seeking out more key elements	Model Crafting
Trying on new plots	Scenario Building
Rehearsing the implications	Identifying Implications

We will further discuss each of these phases in the coming paragraphs, but will use this opportunity to warn the reader that these phases are to aid understanding and are not universally held classifications of the strategic

foresight process. The entire strategic foresight process varies and so we have aggregated the information gathered from our research.

Throughout the foresight process, between projects and as an organisation acquires and loses talent there are many opportunities for the loss of gained knowledge and insight. As individuals on a team scan, research and reflect on relative issues, insight is gained. During this process, there is the potential to either, forget, fail to share, or fail to integrate the gathered insights. Miscommunication or misinterpretation of captured insight can also be another cause of knowledge haemorrhaging. Knowledge flows from peer to peer, or from papers/database to individuals are also filled with holes where there is potential for loss of insight. Some captured insight may never be read again, sitting on a shelf or in a remote section of a digital bank. Once out of circulation, the information is as good as lost. Communication plays an important role in knowledge transfer as there is the threat of loss of knowledge anytime there is a handover from one team to another or from the foresight organisation to the client. Unmanaged and left un-addressed, an organisation's knowledge management might resemble a strainer able to collect only a fraction of the potential insight from the knowledge flow of its projects and efforts. Due to the large amount of data and information tackled by foresight practioners we thought this issue would merit further exploration.

Before we discuss the background, methodology, and results of our research, we will first orient the reader with the primary subjects of our work: strategic foresight and knowledge management.

2.1 What is strategic foresight?

There are many definitions that are applied to the term strategic foresight. For the purposes of our MRP, we agree with Richard A. Slaughter's definition of strategic foresight for its encompassing yet straight-forward language:

> Strategic foresight is the ability to create and sustain a variety of high quality forward views and to apply the emerging insights in organisationally useful ways; for example, to detect adverse conditions, guide policy, shape strategy; to explore new markets, products and services.
> (Slaugther, 1997)

On top of Slaughter's definition we would also like to note that strategic foresight is a process that includes a variety of techniques and tools used to guide practitioners in gaining insight from information in order to make the strategic decisions at the organisational level. A useful reference that frames 44 commonly used techniques and tools for strategic foresight is Rafael Popper's 'Futures Diamond' (Popper, 2011).

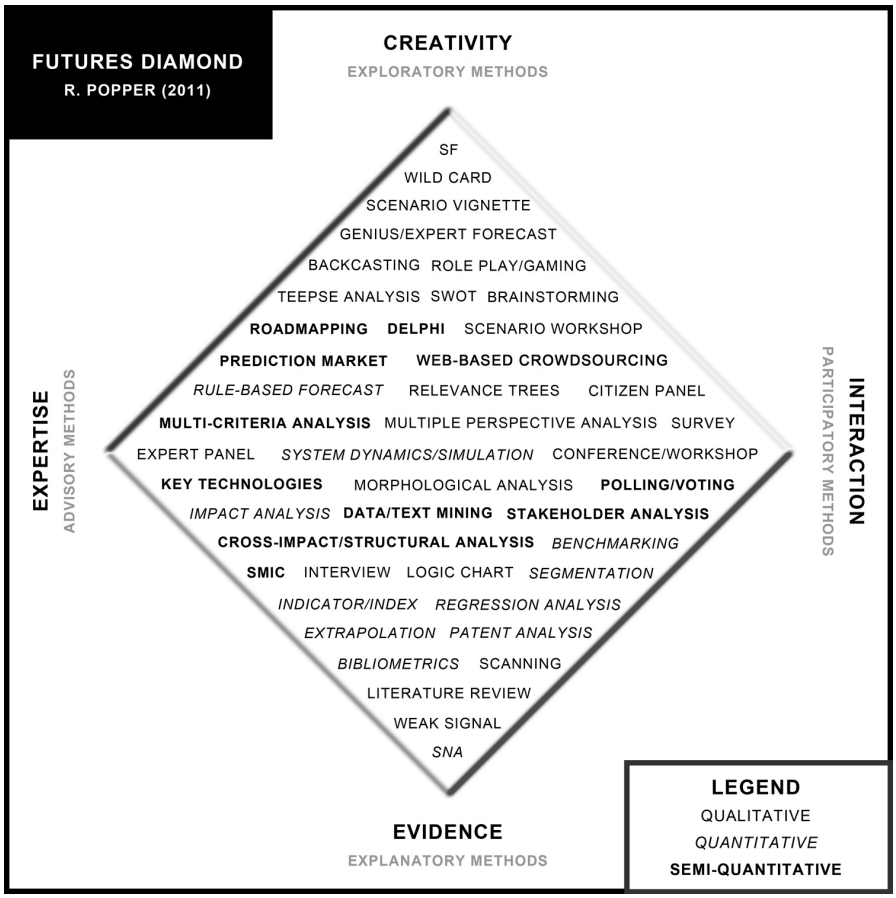

Figure 1. Rafael Popper's futures diamond showing 44 commonly used foresight techniques on a dual axis spectrum.

These techniques and tools allow decision makers to anticipate and understand challenges beyond the usual business planning cycle for both short and long-term decision-making. Within the activities of decision-making, strategic foresighters play three key roles, they anticipate and implicate, they draw attention to magnitude or significance, and they guide inquiry, push out assumptions, and seek corollaries (Stein, 2012).

When speaking of strategic foresight, it is important to differentiate between it and forecasting. Forecasting is the process of using historical, current or predicted environmental factors to extrapolate into the future in an attempt to

illustrate an accurate picture of a single point in the future. In contrast, strategic foresight builds multiple possible futures to allow for better decision-making (Daum, 2001).

These multiple futures are most often built through the scenarios approach. Peter Schwartz describes scenarios as:

> [A] tool for ordering one's perceptions about alternative future environments in which one's decisions might be played out. Alternatively: a set of organized ways for us to dream effectively about our own future.
> (Shwartz, 1991)

Scenarios are stories that demonstrate possible future states in order to allow decision makers to imagine and react or anticipate unexpected events or environments. The aim of scenarios is to provide strategists with various possible futures and not forecast the future (Mietzner and Reger, 2005). Using scenarios in order to make tactical, planned decisions is the process of strategic foresight.

The use of scenarios for strategic foresight is an invaluable exercise as it affords organisations the ability to prepare for unexpected events by challenging assumptions and describing alternatives to the expected future. As Hines and Bishop (2007) note, due to the fact that the future is always forthcoming, the strategic foresight should be an on-going, continuous process:

> [F]oresight methods were not stand-alone tools, but were best utilized as part of an ongoing, iterative process of learning about the future.
> (Hines and Bishop, 2007)

The role of strategic foresight is one that matches the need to be able to comprehend multiple complex and systematic possible situations simultaneously, as Curry and Hodgson (2008) note in their seminal paper on the Three Horizons Method. Methods, like the Three Horizons Method, are especially important as a strategic tool within the strategic foresight process due to the fact that alone the human brain forecasts in a linear fashion, whereas change has rates that are exponential and with many influences, actors and reactions (Kurzweil, 2005). Farrington *et al*., 2012, also explain why strategic foresight is important for organisations in response to accelerated technological change:

> [T]he time required for meeting the challenges presented by breakthrough technical innovation often exceeds a company's time horizon for understanding consumer desires. Foresight methods, which are commonly used by futurists to explore distinct alternative views of the future, can help bridge the gap.
> (Farrington *et al.*, 2012)

The use of strategic foresight has its origins with scenario planning after World War II when the US Air Force prepared alternate strategies in order to prepare for what its opponents might do (Mietzner and Reger, 2005). Since then, the

process of strategic foresight has been influenced and refined by many companies, schools, and organisations, such as the RAND Corporation, Stanford Research Institute, Royal Dutch Shell, and many others (van der Heijden, 1996, Jones, 2005, Popper, 2008).

Arguably one of the most well-known and successful case studies that documented the alignment of strategic intent with the strategic foresight process has been that of Royal Dutch Shell during the 1973 oil crises. Due to its significance in the history of strategic foresight we will briefly recap it here.

Pierre Wack was a member of the newly formed "Planning Group" during the early 1970s at Royal Dutch Shell's London, England office. He and his group began looking at events that may affect oil prices and realized that a systematic combination of the factors that affected oil prices had the potential to alter Royal Dutch Shell's business. He wrote up scenarios and presented them to Shell's management. One of the scenarios included an oil crisis sparked by the Organisation of Petroleum Exporting Countries (OPEC).

At first management did not react, however Pierre Wack came back a second time and explained the dire consequences of the scenarios he had presented and what management could do about it. As a result of this the Shell management imagined how they would react should a scenario become true. In October 1973 one of Wack's scenarios blossomed into reality as simultaneously US oil supply

fell and OPEC flexed its political power causing an oil crisis. Wack's scenarios had prepared the Shell management for the changes in global oil supply and the company was able to navigate the increase in oil prices, taking advantage of the situation and moving from being the smallest of the seven largest oil companies to the second largest in size, and the first in profitability. A change that is still evident to this day.

2.1.1 Strategic Foresight: The Process

The strategic foresight process can be divided into five phases; project framing, scanning, model crafting, scenario building and identifying implications. We apply this taxonomy in order to aid the reader's understanding of the strategic foresight discipline, but would warn that it is not a hard and true classification followed by every strategic foresight practitioner. We offer this synthesis solely to support the reader's construction of a mental model of the strategic foresight process, and will elaborate on each process in our Findings section.

We refer to the five phases as follows;

1) **Project framing:** this initial phase defines the focus and limitations of the project. This is the first step in any project where goals are set, a project timeline is defined and resources are allocated. Specific to a foresight project, once the subject has been identified, the time horizon will also need to be specified. This is the amount of time explored into the future.

2) **Scanning**: this phase involves upfront research to familiarize the researcher with the information and knowledge already in existence that will act as the foundation for the eventual development of the insights. Fundamentally, scanning is an ongoing process that aims to identify

events and environments that may affect the area of interest and is the information that is used to build further elements of the process including trends, drivers and scenarios.

3) **Model Crafting**: it is this phase in which the research pulls out the information from the scan, finding the patterns, meanings, and information that provide insight. System Mapping is often used and is a process by which an individual, or a team, tries to sort the information in order to draw out comprehensive insight about the system encompassing the elements relevant the chosen subject. This is often an iterative process of identifying important elements that guides further scanning, leading to discoveries of relevant events in the past, which then shift the perception of the system and the importance of each element.

   The Scanning and Model Crafting phases could be perceived as either two distinct phases that often follow each other for one or several iterations, or one phase with two distinct activities, as we presented them here.

4) **Scenario Building**: once the trends have been identified and important elements chosen, the components for the scenarios are in place. Scenarios are then written, often following some sort of archetype. These scenarios can demonstrate the possible outcomes of the trends on the system elements. The scenario writing process is less of a deductive exercise as it requires inductive and creative leaps in order to imagine how the trends might play out in the previously determined time horizon.

5) **Identify Implications:** From the written scenarios and the entirety of the work involved in the foresight project, specific implications are identified according to the needs of the client. The scenarios and trends are analysed for potential strategic design interventions, converting the foresight work into insight for decision-making.

Using the strategic foresight process provides decision makers a structured, systemic and systematic way to examine the possible future in which they will one day need to operate. Since the foresight process is one of knowledge accommodation and analysis, knowledge management is very important throughout.

2.2 What is knowledge management?

The field of Knowledge Management (KM) evolved in the latter half of the 20th century and became more widely known in the late 90's. Information technologies began to promise a new scope of possibilities for knowledge sharing initiatives. Along with technology, the promotion of organisational culture was also responsible for the emergence of this new discipline. However, by the mid 2000's, the discipline was already declining in popularity (Frost, 2014), perhaps simply moving away from a buzzword trendy managerial quick-fix discipline to a legitimate body of theory to be considered for the improvement of organisational management. Alan Frost, 2014, further highlights the lack of generally accepted definitions for the terms 'knowledge' and 'Knowledge Management'.

Ikujiro Nonaka's article, *The Knowledge-Creating Company* (1991), is largely responsible for the popularising of the discipline of KM. In his article, Nonaka explains that a knowledge-creating company is involved in 'continuous innovation and self-renewal' by formalising the transfer of individual knowledge into organisational knowledge.

We must now explore the difference between individual knowledge and organizational knowledge as well as define knowledge itself. Prior to knowledge

being accrued by those developing it, the data that makes up the knowledge can be observed as random and undirected. It is up to the individual or team to make sense of this data, combined with the knowledge already amassed at both the organizational level and within themselves, in order to construct a larger knowledge management ecosystem on which to operate their work. It is important to note that even within the organizational knowledge level (on the left in blue) and the individual knowledge level (on the right in pink), activities and subsystems are created and used to further organize and align knowledge. In her article, *Knowledge Management Systems: Issues, Challenges, and Benefits* (1999), Maryam Alavi defines Knowledge Management Systems as;

> An emerging line of systems that targets professional and managerial activities by focusing on creating, gathering, organizing, and disseminating an organisation's ''knowledge'' as opposed to ''information'' or ''data."
> (Alavi, 1999)

Alavi's definition also alludes to a hierarchy between crucial elements (data, information & knowledge) within the knowledge creation process. To these three elements, some KM literature also adds a fourth, wisdom. In her paper, *The Wisdom Hierarchy: representations of the DIKW hierarchy* (2007), Jennifer Rowley identifies various authors mentioning the DIKW elements and compares the many attempts to establish practical definitions for the four elements. She begins by sharing Russell Ackoff's definitions, proposed in his article *From Data*

to Wisdom (1989), which we found to be adequate for our use. We are using these definitions of data, information, knowledge and wisdom.

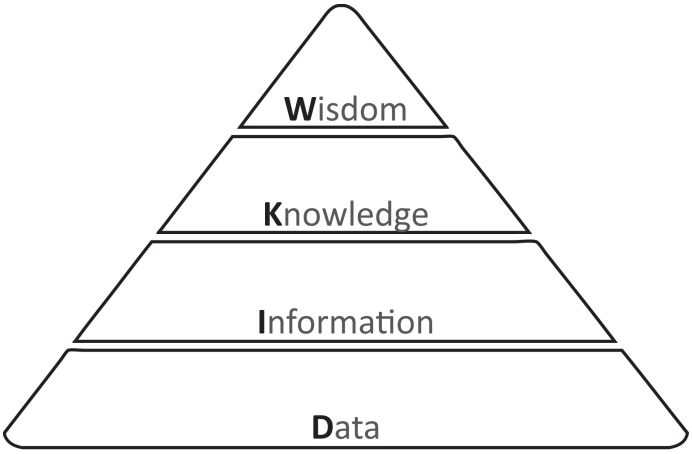

Figure 2. The DIKW hierarchy, Rowley, (2007).

Data are defined as symbols that represent properties of objects, events and their environment. They are the products of *observation*. But are of no use until they are in a useable (i.e. relevant) form. The difference between data and information is functional, not structural.

Information is contained in descriptions, answers to questions that begin with such words as who, what, when and how many. Information systems generate, store, retrieve and process data. Information is inferred from data.

Knowledge is know-how, and is what makes possible the transformation of information into instructions. Knowledge can be obtained either by transmission from another who has it, by instruction, or by extracting it from experience.

Wisdom is the ability to increase effectiveness. Wisdom adds value, which requires the mental function that we call judgement. The ethical and aesthetic values that this implies are inherent to the actor and are unique and personal.

Rowley, 2009

We have now defined knowledge within the practice of KM as a hierarchy of elements that stem from Data to eventually create Wisdom. How might this process unfold?

Gene Bellinger, Durval Castro and Anthony Mills, elaborating on Ackoff's paper, specify how each successive step of the hierarchy is progressively achieved: there is a transition from data to information involving 'understanding relations', and then a transition from information to knowledge involving 'understanding patterns', and finally a transition from knowledge to wisdom involving 'understanding principles' (Bellinger et al., 2004).

The DIKW Hierarchy is implicitly sequential, suggesting that there is a single path to knowledge and wisdom. Ikujiro Nonaka suggests an alternative path to knowledge that introduces two types of knowledge; Tacit Knowledge and Explicit Knowledge. Tacit Knowledge exists solely in the mind of the individual; it is intuitive and instinctive. Explicit Knowledge has been articulated and can be transmitted to others; it is found in manuals, reports or presentations. In Figure 3 we provide a visual representation of Tacit and Explicit knowledge on the top with Nonaka's (1991) four ways that knowledge can be transmitted on the bottom, in order to demonstrate this process with these two types of knowledge.

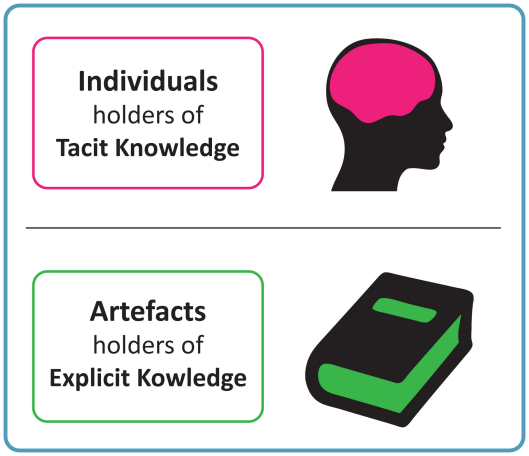

Figure 3. Differentiation of Tacit Knowledge and Explicit Knowledge.

1. From Tacit to Tacit: learning by seeing and doing
2. From Explicit to Explicit: curating various components of reports or papers into new reports or papers
3. From Tacit to Explicit: articulating personal know-how or mental models to others
4. From Explicit to Tacit: internalising shared information in order to reframe personal mental models

(Nonaka, 1991)

Despite the relatively linear representation put forth in Figure 3, the knowledge transfer process is much more dynamic and convoluted. Nonaka (1991) describes it this way: ‘‘In a knowledge-creating company, all four of these patterns exist in a dynamic interaction, a kind of spiral of knowledge’'. The spiral metaphor is not meant to be interpreted literally, as a spiral line would again suggest a linear

path for knowledge creation. Instead the spiral suggests there is a second path to knowledge creation and transfer; a random, iterative path which some of our interviewees referred to as “messy”. Nonaka’s spiral and the DIKW Hierarchy demonstrate two patterns of knowledge creation and transmission (see Figure 4). For simplicity sake, the knowledge hierarchy is often represented as a pyramid (as on the right in Figure 4), however something like Nonaka’s spiral is likely a more accurate representation of the process (seen on the left in Figure 4). KM must then take both these pathways into consideration when attempting to facilitate and improve knowledge transmission within an organisation.

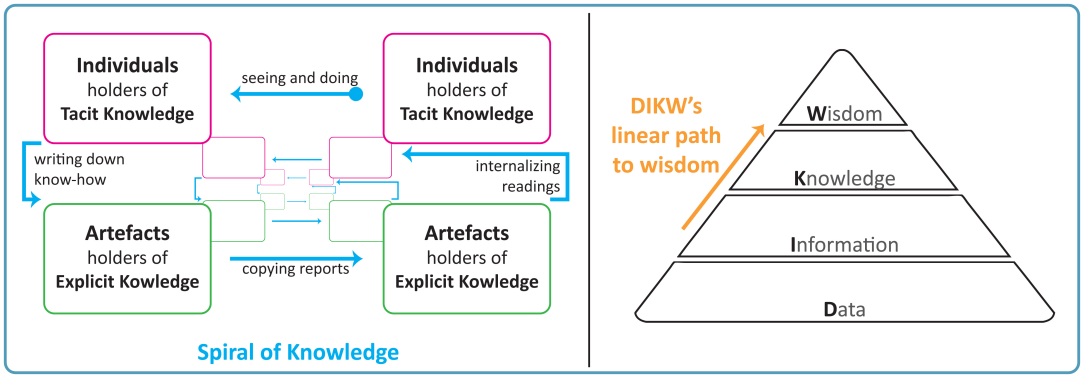

Figure 4. Visual comparison of the Spiral of Knowledge model (constructed by the authors to represent Nonaka’s, 1991, description) and the DIKW model (from Rowley, 2007) of knowledge management.

How does the DIKW model translate into Tacit/Explicit Knowledge? Data and information both reside in artefacts, their difference being ‘functional not

structural', these are forms of Explicit Knowledge. Knowledge is know-how and so resides in individuals and is a form of Tacit Knowledge. In trying to marry thee two models, DIKW and Tacit-Explicit, we come to the conclusion that wisdom is a type of Tacit Knowledge since it requires judgement, which relies on ethical and aesthetic values unique to individuals. Wisdom as tacit knowledge could then be articulated and shared as Explicit Knowledge through a statement (Information) or a precise set of instructions (Data). Figure 5 illustrates our interpretation of the alignment between Rowley's hierarchy and tacit and explicit knowledge.

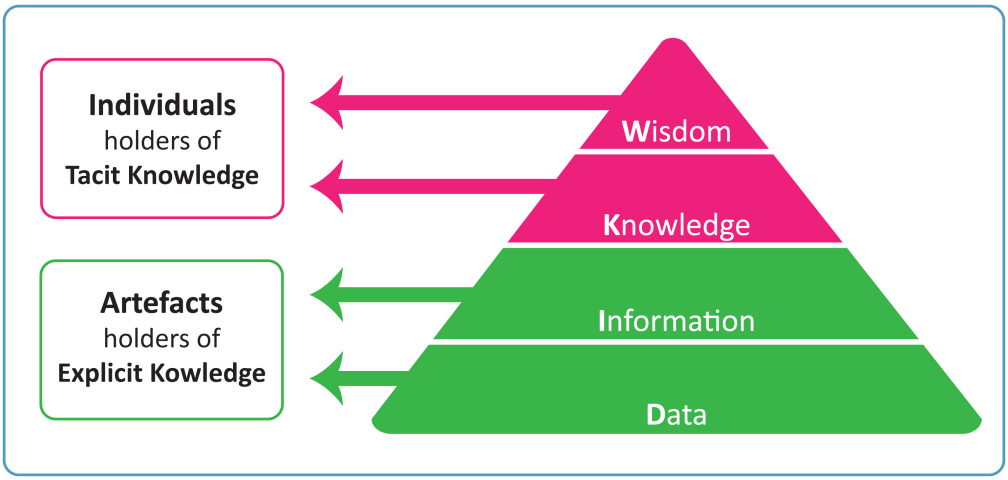

Figure 5. Visual representation showing how the DIKW model by Rowley (2007) aligns to Tacit Knowledge and Explicit Knowledge.

Other KM literature mentions a third type of knowledge; Embedded Knowledge. Embedded Knowledge exists solely within organizations as processes, culture, routines and structures (Frost, 2010). Organizational knowledge would then refer to the Embedded Knowledge guiding activities within an organization as well as

the Explicit Knowledge found within manuals, reports and datasets belonging to the organization. We will then propose a simpler definition for KM, which will be the definition we will apply for purposes of this major research paper;

Knowledge Management is a discipline that seeks to improve an organization's capacity to leverage its Organizational Knowledge and the knowledge of its members. Figure 6 illustrates the knowledge ecosystem.

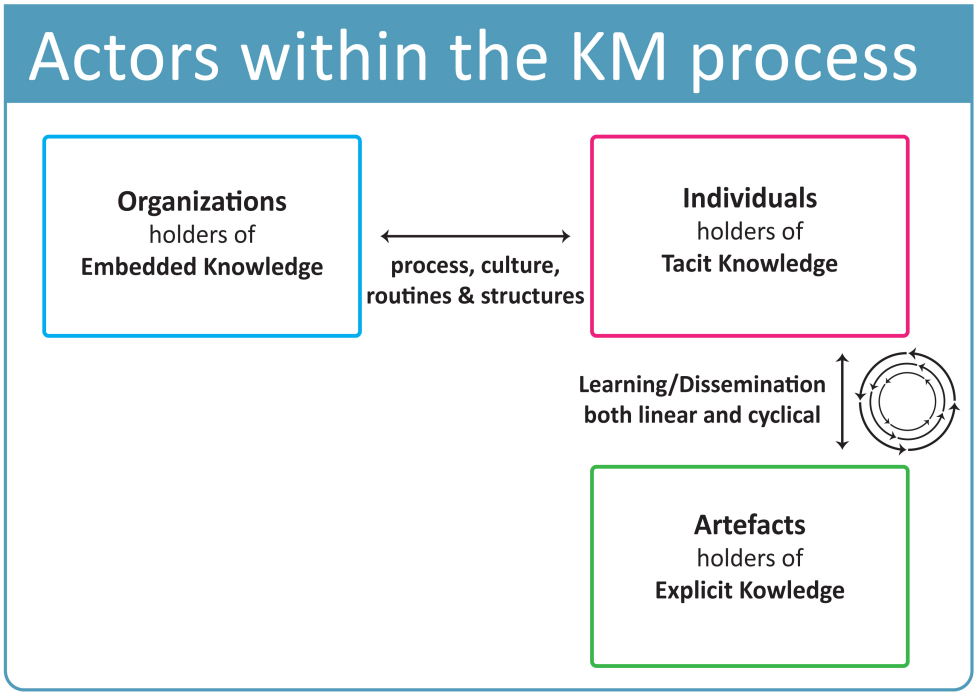

Figure 6. Visual representation showing the role of the various actors within the KM process.

We thought KM to be a natural avenue to improving the foresight process as the task involves tackling vast amounts of data and information in order to analyse

and internalize concepts. Practitioners then leverage gained insight in order to communicate new ideas about possible futures or challenges and opportunities that may arise within them. Improvements to the foresight process using KM should be made both at the organizational level as well as at the individual's level. Foresight practitioners are at the heart of the research, analysis and creative processes that are involved in foresight. The organization should seek to enable the team while growing an institutional database, culture and set of methods and practices.

3.0 METHODOLOGY

Our methodological process was broken down into 5 activities: a literature review, an industry scan, expert interviews, process mapping and identification of knowledge management improvements within the strategic foresight process. The literature review and industry scan allowed us to gather information and define our area of study; the expert interviews provided us the primary research we used to answer our research questions; while process mapping was used to analyse, summarise, visualise and communicate our findings. Appendix C – Notes on Methodology, provides the formal definitions used for Literature Review, Expert Interviews and Process Mapping. Below we review each of the areas that created the backbone of our methodological structure. During the execution of our methodology, we identified discussion points that we deemed note worthy. These were the identification of 'Bias in Sampling' and the 'Refusal of Our Interview Request'. Each of these are discussed in Appendix C - Notes on Methodology. Also, as there are two authors for this study, in Appendix D – The Division of Labour, we define how Martin and Dustin both contributed to the work presented.

3.1 Literature Review

For our MRP research, key literature review sources from three primary topics were used; Strategic Foresight, Knowledge Management, and Methodologies (see 7.0 References for full list). For Strategic Foresight and Knowledge Management the literature review focused on defining each discipline to a degree so that we could relay its importance in pertinence to our study and therefore forward this information for the reader to ensure their understanding of the project. For the Methodologies literature review, each of the methodologies listed in this section were researched and had their process supported in literature review (see Appendix C for definitions). We used this literature review to dictate and define the key elements of our project and to support the substantive analysis of our data. The base knowledge that the literature review provided, also allowed us to understand a broad range of terminology and taxonomy surrounding strategic foresight and knowledge management, skills that were essential during our interviews with our diverse set of interviewees. Please see the reference section at the end of this report for the full list of references and literature reviewed.

3.2 Industry Scan

We used an industry scan to identify possible participants/interviewees for our expert interviews. This was completed in three primary ways; through our

professional and academic networks, Internet search, and by consulting a prefabricated list of one hundred global foresight organisations. The list of one hundred global foresight organisations was compiled by Policy Horizons Canada and was used with their permission.

Consulting our professional networks included asking people we already had contact with, what they knew about the knowledge management practices within the strategic foresight process and who would be good to interview for our study. This mainly took place at the beginning of our study, and was usually a conversation probe, seeking out information. For this, we reached out to our contacts via our places of work (Idea Couture and Policy Horizons Canada) and our educational institution, OCAD U.

We also researched knowledge management practices within the strategic foresight process. This aided us in understanding what information already existed within the academic literature and in confirming that our area of study was a worthy pursuit.

Finally, we consulted (with permission) a list of one hundred foresight organisations across the globe in search of examples of divergent foresight activities. The list and primary data was gathered by a research team at Policy Horizons Canada, as one of our two researchers, Martin Berry, was an active member of the Policy Horizons Canada research team.

We used these three methods to perform our industry scan in order to paint a holistic image of the various foresight activities taking place and emerging across the globe, understanding what information was already present pertaining to knowledge management within strategic foresight, and to gain perspective on how we would drive our sampling for our expert interview participants.

From the industry scan, we used the data to identify the multiple business practices, methods and products, for which foresight is applied. In order for the researchers to gain a more inclusive understanding of the foresight organizations, and hence later categorize them, the following information from the list of foresight organisations was collected and considered from their websites:

- mission statement
- organisational type (governmental, profit or non-profit)
- organisational practices (scanning, foresight or both)
- types of products (free/sold scanning articles, free/sold foresight papers,
- geographical location

By assembling these characteristics we were able to achieve an overview of which organizations were practicing strategic foresight and to what capacity. This information was compiled and then used to target individuals for contact within the various organisations as possible participants for our study. We were unable to collect all characteristics for all organizations, however we were able to gather enough information to make the decision for our research sampling.

For the qualities and organisation of our sampling practice, please see the Sampling section below.

3.3 Expert Interviews

Our primary data collection method was the application of semistructured expert interviews.

We utilized semistructed interviews to have flexible open-ended interviews with our research participants in order to gain expert opinion and understanding of the knowledge management and data collection practices within the strategic foresight process. Our expert interviews were conducting using a preformulated Interview Guide (see Appendix A), which acted to provide general direction, form the conversation and frame our respondents' open-ended answers. The Interview Guide is intended to last approximately 45 minutes but is variable depending on the interviewer, the interviewee and their facilitation approach. Each question is not intended to be asked verbatim, but rather to be used as a prompt or launching pad for discussion. However, during our interviews we made sure to ask all questions so that we would have comparable data to analyse. It can be noted that during our interview process we warmed up our interviewees by beginning with simple questions requiring less mental processing (for example their background and relation to strategic foresight)

before asking more challenging material, and our Interview Guide (see Appendix A) reflects this. We also made sure to supply our interview guide to our interviewees prior to the interview so that, should they wish, they could pre-read the guide and have time to think about their answers. With permission from the interviewee, each interview was audio-recorded for later analysis and reference. In accordance to OCAD U's research guidelines, all interviewees filled out a consent form that provided an overview of the project, the potential benefits and risks, what is expected of them, and disclosure on the researchers. For an example consent form please see Appendix B.

Upon the completion of each interview we codified the interviewee's responses (highlighting phrases and sentences using a coloured taxonomy) identifying their strategic foresight process, the tools they use for knowledge management, key terms that define their processes, and other interesting material worth revisiting. For an example of our coded interview data please see Appendix D. By codifying each interview in this manner we were then able to aggregate information across all the interviewees and compare them to each other both directly and by organisational category. For example, we could compare how one individual's tools for knowledge management differed from that of another, and/or we could compare how consultancies' strategic foresight process was different from governmental strategic foresight process. Organizing the data in this manner allowed us to identify patterns in the data, make insights, and propose

conclusions. This was completed both digitally using an online collaborative cloud-based spreadsheet (in this case Google Spreadsheet) and in tangible form on a wall that was organized into the 15 interviewees. Using the digital form fostered easy manipulation and editing, as well as cloud-based remote access, while the tangible on-the-wall form permitted a war room-like analysis that permits the researcher to view all the content quickly and easily in a single place. We discovered that having the data in multiple formats provided a variety of interpretations, allowing us to identify patterns that may have not been identified in a single form. Interestingly, this was also a finding that came through in our interviews – analysing data using a variety of media allows for greater depth of insight.

Once the interview data was collected and codified, we performed sensemaking to establish patterns and themes that carried across our interviewees. We also used personal judgement to discern outlier data that was of interest. For the outcome of our data analysis, please see the Findings section.

3.4 Process Mapping (Analysis and Summarization)

The final stage of our research process was the development of a process map. During the interviews we asked our interviewees to describe their strategic foresight process, the tools they used and how knowledge was managed. After

the interviews we mapped out each interviewee's process using process maps, displaying in a visual manner the various phases, actions and tools applied (See Appendix F for examples).

Upon completing rough process maps for each individual interviewee, we then pulled the maps together, compiling the information to develop a higher-level map displaying how each individual's strategic foresight practice is related, and how they are not (for images on the codification process and how it was developed into the process map, see Appendix D).

The process map creates a visual representation of the accumulated processes, tools, barriers, opportunities and paths that we have identified from our research. By placing a KM lens overtop of the aggregate strategic foresight process (as described by our interviews) we can demonstrate how each phase of the process and the tools used for that process relate to KM. The process map elements (as defined by Biazzo) relate to the elements in knowledge management.

Table 2. Alignment of the terminology used during process mapping and knowledge management.

Process Mapping Terminology+	Knowledge Management Terminology*
activities	Organisational culture or embedded knowledge
people	Holders of wisdom or tacit knowledge
objects	Data and Information or explicit knowledge

+As detailed and defined in Biazzo, 1997.
* As previously defined in the Knowledge Management section of the Introduction of this document.

By aligning these two terminology bases, we can better understand how to fit a knowledge management lens onto the strategic foresight process by using a process map. This permitted us to develop the final process map seen in the findings section (Figure 7).

3.5 Sampling

In total we approached 22 individuals who practiced and/or studied strategic foresight. Of the 22 we approached, 15 agreed to participate in our study, one refused our request (see below for more), and six did not respond. In total we interviewed 15 participants. We approached individuals through three methods:

- Email
- Personally/verbally
- Through a mutual contact's introduction (see below)

In order to obtain a broad sample of participants, and thereby gain a general perspective on knowledge management practices within the strategic foresight process, we interviewed individuals with a variety of backgrounds. We split the

participants into the type of strategic foresight work they were doing at the time of the study and/or within the previous year. This provided the following four categories:

- **Consultancy**: A for profit organisation or individual that sells their foresight process as a service/product to other organisations.
- **Think Tank/Labs**: An organisation or individual that is funded or sells foresight research centralized around policy, social policy, political strategy, military strategy, technology, and/or culture.
- **Educational Institutions**: An organisation or individual that researches and applies foresight for the purpose of education and knowledge expansion.
- **Governmental**: An organisation or individual that utilizes foresight to influence policy decisions.

These categories not only organized our data, but also permitted us to identify any patterns and/or differences between the four category organisations and their use of strategic foresight. We had a total of three interviewees for each category (with an extra interview for both the educational institution and governmental), with no more than two interviewees from any single organisation.

In order to qualify for the study we sought participants that met the following qualities:

- Practiced and/or studied strategic foresight within the past year (as of time of study) as part of their profession/livelihood
- Was able to speak to the knowledge management practices in regards to the strategic foresight process
- Fluent in English

At the time of the study, both authors were employed in organisations that practice strategic foresight; one author was in a governmental organisation, while the other was in a consultancy. Using their place of employment as well as OCAD U to recruit strategic foresight practitioners as interviewees provided the start of the recruitment process. In order to meet the targeted quantity of participants, at the end of each interview we would ask if the interviewee had any recommended contacts that we should also interview. This turned out to be a fruitful practice as of our final 15 interviewees, seven came from recommendations. Compared to 'cold calling' other potential interviewees via email, using our interviewees to connect us to their networks was highly successful and would be strongly recommended to future researchers attempting similar methodological practice. Note that internal foresight groups for corporations are not represented in this study as none of the interviewed experts came from this category.

4.0 FINDINGS (AND MICRO-RECOMMENDATIONS)

In the Introduction section we identified five main phases of the foresight process. These phases were analogized to the phases Peter Schwartz describes in his seminal book *The Art of The Long View*. The five phases we suggest here attempt to create a more inclusive terminology, and to meet the evolving practice that is the strategic foresight discipline. The reader should understand that the foresight process is varied, and that our five phases are put forth to assist their building of a mental model and to complement our accompanying process map, rather than taken as a governing protocol. Also, our sampling of 15 expert interviews does not wholly represent the entire community of foresight practitioners but is meant to shed light on the various tools of knowledge management within the foresight process, providing the reader a foundation of knowledge to better their own practices.

Our five phases are:

1. Project Framing
2. Scanning
3. Model Crafting
4. Scenarios Building
5. Identifying Implications

In the following sub-sections we will further define each of these phases and the tools that are utilized during each phase, as well as highlight how our experts use knowledge management throughout the foresight process. We divide each of

the five phases into findings from our interviews which we share in the *Process* and *Tools* sub-sections followed by conclusions we came about after aggregating all of our findings which we share in the *Insights* and *Recommendations* sub-sections. Here are brief descriptions of these sub-sections and what they aim to explore:

1. **Process:** what is the phase and what is involved during the phase, how it unfolds and the goals of the phase. This may also include any differences observed between the processes of the various organisational types.

2. **Tools:** what software/techniques/methods were mentioned through the interviews as being used during this phase, how are the tools used and how is knowledge managed. Here we use tools to encompass all forms of knowledge management aids including tools, techniques, software and methods. These lists are not exhaustive as we have limited ourselves to the tools mentioned by our interviewees.

3. **Insights:** what are the important lessons and pieces of wisdom that can be gained? What are the challenges that arose? Also, what are the major KM challenges and activities involved in this phase? The insights were gathered through our observation of the interviews we conducted, combined with our knowledge of the past research.

4. **Recommendations:** what are some potential solutions to the challenges, and/or key learning gained. These recommendations are those of the authors upon completing analysis of the data, and are offered to the foresight community as a way to improve their foresight process.

By aggregating the process and the KM tools of all those we interviewed we have been able to produce the overall process map (see Figure 7). In the following subsections we will detail each phase of the foresight process that is displayed on the map according to the experts we interviewed. We would like to

acknowledge that our foresight map is a current (at time of writing – December 2014) snapshot of the KM tools being applied to the strategic foresight process, and that these tools are likely to change over time, as new tools arise and older tools become obsolete.

It is for this reason that we have attempted to focus less on the tools themselves, but more on the categories in which these tools live. The categories are unlikely to change unless there are major modifications to the strategic foresight process, and therefore are of more relevance to the future strategic foresighter reading our work.

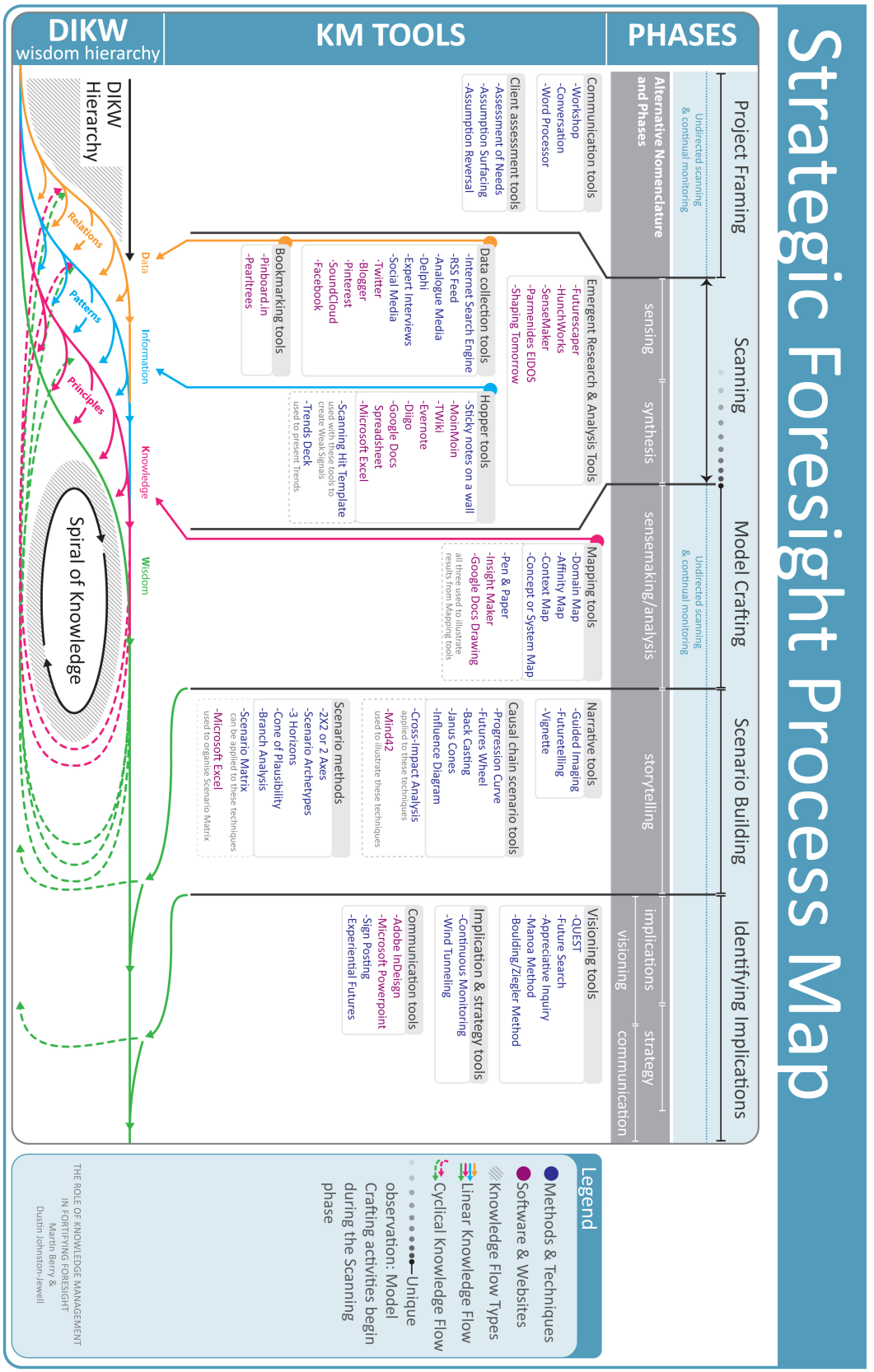

Figure 7. Process map of the strategic foresight process demonstrating the various KM tools applied as defined by the experts interviewed and aligned to the wisdom hierarchy.

(The above map is a place-holder for the accompanying foldout).

It should be noted that for the following paragraphs, when we refer to 'the client', we are speaking of the individual or organisation that will use the outcomes of the strategic foresight process with the intent to influence strategy and/or policy decisions.

4.1 Project Framing

The first phase of any foresight engagement is to determine the project's objectives, roles and responsibilities, scope, depth, breadth, definitions, boundaries and other key information that give the project structure. This includes consensus building on what the project will and will not entail, defining the requested time horizon, how far into the future the project will explore, as well as the specific tools and methods that will be used in the following phases of the project. The information identified and established during this phase acts as the blueprints on which the rest of the project will be designed and built.

4.1.1 Project Framing 'Process'

For some engagements, project framing is a formal and necessary step within the overall foresight process – a fact that was especially true for the experts interviewed that were categorized as consultancies. Other organisational categories described a project framing phase, however it tended to be less formal and more organic in nature. This was also referred to as the 'design thinking' phase and included ensuring that the question or objective of the

foresight engagement was properly defined. Multiple experts declared the importance of not defining the frames of the project but also ensuring that the right question was being asked and that what the client wanted was aligned with the project design.

4.1.2 Project Framing 'Tools'

For this phase of the project there are not many formal tools that were described during our interviews.

Communication Tools

The primary method of knowledge management referenced was the use of meetings or workshops with clients and stakeholders to ensure that all were in collective agreement. This would include the recording and formalization of the preliminary project information in a written document (using a word processor program) for all to refer to.

Communication tools mentioned by interviewees: workshop, conversation, word processor (for more information on these tools refer to Appendix F).

Client assessment Tools

Other communication tools during this phase are used to identify the underlying state of the client's mental model. Identifying the client's understanding at the beginning of the project allows the foresight team to determine what types of futures work will be needed in order to challenge the client. Experts tend to be

aware of recent advances in their own field and so may need to be challenged through the discovery of recent developments outside of their field that might affect them. Other clients may not possess information about recent developments in any specific field and so may be challenged by a greater amount of new concepts and developments. Some of the foresight practitioners we interviewed mentioned using Assumptions exercises to help identify the client's expectations of the future and clarify the zeitgeist that they hold to be true. These activities help guide the focus areas of the research and the types of scenarios to write later on.

Client assessment tools mentioned by interviewees: Assessment of Needs, Assumption Surfacing, Assumption Reversal (for more information on these tools refer to Appendix F).

Figure 8 illustrates the knowledge transfer activities facilitated by the tools used during the Project Framing phase. During this phase the foresight team and the client share their respective Tacit Knowledge via communication tools in order to come to a written agreement, or Explicit Knowledge (pink arrows). In parallel, the foresight team and the client share their respective Tacit Knowledge via client assessment tools in order to inform the foresight team as to the appropriate course of action for the foresight process (green arrows).

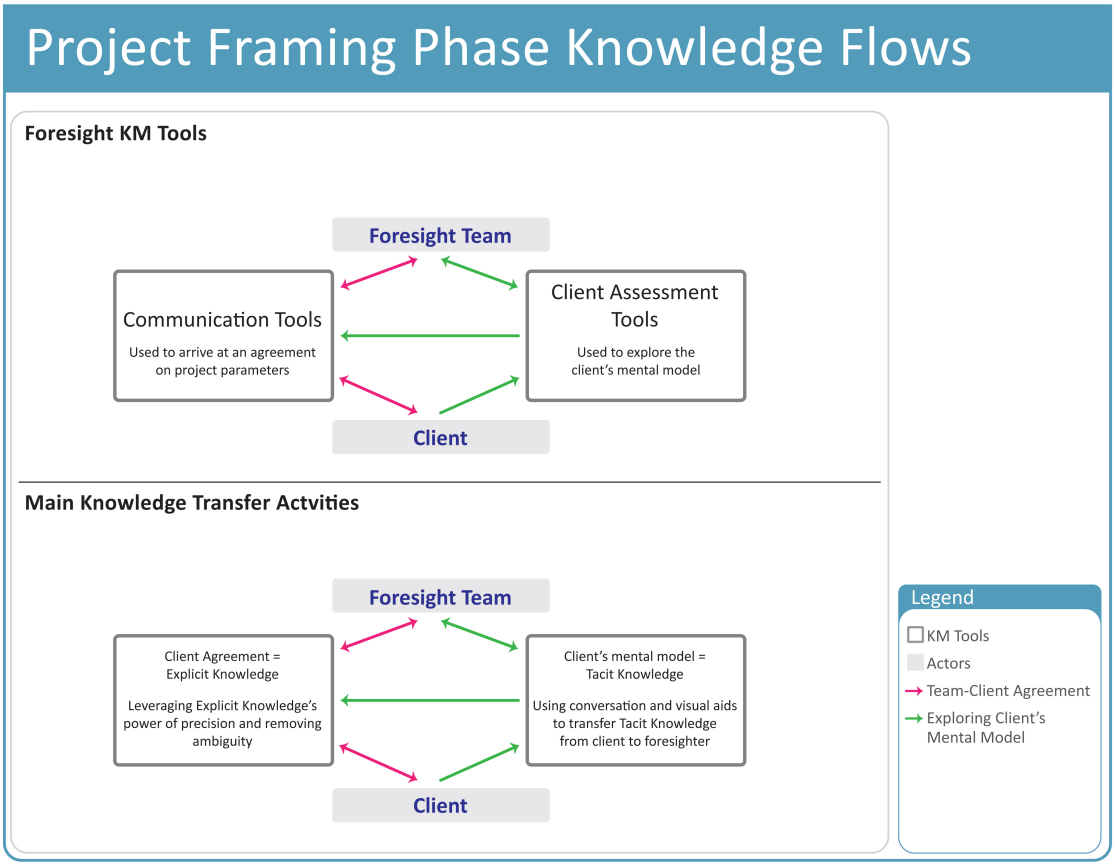

Figure 8. Representation of the knowledge transfer process as it relates to the tools used during the Project Framing phase. The tools facilitate the transfer of Tacit Knowledge from the Client to the Foresight Team, which then creates Explicit Knowledge (agreement) to be presented to the client.

4.1.3 Project Framing 'Insights'

The two underlying goals of this phase are: defining the expectations of the client (which should then be captured in the agreement) and defining the current grasp the client has of the future (which would be explored via the client's mental model). The major knowledge transfer challenge of this phase is then to properly capture relevant knowledge from the client (Tacit Knowledge) in order to have the team adopt the knowledge, merging it to their own Tacit Knowledge.

Once this has been accomplished the team should then be able to frame an agreement (Explicit Knowledge) which will best serve the project.

Failure to properly engage the client in order to surface important information about their mental model could lead the foresight team to either:

1. Fail to properly communicate the findings. Improperly communicated findings could result in failed knowledge transfer. Should the insight from the project not reach its target, the whole endeavour may have been without effect.
2. Present unsurprising findings or ideas that would be dismissed by the client as implausible.
3. Have the team explore domains and ideas that the client may consider un-important leading to lost time and efforts.

Expectations will help guide the tone of the work. Some clients may need considerable prepping before being introduced to dramatically new ideas of possible futures and some clients may not be open to exploring certain ideas they might consider *too wild.* Understanding the extent of the client's knowledge about current trends may help avoid disappointment. No foresight practitioner would want to present scenarios that were considered too conservative by their client.

A challenge our interviewees identified for the project framing phase was ensuring that the client had the proper language to define the project from the onset. Making sure that foresight is applied properly to a situation is important if it is to add value. It is the responsibility of the foresight practitioner to educate the client on what foresight can do for them. This may require a brief sharing of foresight literacy in order to inform the client of the value of foresight, how it can be used and what the limitations are.

4.1.4 Project Framing 'Recommendations'

Foresight organisations need to learn to leverage organisational memory in order to better understand the client's needs. This is both in referring to past projects' methods and approaches as well as content and insight from past work.

In order to manage a client's expectations, the project should be communicated with tools appropriate to the needs of the client. Some clients are more sceptical, while others are open to bold new concepts. Similarly some clients have a narrow view of recent developments (experts in a specific field), while others have broader fields of interests. During this phase, a foresight team may wish to explore the types of tools it intends on using later on in the project's foresight process. Some tools are a better fit with certain clients. Table 3 suggests tools that would be appropriate for a client's tolerance of change and their level of scepticism. For a definition of these tools please refer to Appendix F

and to better understand where these tools belong in the overall process refer to Figure 7.

Table 3. Identifying the correct tools to use during a foresight engagement dependent on the client's tolerance for change and their level of scepticism. This table illustrates some example tools mentioned by our interviewees and the situations in which they could be applied.

Examples of the right types of tools for each client or project		
	Client with narrow fields of interests	Clients with broad fields of interests
Client sceptical of foresight or conservative about the pace of change	**Trends deck**: can be used to present the client with a large range of forces at play in the present, beyond their field of interest. Helping your client understand how developments in other fields might impact their interests. **Janus Curve**: presents change in a timeline from past events into future outcomes. Timelines with short intervals might help the client understand the causal logical chains used to arrive at the scenarios, easing scepticism. Timelines focusing on field specific issues can be influenced at certain intervals by outside forces while maintaining a field specific narrative arc.	**Weak Signals**: engaging the client with some granular level information may help them become familiar with surprising developments within specific fields in the recent past. Paving the way for the acceptance of plausible shocking outcomes in the scenarios. **Concept Map/System Map**: demonstrates the interactions many forces/domains on the project question. May help the client understand the network of causal influence from field specific trends or drivers on the larger system.

Client open to foresight and receptive to dramatically new ideas of the future	**Cross-Impact Analysis**: crossing trends or drivers from within the client's field of interest with those from beyond the field could help demonstrate how compound progress and change may bring about dramatically different outcomes or accelerate the pace of change.	**Futures Wheel**: demonstrates a large variety of outcomes from a central question/trend/driver. First order nodes in a Futures Wheel are sometimes domains/lenses/drivers, which would allow the exploration of a wide variety of outcomes considering many variables.

Ultimately, the work will need to be presented into a research and findings narrative appropriate to the type of client requesting the project.

Figure 9 demonstrates how past work (Explicit Knowledge) can be used by the foresight team to challenge and inform the client (pink arrows). This may help the team understand which approach, tools or processes to apply to the project, or flag relevant insight from previous projects for the present project. Flagged work will be used during the Scanning phase (green arrows).

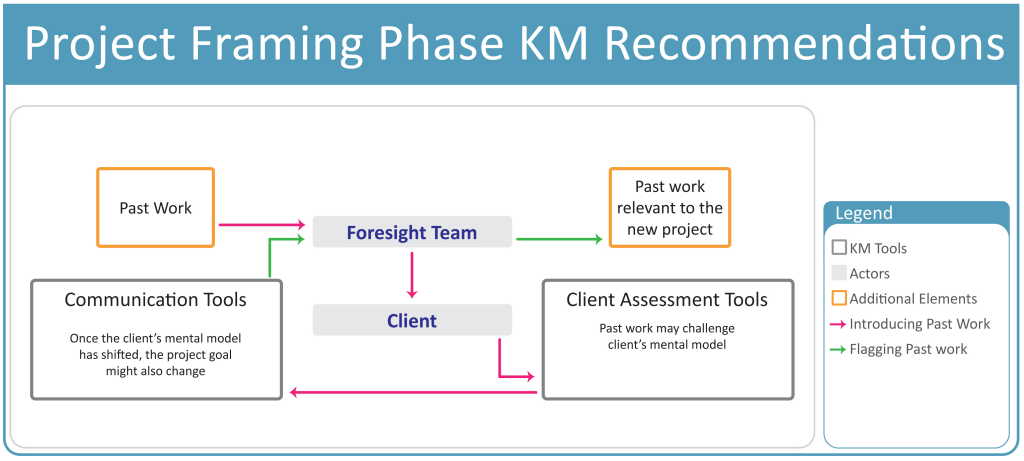

Figure 9. Knowledge gained from previous projects can be transferred either to the client during the Project Framing phase or identified as relevant to the Scanning phase.

Previous work done by the foresight practitioner can be invaluable during this phase as it may be presented to the client in order to gauge their reaction. Examples of scenarios or trends from previous work can facilitate conversation with the client and help establish the client's grasp of possible futures, as well as openness to dramatically new concepts of the future. Foresight organisations or individual practitioners may wish to develop new products from previous work appropriate to this goal.

An organization will also wish to identify relevant past work (e.g. continuous monitoring activities or specific scenarios, trends, drivers and weak signals) in order to incorporate it into the new project. New areas or domains, as well as new research needed to bring up to date previous work, will need to be properly identified in order to allow the project team to elaborate a scanning strategy.

Having properly defined the scope of the project and the assumptions of the client will determine how to intermingle trends and forces from outside the area of research with the trends identified within the narrow project domains. Our interviewees pointed out that foresight practitioners often bring to a project an understanding of larger trends throughout many fields while clients may bring narrow expertise in their field of work. The surprises of seemingly unrelated outside forces and trends acting upon a specific system (e.g. the effects of new economic development models on the field of bioengineering or vice versa), is one of the benefits of foresight. The team can strive to articulate how it will manage past acquired knowledge with the task of collecting new information. This will be done in any case, but a clearly articulated strategy can prove more efficient than an ad hoc approach.

4.2 Scanning

During our interviews, the scanning phase was the most talked about of all the phases. Some foresight projects start and stop with the scanning phase, while others use the scanning phase as the foundation for following phases. While scanning is an activity that most practitioners do nearly every day (e.g. through newspaper, evening news, blogs, magazines, etc.), scanning in the foresight process refers to specific or directed scanning (Choo, 2001). This is a systematic

process that aims to capture the important developments in all relevant fields to the research question.

4.2.1 Scanning '**Process**'

The first step to scanning is defining the limits of the sphere of study. Eventually there can be a system of partition in order to create a manageable list of categories. This would increase the efficiency of the scanning phase. These scanning categories are a first step towards the model crafting phase but should not be considered final. The research process will most likely challenge these categories, requiring the team to try several categories, domains and system elements in order to best serve the foresight project.

As described by our interviewees the scanning phase is a broad search and identification of data that are ultimately collected and curated. Many of our interviewees noted that a good foresight practitioner, in some sense, is always scanning, and therefore scanning is an on-going and continuous process. In light of this, we have come to realize that scanning can be defined as either indirect or direct (Choo, 2001). Indirect scanning is continuous and general in nature, while in contrast direct scanning is specific to a particular project or objective and most often time or resource limited. For both indirect and direct scanning, the foresight practitioner collects large amounts of raw data from a variety of sources and then culls the data down using a variety of sensemaking methods with the aim of meeting the strategic direction of the project.

4.2.2 Scanning '**Tools**'

Despite the fact that many different tools can be applied for use during the scanning phase many of the tools, such as Google Docs, Microsoft Excel, Pinterest, Pinboard, Evernote, had common characteristics:

- controlled and regulated access
- ability to provide remote access to multiple parties/people
- ability to tag/build a taxonomy (usually as a precursor to sensemaking)
- editable
- relatively simple and easy to use

An interesting insight that we identified anecdotally, but was also brought up during a few of our interviews, was the complementary nature of digital and analogue tools. Where digital tools offered many advantages, analogue tools (e.g. sticky notes on a wall) offered a different dimension, allowing researchers to explore a dataset in a physical space at a more human scale. Likewise, we identified a variety of newer digital tools that are automating the scanning process (for example, Futurescaper, HunchWorks, SenseMaker), building weak signals and trends from crowdsourcing or artificial intelligence collected information. We can imagine that these will be the tools most likely to be used in the future but that tactile tools will continue to be used for their intuitive and collaborative aspects.

Data collection tools

These are tools that facilitate a foresight practitioner's access to sources of data. The act of collection is usually made through bookmarking, via bookmarking tools, note taking or the creation of a Scanning Hit (explained in the Hopper tools section below). News media, expert interviews, fringe blogs and publications, whatever the source the goal is to sift through large amounts of data asking the questions; Is this relevant to the project? Is this new to my client or me? Mainstream or reputable sources offer a higher degree of credibility while fringe sources offer novelty. Both sources need to be visited in order to create both credible work that is novel and presenting challenging concepts to the client.

Data collection tools mentioned by interviewees: internet search engine, RSS Feed, analogue media, Delphi, expert interviews, social media (for more information on these tools refer to Appendix F).

Bookmarking tools

In order to avoid creating futures work that has been blind-sided by a lack of research, the research team will need to peruse a vast amount of data. Once a source has been identified as relevant, bookmarking tools can be used to elevate the data to the status of 'useful information' to the project.

Bookmarking tools mentioned by interviewees: Pinboard.in, Pearltrees (for more information on these tools refer to Appendix F).

Hopper tools or database management tools

Beyond simply bookmarking the source, the information might be entered into a project database. A Scanning Hit Template is a useful tool to ensure the database is ordered, increasing the ease of access to the material for collaborators or for future references. Information categories on a Scanning Hit Template might include; name/title of signal of change, summary of the change, possible implications, source, tags of relevant domains, and possible timeline for implications. These templates guide the members of a foresight team to enter findings into the database in a similar manner. What we have named 'hopper tools' facilitate the task of ordering large amounts of findings into categories, often with tags or other functions to peruse the database. A Trends Deck is a compilation of all the gathered findings destined to the client. The Trends Deck is often used to communicate to the client either during the foresight process or as part of the final deliverable.

Hopper tools mentioned by interviewees: Sticky notes on a wall, MoinMoin, TWiki, Evernote, Diigo, Google Docs Spreadsheet, Microsoft Excel, Scanning Hit Template, Trends Deck (for more information on these tools refer to Appendix F).

Emergent research and analysis tools

These tools combine many functions to offer a powerful platform facilitating the task of transforming large amounts of data/information into key insight, knowledge and wisdom. Many offer the ability to customize continuous monitoring, integrate bookmarking and categorizing as well as further sensemaking functions. Some offer AI functions and others facilitate using the power of crowdsourcing, for research and analysis goals.

Emergent research and analysis tools mentioned by interviewees: Futurescaper, Hunchworks, SenseMaker, Parmenides EIDOS, Shaping Tomorrow (for more information on these tools refer to Appendix F).

Figure 10 represents the iterative nature of the relationship between the foresight team and the tools they use during the Scanning phase. As the foresight team collect data and information, using Data Collection tools, from data sources (Explicit Knowledge from the writer's Tacit Knowledge) and external collaborators, for example via expert interviews (Tacit Knowledge), they

reference this information using Bookmarking tools (pink arrows). The foresight team then stores this information using Hopper tools and/or Emergent Analysis & Research tools (Explicit Knowledge) (green arrows) Finally stored information is organised into a database along categories and hierarchy which challenges and begins to resemble the mental models of the foresight team and collaborators (blue arrows).

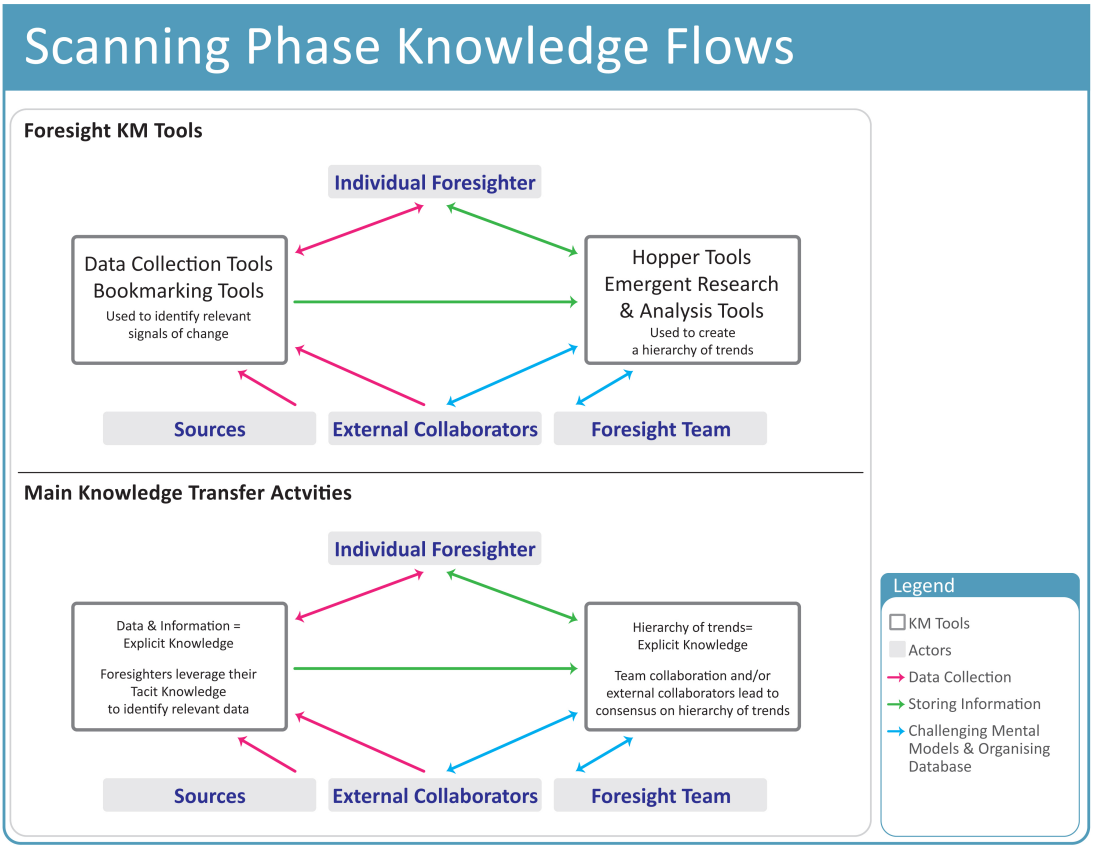

Figure 10. Representation of the knowledge transfer process as it relates to the tools used during the Project Framing phase. The tools facilitate the transfer of Explicit Knowledge (Data Sources) to the Foresight Team. Iteratively team members bridge their own gathered Tacit Knowledge with each other and their collaborators via some sort of database (hierarchy of trends) which is stored as Explicit Knowledge.

The created database can then be used as a reference to collaborate within the foresight team or with external collaborators, challenging and growing individuals' mental models, or Tacit Knowledge (blue arrows).

4.2.3 Scanning 'Insights'

The scanning phase has two main goals. First, to uncover important signals of change occurring that are relevant to the project. These Signals are past events that fit together to shape an image of the present state and the direction of change, often referred to as trends. The second objective is to create a hierarchy of trends in order to begin formulating a mental model of important forces of change to the area of study.

Foresight teams explore large amounts of information during the Scanning phase. Failure to properly organise and share the information and gained insight from the work could lead to:

1. A duplication of the work by different team members, resulting in reduced team efficiency.
2. A loss of produced findings through improper filing practices and sharing practices.
3. Missed opportunities:
    a. A failure to capture interactions between findings.

b. A failure to have findings challenge and inform all team member's mental models.

As computational power increases, combined with networking abilities, crowdsourcing and big data analytics, scanning is being commoditized and automated. Due to this, the added value that strategic foresighters attribute from the strategic foresight process may shift away from the initial scanning phase to other parts of the process. This speaks to a general shift for all data as the Internet breaks down the asymmetry that made data valuable. The use of automation through artificial intelligence (AI) and crowdsourcing seemed to be a new concept emerging in the practice of some of our interviewees and the tools they used. We were however not able to uncover enough information on these new practices to write in detail about these emergent tools. We will therefore mention briefly where in the process these tools seemed to be used without going into much detail of how they might be integrated into the insights and recommendations we have elaborated.

Our interviewees repeatedly used terminology associated with the Scanning phase; weak signals, trends and drivers. These represent elements within a hierarchy of change used to track how small signals of change (weak signals) accumulate into large forces of change (drivers). The names of the elements within the hierarchy of change are widely accepted within the foresight

community. Here are widely accepted definitions for these elements by Olavarreita, Glenn and Gordon:

- **Weak signal, seed of change:** Indicator of change to come that it allows to initiate a work of anticipation and characterization of its future evolution. It is an indicator of impending change built on the base of (internal or external) environmental scanning.
- **Trend:** General tendency or direction evident from past events increasing or decreasing in value and often forming a pattern that is evident from past events. Sufficient data are required to observe relationships and change over time. A trend is a measurable or observable transformation in a given system.
- **Drivers:** Drivers are considered the forces that move a system. They are forces for change or trends- usually external- that act as independent variables, often with the greatest impact.

(Olavarreita, Glenn & Gordon, 2014)

There are many similarities between the scanning hierarchy elements of change and the DIKW hierarchy.

- The transition from data to information involves 'understanding relations'
- The transition from information to knowledge involves 'understanding patterns'
- The transition from knowledge to wisdom involves 'understanding principles'

(adapted from Bellinger et al., 2004)

Weak signals are identified by understanding the relations between an event and the studied questions. By flagging the event as a weak signal and transcribing it into some form of database, the data becomes information to be used by the team. Trends are identified by understanding patterns from past events. Their

introduction into the project coincides with the team gaining knowledge into the forces of change acting on their area of study. Once a team is capable of expressing ideas in the format of a driver, they are confident in their understanding of the system, which would suggest that they now possess wisdom over the studied area. This process occurs as the scanning phase moves into the model crafting phase.

The sub-goals of the scanning phase are then of facilitating knowledge transfer. First between the artefacts holding the raw data (sources) and those where the data has been contextualised to become information (weak signals). Then between project team members, artefacts and experts or other collaborators in order to create trends and drivers. Finally knowledge transfer to the client, who has requested the gained insight, is perhaps the goal for the Identifying Implications phase but our interviewees highlighted the importance of continuous engagement with the client throughout the foresight process. We will now explore the various elements contributing this this knowledge transfer.

4.2.4 Scanning 'Recommendations'

During the Scanning phase, teams must understand the value of order and method in their filing. It is in proper storage of findings that an organisation builds a useful repertoire. Stored information is only part of organisational memory if it can easily be accessed and found. Properly interlinked databases will facilitate navigation for future

employees as well as encourage cross fertilisation within the team during the current project.

Weak Signals, artefacts of raw data and information

Organizational culture (Embedded Knowledge) plays an important role in the proper gathering of weak signals. Our interviewees revealed that at times foresighters are engrossed in their studies and fail to properly catalogue their findings. The creation of weak signals as artefacts allows for the team to share their findings with each other as well as sort and manage them for future projects. The Embedded Knowledge of an organisation becomes central to this task. An organisational culture must be created which promotes meticulous archiving of findings in order to create a database that is easily navigated with clear and concise 'pages' or wikis. This goal may be less important for a small project with a short timeline, as the team may be able to manage the information by memory or using sticky notes on a wall, but is of importance for building a high value database. The database allows the organisation to retain knowledge from project to project and from team to team. For an organisation looking to invest in future projects and plan for the possibility of losing employees, such a database and the protocol for working with the database is important. To reference where data and information fall in the DIKW hierarchy please refer to Figure 7.

Trends, artefacts of knowledge

With its trove of weak signals, team members must reflect, discuss and create visual representations of the patterns they see emerging within their collected information. This can be both an individual and a collective effort. In order to craft trends, the team attempts to draw conclusions as to what directions past events might take. This is best done in iterative cycles that reveal assumptions, discussions and further research. A trend will be created as an artefact, usually with supporting arguments, which may be weak signals, and presented to the team.

There are usually more weak signals then there are trends, which presents the challenge of a large amount of elements to manage at once in one's mind. Categories will help with this challenge. Eventually trends are created from patterns that will reduce the amount of elements needed to be considered once the team moves to the stage of trends. The challenge is now managing both a large list of event based concepts (weak signals) as well as managing a smaller list of more developed concepts (trends).

Each element, whether trend or weak signal, can be written in a short and concise manner (abstract), with a longer more in depth description if needed. The process of abstraction requires choices made by the writer. The making of these choices affords the writer with certain knowledge about the most

important aspect of the trend. Names or titles that offer yet another degree of abstraction and synthesis can be valuable for facilitating conversation, but only to those who have already familiarized themselves with the concepts within each element. This is important as trends may need to be scrutinized by the team via discussion in order to test their validity and improve the robustness of the concepts. Often new questions arise which will require further research.

Again, in order to have this work remain available for future projects the cataloguing of trends can be meticulous and done according to a formal archival method. Tags or links can also be properly added, allowing ease of navigation among trends and weak signals. To reference where Knowledge falls in the DIKW hierarchy please refer to Figure 7.

Drivers, artefacts of wisdom

As the team moves towards consensus around the created trends (potential impact, likelihood and credibility) each member grows their personal mental model. Underlying principles are then captured in the form of drivers. We are not putting forth the idea that foresighters become *wise* once they have written drivers. Drivers require foresight practitioners and team members to use their knowledge of underlying system level principles in order to communicate forces of change at a higher level of abstraction then those communicated in trends. Drivers are a representation of the important forces of change relevant to the

project. This task requires that they leverage whatever wisdom they poses at the time of the task. This is simply a useful distinction of the types of knowledge a team is attempting to use at each stage of the scanning phase. Flagging weak signals is a relatively easy task that requires a lot of time invested in reading, interviewing experts and riffling through various sources. Identifying Drivers may be an easy task as they are often well known. Framing drivers for a specific project may then be more difficult task that requires a *messy* process of strategic discussions, visualisations and iterative writing and editing. Interviewees mentioned that this task was usually tackled later on in the scanning phase, probably since it requires that the foresight practitioners have acquired some wisdom in order to feel confident of their understanding of the relevant system. Choosing how to articulate drivers, how many to create and when to merge drivers together or split drivers into multiple parts (some practitioners use the term 'mega-drivers') is part of the process of defining what is the hierarchy of importance of all the concepts the project has explored and gathered thus far. This is also an activity that could be considered part of the model crafting phase. Several interviewees emphasised that there were no clear distinctions between the scanning and model crafting phases.

Beyond an organizational culture that promotes a clear protocol for building and interacting with a well-organized database, here are a few other

recommendations we gathered from our interviewees. To reference where wisdom falls in the DIKW hierarchy please refer to Figure 7.

Division of labour

The scanning phase requires both high-level thinking about the system and narrow research into specific weak signals and trends. It can be difficult for individuals to move from one task to another as they require different levels of abstraction. A division of labour either by team member or by dividing the day, work week or project timeline may make the task more manageable, and would be defined during the project framing phase of the strategic foresight process.

Assigning sub-teams to different domains could allow individuals to concentrate their energy on a smaller portion of the research field. One example of useful domains in foresight is the STEEPV categories (Social, Technological, Energy, Economy, Political and Values). There are many variances on these domains. Each project may need a different list of domains. The team might also be divided by task. Some members assigned with collecting weak signals, others with formulating trends and others with articulating drivers.

Regular Discussions

In any of these configurations of the division of labour, there can be regular meetings with all members of the team in order to promote discussions on findings and questions at all levels. Meetings with smaller sub-teams or in pairs

may also help scanners with their task. One participant underlined the importance of informal discussions. An organizational culture that promotes, encourages, or creates a safe space for impromptu discussions can help with the scanning phase.

Visualisations

Many interviewees mentioned the use of a sticky notes wall. This artefact, a real-world sized database, may allow some to play with ideas in a tactile manner. This is also a useful tool for discussion as it would allow some to speak with their hands and point to ideas or relations. These walls are also very useful for Affinity Mapping, a process by which foresighters create themes by aggregating data using similarities, during the scanning phase (see Appendix F for list of tools and their descriptions). Other visualisations may include sketches, images or graphs and can facilitate communication amongst team members or with guest collaborators. A challenge with analogue artefacts is properly transferring them into any digital databases. Handwriting can be entered into text format accompanied by a picture of the wall as there is often important information captured by different use of colour, size or hand drawn icons. All of these symbols may hold valuable information, which should not be lost.

Figure 11 depicts the value of regular discussion within the Scanning phase. Individual foresighters are challenged and informed through conversations with

other team members and external collaborators (pink arrows). These discussions can help the foresighter in their task of contextualising data and information (green arrows). As the hierarchy of trends evolves, new conversations are possible which further challenge and inform mental models (blue arrows).

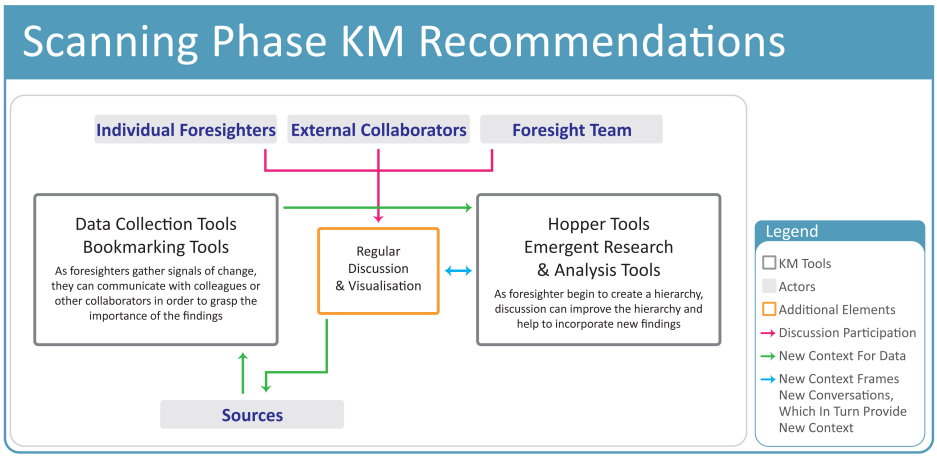

Figure 11. Discussions, facilitated by visualisation, and an adequate culture around database management and interactions protocols should greatly improve an organisation's capacity to transfer knowledge throughout its teams and projects.

4.3 Model Crafting

The model crafting phase, in some cases, can be seen as an extension of the previous Scanning phase. During this phase the results of the scan, or scan items, (weak signals, trends and drivers) are brought together in a form that creates narrative and relates to the larger question that is trying to be answered by the foresight engagement. The usual output of this phase is a map or understanding

of relationships between the important high-level elements of the system governing the possible outcomes for the problem question.

4.3.1 Model Crafting 'Process'

The process of model crafting begins informally during the collection, synthesis and analysis of the weak signals, trends and drivers. It is a natural and organic process of pattern recognition and organization that becomes increasingly concrete. According to our interviewees, this process is largely a cognitive exercise, and therefore is deeply personal and individualistic, prior to it taking form in a visual manifestation. The crafting of an agreed upon visual manifestation or framework however is a collaborative exercise not practiced by all foresight practitioners.

4.3.2 Model Crafting 'Tools'

The Model Crafting phase is a formalization of the collective sensemaking process. Sensemaking is the process by which people give meaning to something. For some this takes place as a form of sensemaking with sticky notes on a wall or themed groupings. For others this includes system mapping (or concept mapping) the relations between scan items. According to Olavarreita, Glenn & Gordon, 2014, a concept map is:

> A diagram that helps to organize ideas and their relationships in a graphic manner. [...] Futurists use it to package complex information into visual representations that communicate better than many words.
> (Olavarreita, Glenn & Gordon, 2014)

Some of the experts we spoke to use or know of automated or semi-automated scanning programs that incorporate a form of model crafting via the use of algorithms. This type of model crafting tool assists the foresight practitioner in crafting their personal mental model and can create physical representations of the system automatically (see emergent research and analysis tools in Appendix F).

Regardless of if the data is aggregated in a way that is automatic or not, digital or analogue, through icons or titles and texts, all the experts we interviewed expressed the importance of reviewing the model in order to ensure that it meets the needs of the client and the larger foresight process, which is attempting to answer the project's inquiry.

Mapping tools mentioned by interviewees: Domain Map, Affinity Map, Context Map, Concept Map/System Map, Pen & Paper (or stickies on a wall), Insight Maker, Google Docs Drawing (for more information on these tools refer to Appendix F).

Figure 12 demonstrates how Mapping tools play a central role in the foresight teams collective sensemaking efforts (as a subsection of the Model Building

phase). The individual foresighter uses the findings from the Scanning phase (Explicit Knowledge) to individually challenge and grow their mental model, or Tacit Knowledge (pink arrows). The foresighters then use Mapping tools to collaborate in creating an artefact (Explicit Knowledge) of their collective mental models (green arrows).

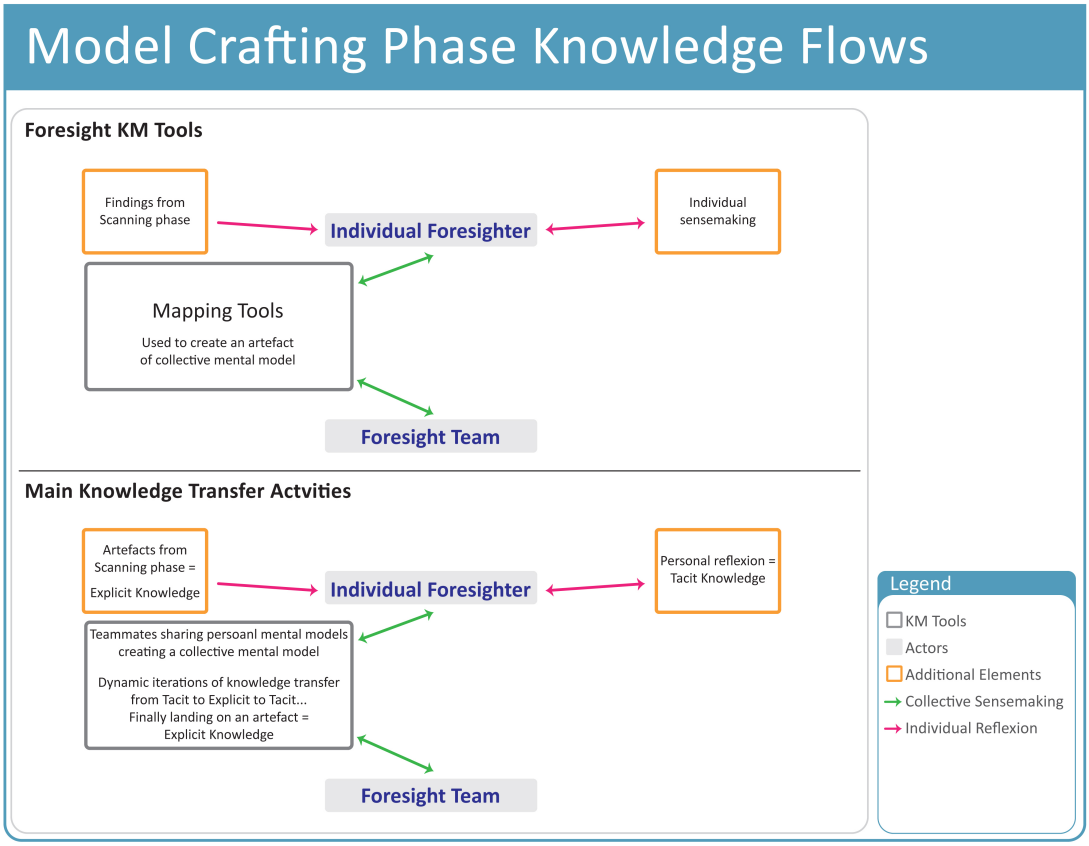

Figure 12. Representation of the knowledge transfer process as it relates to the tools used during the Model Crafting phase. Both individuals and the team use mapping tools to reflect upon and elaborate their mental model.

4.3.3 Model Crafting 'Insights'

There are a number of ways to visually represent the sum of the project's research, scan items and their relations or categories. Ultimately the goal of this phase is to use the information captured during the scan and to curate it specifically to the context of the foresight project.

Failure to properly express Tacit Knowledge (mental model) will slow down knowledge transfer between the team. With only a finite amount of time to come to a strategic conceptual interpretation of the project findings, any facilitation to knowledge transfer amongst team members may help in arriving at a better system model.

Interestingly, many of the experts openly admitted to the fact that much of the model crafting phase is about building individual mental models using the information gained through scanning and determining how to properly package it. The team needs then to achieve a certain amount of census or collective mental model in order to be in agreement as to the needed scenario logics for the Scenario Building phase. A visual representation of a shared model, ideally produced in a large format, allows the team to explore specific uncertainties and come to a consensus: an approximation or acceptable compromise of each of their personal mental models.

A model that is defined and understood by the team, with clear relationships and spheres or categories, is the ideal end result of this phase.

4.3.4 Model Crafting 'Recommendations'

The foresight team should properly record its journey of combining individual mental models into a collective artefact. The methods and challenges used to arrive at the final model might be of value to the same team or different teams in future projects. This journal would be of great value in improving the organisational memory on properly and efficiently talking the complex task of the Model Crafting phase. Here now are more phase specific recommendations on how to tackle the challenges of this phase.

Playing with the model

The project team is getting ready for the Scenario Building phase, which requires inductive reasoning, while the process so far was mostly done through deductive reasoning.

This transition requires a new approach to the notion of what is right or useful to the project. Interviewed experts mentioned notions of the expected future, plausibility and novel ideas. A foresight project highlighting future possibilities and creating scenarios which are considered *expected* are of little value to the foresighter and the client alike. The challenge is using the collected information to introduce to the client novel, plausible possibilities which will surprise the client while originating from a clear and credible chain of causality. The model created for the project will allow the team to play with various scan items,

pushing them into the future and communicating how other elements react. This tool will be used by the team to communicate to each other how they can envision trends playing out, and may be helpful as a communication tool with the client. Once the model is crafted, playing with the elements and exploring different paths should help arrive at these surprising and credible outcomes.

DIKW Tree

Once the model has been created, and before any needed deadline has arrived, the team can revisit past findings, going back down the DIKW tree, in order to test whether the proposed model accommodates all or most of the discovered and proposed concepts. Especially with longer projects, there may have been a large amount of ideas and findings visited prior to the Model Crafting phase and the team can reserve some time to make sure nothing has been overlooked or forgotten, and as a result loosing knowledge.

The model is also a great collaborative tool that may facilitate discussions with experts, the client or other collaborators.

Figure 13 tracks the knowledge transfer between stakeholders as they *play* with draft models in order to guide them in their process of improving their understanding of the project findings. The findings inform the individual foresighter's mental models (pink arrow). Using the latest draft version of the model, the foresight team *plays* or experiments with new interpretations or

ideas (grey arrows), in order to: guide further exploration of the findings (blue arrows), test whether the model will generate desired content (green arrows) and engage with external collaborators (purple arrows). Each of these activities will push the team to revisit and improve upon the model artefact.

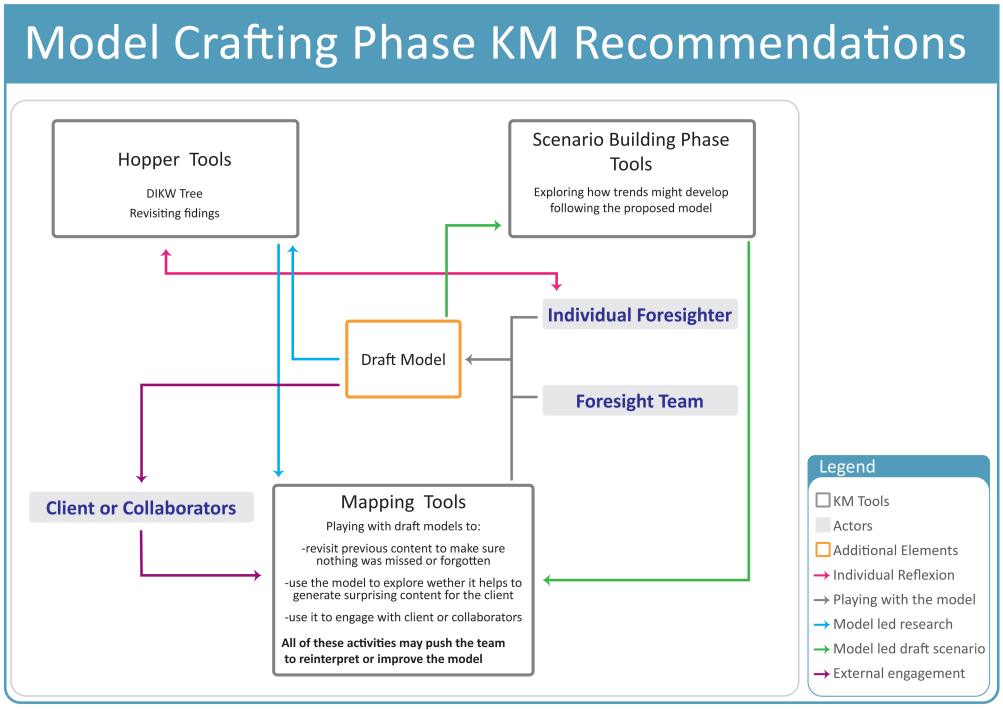

Figure 13. Building early drafts or working models allows a team to identify where they have consensus. This model can then be used as a guide to revisit the findings, explore early ideas about scenarios or engage with the client. The model artefact (Explicit Knowledge) facilitates coordinated efforts to improve team members' individual mental models (Tacit Knowledge), which can then be leveraged to improve on the model.

4.4 Scenarios Building

In this phase of the foresight process, practitioners create narratives or stories that bring the gained knowledge to life, in an attempt to guide and shift the thinking of the client. These narratives are based on the systems identified and created during the model crafting phase, and are supported by the weak signals and trends of the scanning phase. Essentially, the scenario phase is an articulation of the possible future worlds that emerged from the data. Other formats may present the scenarios in other descriptive text or list of properties of the state of the future.

Despite the attention given to it in Schwartz's *The Art of The Long View*, the scenarios phase was the least used phase by our participants. It was noted by multiple interviewees that some projects do not require the narrative support that the scenario building phase provides in order to identify implications and fashion strategy.

4.4.1 Scenarios Building '**Process**'

The scenarios themselves are crafted using a number of specific tools that give structure to the building of the narratives. Generally a Scenario Method is chosen which will prescribe a set amount of scenarios (for example the 2X2 method implies four scenarios for the project). Many of these Scenario Methods will also prescribe general scenario logics (for example the Scenario Archetypes method usually has a progressive, a decline, a muddling through and a

transformation scenario). Beyond these general scenario logics, the foresight team may wish to elaborate more detailed scenario logics for each of the scenarios which are then used to guide the scenario writing process.

4.4.2 Scenarios Building 'Tools'

Narrative Tools

These tools help the foresight team explore their findings through narrative arcs or with the lens of an individual's perspective. Since this phase requires a creative approach and inductive reasoning, narrative tools help transform findings and logic causal chains into story arcs.

Narrative tools mentioned by interviewees: Guided Imaging, Futuretelling, Vignette (for more information on these tools refer to Appendix F).

Causal Chain Scenario Tools

In order to determine how much change might occur during the chosen time horizon some foresight practitioners use time intervals as a means to map how a trend might play out. Another use for these tools is considering second, third, fourth, etc., order consequences. Visiting a world where a possible outcome has been realized can then present new outcomes either to the newly changed element or to other elements, which may be impacted by the change. The idea

of cross-impacting, where two possible changes are held to have happened in order to visit compound change of their intersection, is a method that can be applied to any of the causal chain tools.

Causal chain scenario tools mentioned by interviewees: Progression Curve, Futures Wheel, Back Casting, Janus Cones, Influence Diagram (for more information on these tools refer to Appendix F).

Scenario Methods

These are specific ways of determining how many scenarios to write and which overarching tone or logic to give them. Interviewees mentioned the 2X2 matrix (or Two Axis) and the Archetypal scenarios methods as the most popular. With different scenario logics, each scenario will then need to be elaborated in detail. Filling out a Scenario Matrix can be a useful step before attempting to write the scenario in length.

Scenario methods mentioned by interviewees: 2X2 or 2 Axes, Scenario Archetypes, 3 Horizons, Cone of Plausibility, Branch Analysis, Scenario Matrix (for more information on these tools refer to Appendix F).

Figure 14 illustrates the relation between the two types of tools. The foresight team, which may or may not include the scenario writing team, use Causal Chain Scenario tools and Scenario Methods to develop scenario logics for the scenarios

of the project (pink arrows). The scenario writing team then uses the scenario logic and the Narrative tools to write the scenarios (green arrows).

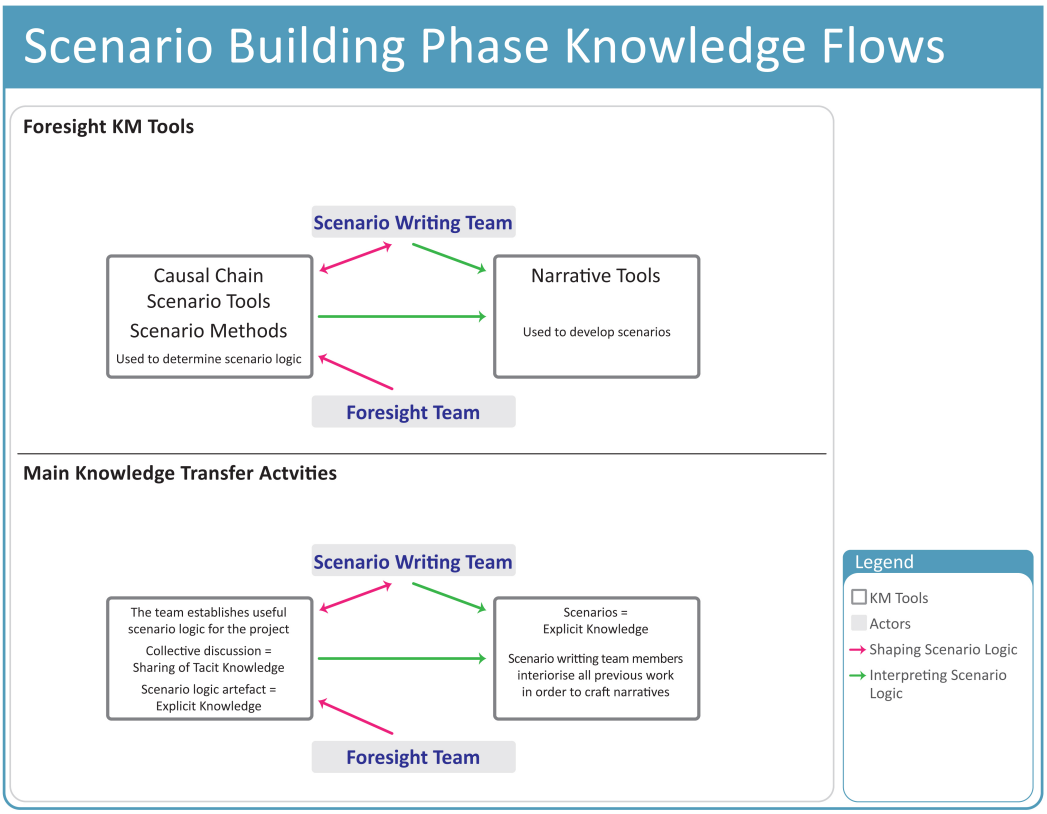

Figure 14. Representation of the knowledge transfer process as it relates to the tools used during the Scenario Building phase. The foresight team members transfer their Tacit Knowledge into the scenario logic which then guides the writing process. The written scenario may then be revisited by the foresight team for editing.

4.4.3 Scenarios Building 'Insights'

The main goal of the scenarios is to properly frame the findings of the project in a fashion that will facilitate knowledge transfer with the client. Scenarios bring many diverse findings and present them in narrative form in order to properly

contextualise the information. They present new ideas about the future and make them more readily accessible to the reader. Scenarios also suggest how certain new ideas might have broad ripple effects across different domains. Some interviewees mentioned reservations about the use of scenarios. While they may not be entirely essential to the foresight process, they are commonly used throughout the practice. All of our interviewees mentioned the use of scenarios.

The scenario writing team is tasked with a creative process, which must be inspired by and properly represent the findings from the project thus far. The scenario logic will allow the foresight team to arrive at a consensus around the important elements which should be incorporated in the scenarios. Failure to elaborate adequate scenario logic could result in:

1. Missed opportunity:
    a. To have the foresight team systematically explore the most strategically useful narratives and scenario outcomes.
    b. To have all team members share their ideas (or vignettes) which could see potentially useful ideas gone unexplored or considered by the group.

2. Lost time as the scenario writing team may write scenarios which are then rejected by the foresight team.
3. Elaboration of scenarios with content irrelevant to the client.

As mentioned earlier, and touched on throughout our interviews, scenario writing is considered more of an art than a science, often requiring an individual or a couple of individuals to craft the scenarios using the project findings. Therefore it generally falls on the shoulders of a few to ensure that the narrative given by the scenarios is one that will resonate with the client, while simultaneously challenging the client. This is a balance between wild ideas, that may draw dismissal, and benign ideas, that may leave no impact. Understandably this can be challenging, a fact that was expressed during our interviews as participants noted the importance in striking this balance.

4.4.4 Scenarios Building '**Recommendations**'

Management must appreciate the opportunity that lies in the work generated during this phase. As individuals on the scenario writing team attempt to produce the right product for the client they may write or craft a lot of eventually unused material. The team must be given the time and permission to explore and create products which may not benefit the project at hand. Developing a large repertoire of Vignettes will allow the organisation to explore styles and content efficiently. An organisational culture which prizes the creation

and revisiting of these types of content will improve its ability to grow and remember content with its organisational memory.

It was mentioned during the interviews that some of the scenarios work may seem credible among those who helped write the material while seemingly impossible to those who did not participate in the scenario building process. The challenge of scenario writing is sharing enough information about the weak signals, trends and drivers for the reader to accept the statements about the surprising and plausible future of the scenario. This must be achieved while keeping the scenario short and engaging. The scenario is a tool for inciting further engagement between the foresight team and the client. Surprising opportunities and challenges, of various levels of plausibility, can be presented.

High Impact low likelihood

High impact high likelihood events are unlikely to surprise the client. Low impact outcomes are of minimum interest to the client however likely they may be. Low likelihood events, representing significant strategic disruptive change, will surprise the client and inform them of opportunities or challenges they had not yet considered.

Table 4. Creating scenarios that engage the client is a result of the combination of the level of impact and the likelihood of the events within the scenario.

		Likelihood of Scenario Events Occurring	
		Low	**High**
Impact	**Low**	uninteresting	insignificant
	High	Novel and thought provoking	unsurprising

When presented with a large amount of information to share with the client, the scenarios can be written to highlight the most novel and thought provoking ideas.

Revisiting weak signals, trends and drivers in order to craft story arcs around the high impact low probability findings may be a good approach, leveraging a strong database to deliver the right amount of information. Enough to make scenarios that are logical, plausible and comprehensive without being too long as become difficult to comprehend.

Vignettes

While scenarios attempt to describe the world in the future, Vignettes are mini scenarios or slices of a scenario that are easily developed on their own. Vignettes may be a useful tool alongside scenarios. The creation of Vignettes may be an easy first step in the scenario writing process and might have already been

created in earlier phases. During discussions people often speak with specific examples before being able to articulate abstract ideas. These examples can be used as manifestations of the underlying concepts behind weak signals, trends and drivers. Vignettes might also be used alongside scenarios as another deliverable, capturing some ideas that did not fit into the scenarios.

Figure 15 displays how Vignettes can facilitate knowledge transfer throughout the Scenario writing phase. First the team may use Vignettes from previous phases or from past projects, along with the rest of the findings of the project, to inform their scenario logic (pink arrows). The preliminary scenario logic, along with the findings and vignettes, are then used by the scenario writing team to compose initial scenario narratives (blue arrows). During the scenario writing process, Vignettes may be crafted as a bridging tool or for communication with the foresight team which may decide to improve upon the scenario logic (purple arrows.). Finally, Vignettes may be developed into a deliverable for the client as a useful communication tool (green arrows).

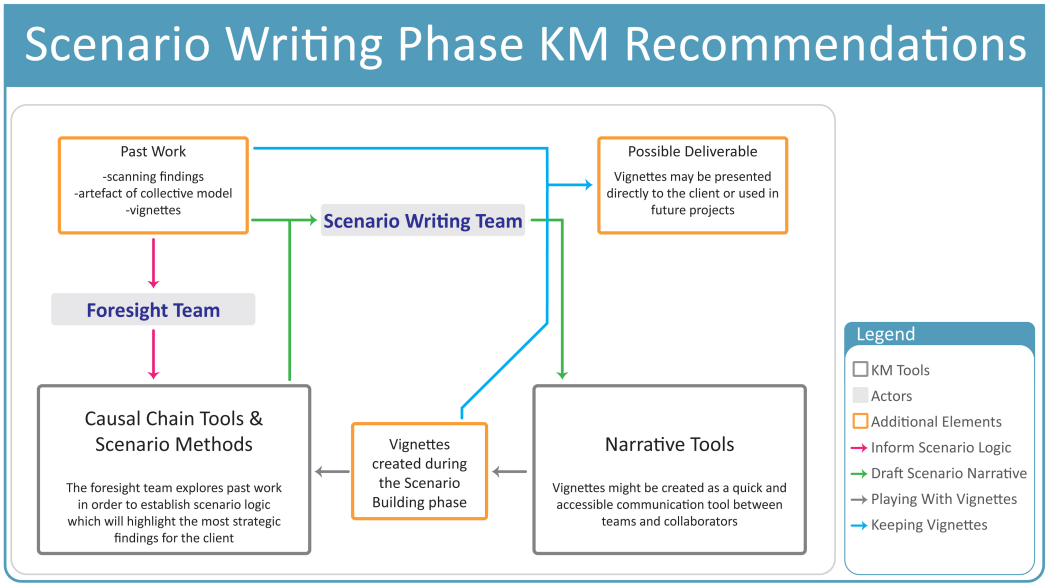

Figure 15. Past work informs the foresight team as to what scenario logic will present the most surprising ideas. From these decisions the scenario logic is crafted which will guide the scenario writing process. Vignettes are used to explore possible scenarios during the scenario logic framing exercises, to enhance the scenarios during scenario writing and as a stand-alone deliverable.

4.5 Identifying Implications

The identifying implications phase brings together all the previous work into a final “so what”. It provides the actions and reactions that would be recommended based on the possible futures presented through the scenarios and scan. While we identified many possible activities for this phase they all included identifying important information for the client and communicating the gained insight. This is the phase in which strategies are built in response to the scan items and the scenarios, and the insights from the foresight engagement are made actionable. For some the foresight process did not include design

interventions while for others the opinion seemed to be that foresight was ineffective if there were to be no action elaborated from the work.

4.5.1 Identifying Implications 'Process'

According to our interviews, the process for the identifying implications phase is not as structured as some of the other phases of the strategic foresight process. During this phase, practitioners and teams use the scenarios to recognize and distinguish the implications of the worlds created on the area of study. These implications are placed under the lens of the entire project and the objective of the project, giving the team the plausible actions and reactions that would occur should the futures occur. From the implications, strategies and or policies are then devised in order to take advantage of the gained knowledge.

4.5.2 Identifying Implications 'Tools'

Visioning Tools

While many of these tools are devised as foresight processes in and of themselves, the added difference is the consideration or searching for the client's preferred future. During a visioning exercise the foresighter helps their client imagine an ideal outcome from the scanning material. From this vision a strategy can then be developed in order to realize or create this preferred future.

Visioning tools mentioned by interviewees: QUEST, Future Search, Appreciative Inquiry, Manoa Method, Boulding/Ziegler Method (for more information on these tools refer to Appendix F).

Implication & Strategy Tools

Our interviewed experts did not mention many specific foresight tools for uncovering implications or strategies (with the exception of wind tunnelling and workshopping). These activities are a return to deductive reasoning, looking at the created scenarios and drawing out a list of implications. From the implications, design and innovation tools could be used to devise possible strategies. Launching a continuous monitoring effort is a foresight strategy that allows the client to keep eyes and ears open for signs of either possible opportunities or threats that may be awaiting them later in the future.

Implication and strategy tools mentioned by interviewees: Continuous Monitoring, Wind Tunneling (for more information on these tools refer to Appendix F).

Communication Tools

These tools are used to transfer the entirety of gained insight to the client. Effectively using these tools allows the foresight practitioner to engage the client in the foresight work. Well communicated work will convey urgency, a hierarchy of importance, relevance and disarm sceptics. Strong and sound foresight work

that is poorly communicated may fail to deliver its potential impact.

Communication tools mentioned by interviewees: Adobe InDesign, Microsoft Powerpoint, Sign Posting, Experiential Futures (for more information on these tools refer to Appendix F).

Figure 16 demonstrates the role of the KM tools for the Identifying Implications phase. Either on their own or with the client, the foresight team identifies relevant findings from the foresight work in order to develop strategic implications (pink arrows). The foresight team must reference business and innovation concepts (Explicit Knowledge) as well as theirs and their client's knowledge about the client organisation (Tacit and Embedded Knowledge). The foresight team then shares its gathered Tacit Knowledge from the whole project via communication tools (Explicit Knowledge) to the client (green arrows).

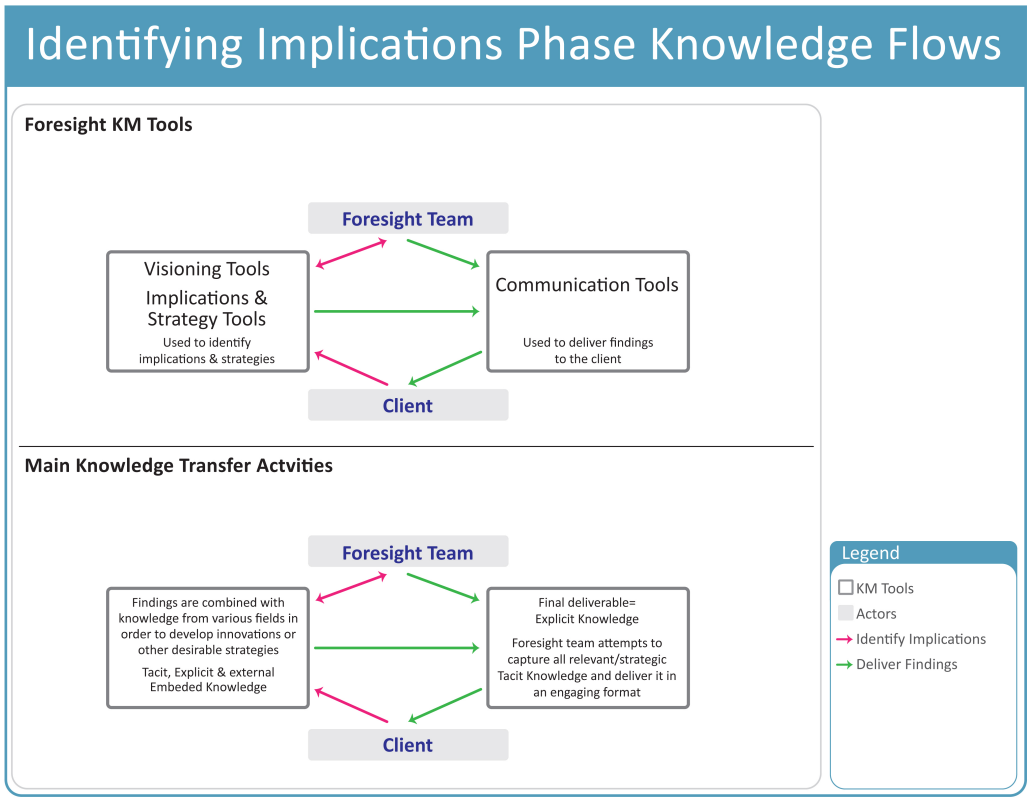

Figure 16. Representation of the knowledge transfer process as it relates to the tools used during the Identifying Implications phase. The foresight team must make the foresight work relevant to the client and deliver the insight in a powerful and engaging manner.

4.5.3 Identifying Implications 'Insights'

A major insight for the identifying implications phase is the importance of communicating and visualizing the final outcome of the scan and scenarios. As this phase of the foresight process is often the ultimate goal of the engagement, it is vital that practitioners deliver the material in a way that stimulates the client, and allows them to gain the knowledge in a way that is both easy and

clear. This is especially true since the foresight process is complex, ambiguous, and is likely incorporating an individual's personal mental model, which can be a lot of data to relay. The findings can be presented in such a way as to hook the client's attention with the reader's journey of discovery through the content in mind.

Implications may be presented in the form of opportunities, threats, policy challenges, challenged assumptions, or any other form of high-level takeaway for the client. Unlike the scenario, which should engage the client and demonstrate how the scan items could play out in a specific manner, the implications can be broad statements about the surprises the project has uncovered. That being noted, implications give way to strategies, which can be actionable and specific. The greatest challenge of this phase is that the hand off point is a strangle point for information. While there was a vast amount of data, information and knowledge transferred into the deliverable artefact, it is now up to the client to properly unpack and decipher the locked insights in order to gain wisdom from the work. This may be a challenge only achievable by the client but the futurist must attempt to facilitate the task.

Failure to identify relevant implications or to properly communicate the findings could result in:

1. Delivering implications which are not suitable to the client: not relevant, un-implementable, already known.
2. Having the findings fall on deaf ears

4.5.4 Identifying Implications 'Recommendations'

Foresight organisations will want to integrate the findings of the project into a broader, continuous internal conversation about important changes and advancements in the world and their possible effects on the future. The organisational memory of the organisation should be developed to provide content for this conversation. Client's invited or offered to have their questions about the future further explored or monitored may offer as much to the conversation as they take away from the insight uncovered.

Learn or hire

With this in mind, it is imperative that foresight practitioners either gain the skills themselves or create partnerships that will allow them to effectively communicate their findings and implications. Graphic design, creative writing, theatrics etc., foresight practitioners can consider using multiple forms of communication. This may be best achieved by collaborating with professionals from other fields.

Just the beginning of a conversation

While the client may have requested a report as a deliverable, the research and foresight work will have created rich content within the mind of each team member of the foresight project. One interviewee made the point that an ideal deliverable is a collaborative workshop once the initial findings have been presented by the foresight team and digested by the client. The workshop would allow the client to engage with the content, ask questions, put forth new ideas and receive feedback. Through the conversation the client could receive further explanation if they misunderstood concepts from foresight report. The conversation may also surface new ideas or vignettes from the foresight team.

Design and innovation

Visioning and strategy development were included as an integral part of the foresight process by some of our interviewees but not all. It seems clear that some practice foresight as an exercise apart from the design and innovation process while others see foresight as an integral activity within these fields. This is a distinction that can clearly be articulated in the Project Framing phase. An interesting question we might have wanted to explore with our interviewees is the differences in Knowledge Management for these two types of foresight approaches.

Figure 17 maps how continued collaboration can enhance the knowledge transfer process between the foresight team and the client. An initial deliverable is presented to the client, prepared with the help of collaborators (pink arrows). The deliverable guides the foresight team and the client in identifying implications and/or a strategy in a continued discussion (green arrows). As part of the developed strategy, a continuous monitoring initiative is developed to continue guiding the client in their next steps (blue arrow).

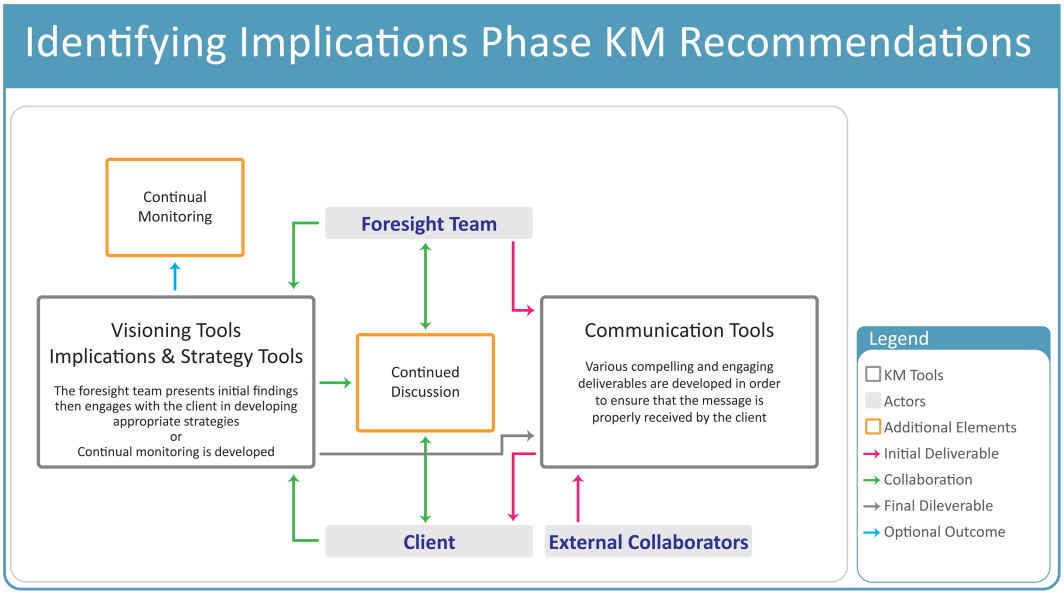

Figure 17. The foresight team may collaborate with experts in communication and product delivery in order to deliver their findings via a powerful medium. The foresight team might also collaborate with the client in developing the implications. The agreed upon deliverables might then be used as a stepping off point for further collaboration.

4.6 Overview of Micro-Recommendations

Here is a compilation (Table 5) of the main KM challenges and opportunities throughout the five phases. It should be noted, that all recommendation provided are by the authors and are targeted towards strategic foresight practitioners in attempt to help them better their practice and discipline.

Table 5. Overview the main KM challenges and opportunities.

4.6.1 Opportunities For The Future

From our map and from Table 5 it has become apparent there are particular moments within the strategic foresight process where there is opportunity for the development of knowledge management tools. This is especially true for the Model Crafting phase, where emergent tools offer the possibility of leveraging crowdsourcing and AI. While these new tools may perhaps be the most difficult to learn and integrate in existing practices, they also hold large promise for potential benefits. Considering the increasing technical ability of computer programs, combined with the plethora of data now freely available online, we propose that it is only a matter of time before these practices become widely used.

5.0 MACRO-RECOMMENDATIONS

From our interviews with our experts we were able to describe and define the entire foresight process, and the knowledge management practices and tools that accompany it. Through this, we have assembled three high level recommendations that we put forward to assist other foresight practitioners in their practice. These three are intended to compliment the recommendations given at the end of each phase description above in the Findings section.

5.1 Bridges from Digital to Analogue and Back

Foresight organisations need to develop a cooperate culture around how its employees move content between digital and analogue formats. Strict and clear protocols will create uniformity throughout databases, improving accessibility of the content and facilitating collaboration within the organisation as well as with external collaborators.

There are many digital tools available for foresight practitioners. Powerful search algorithms like the Google search engine, cloud based collaborative creation applications like Mind42.com and Artificial Intelligence programmed to execute scanning tasks (one example of AI scanning services being Shaping Tomorrow) as well as report-like curation of information. Foresight practitioners can continually be familiarizing themselves with the capabilities of new digital tools.

One challenge for foresight organisations is choosing which services to choose and determining the right time to migrate to a new platform. New platforms may offer increased capabilities but might require the manual transfer of the existing data from its scanning database into a new format. Whatever the digital tools the organisation chooses, most interviewed experts we spoke with expressed their use of analogue tools (Sticky notes, chalk boards, white boards and walls covered in dry-erase marker). These tools are likely to remain useful as they allow participants to play with their environment and arrange their work on a scale that is not restricted by their screen size but more in tune with their field of vision. It is for this reason that a good foresight space should be equipped with a dedicated space or movable walls.

A good practice might be to properly work with tools both digital and analogue. A foresight organisation can then develop work efficiencies around this goal. The digital tool, used to properly sort and catalogue the large amount of weak signals, trends and drivers, can facilitate the conversion of these digital artefacts into physical artefacts. This might involve the careful planning of how the digital files will be printed, often requiring a function that allows the team to print off condensed versions of the digital files. A best case scenario would have a database management tool that allowed for quick printing commands of selected sets of weak signals, trends and drivers determined either by project, tag, keyword or any other practical grouping. The print command might also

offer different print sizes with various choices for selecting which information to print. A weak signal on a digital database can include a hyperlink to the original source, however this information becomes less valuable when placing the artefact on a wall for a collaborative activity.

An organisation can also establish best practices when converting work done by pen and paper into digital format. How it is to be captured can depend on how it will be used in the future while keeping in mind possible use for the work beyond the current project. A strong organisational culture on tagging, naming, filing and linking new digital items can greatly increase the value of the database created throughout several projects. The value of the database is not only in the quality of the individual scanning items but in the accessibility of the items. Linking items would then be of great value in order to allow users to easily navigate past work. Organizing weak signals along trends and finally articulating the trends relations to drivers would allow navigation through the database via tree like structures of links. The ability to navigate the database both through trees of links (linear logic) as well as keyword or tag searches (random or inspired search) would increase the usefulness of the database (see Figure 18). These two different manners of archival connectivity would better mimic the various mental models of those who originally shared the information and those who will subsequently traverse the database in search of relevant findings for the new project.

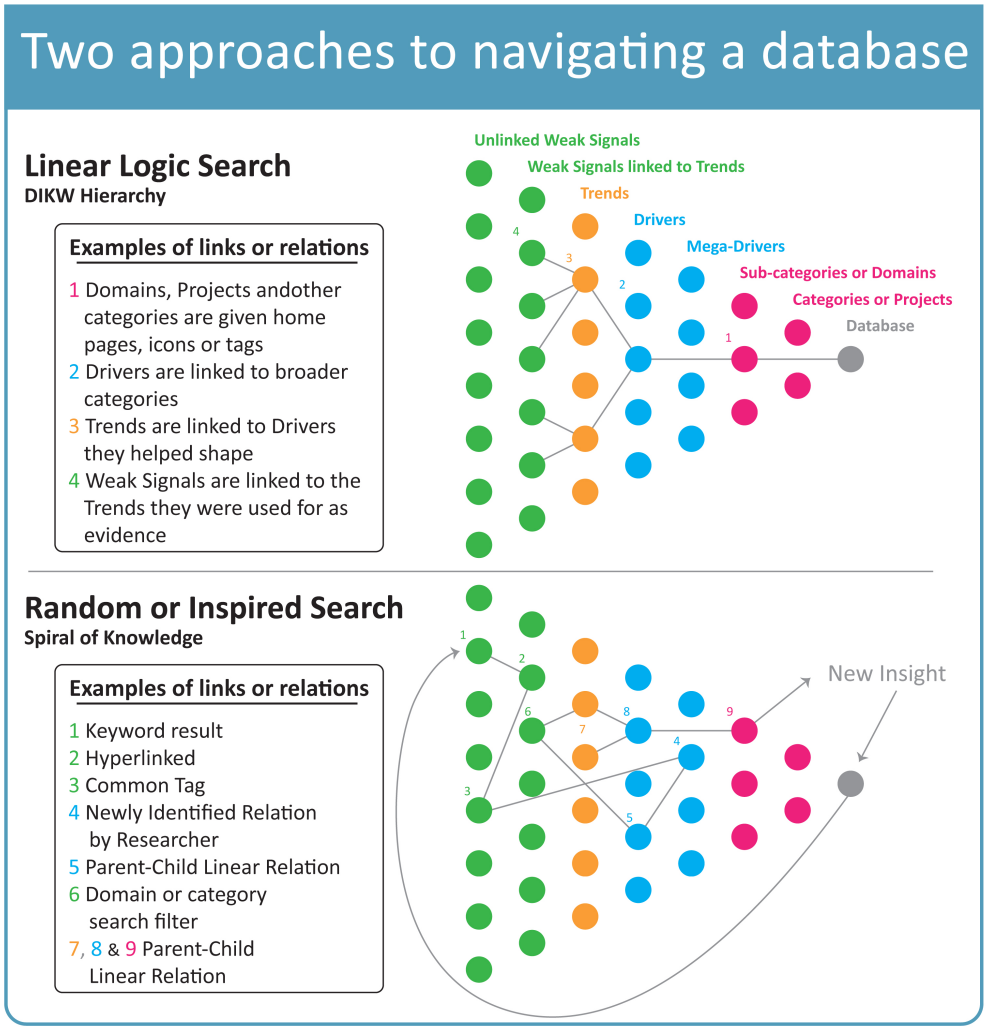

Figure 18. Overview of the Spiral of Knowledge (new insights both emerge from and guide research initiatives) and Linear DIKW knowledge sharing methods at work within a database. Categories, Domains, Drivers, Trends and Weak Signals should be interconnected in more than one manner as to accommodate various modes of pattern recognition and trains of thought.

5.2 Goals in Parallel

Foresight organisations must develop a protocol for storing important findings and periodically revisiting findings. This activity must fall outside the scope of projects, reserving man hours to consider the totality of collected findings and attempting to create a mental model artefact based on the organisational memory. The artefact may take the form of revisiting the way the databases are organised, reframing findings from past projects or keeping a list of the most important findings at the time according to the organisation.

A database is a useful knowledge management tool for conserving past insight and sharing it with forgetful staff from project to project or to new staff. Projects inherently must have limitations to their scope of research and desired client centred final message. Many of the experts interviewed mentioned managing findings that fell beyond the scope of their project.

Determining how team members are to manage their time around this issue is crucial. The team cannot be overly side tracked from the current project in this endeavour but can know precisely how and where to park insightful findings. During the various phases of the foresight project, the team can transfer these gained insights to an artefact of explicit knowledge as the article may be addressed at a time when the team member who originally found the information might have forgotten the context and value of the information. By

developing a quick and efficient process for transferring found insight into Explicit Knowledge the organisation capitalises on an opportunity that might have otherwise been lost had the information gone unrecorded. The organisation must also develop a practice of setting aside time and a team to revisit the artefacts of information. The team would explore the potential connections to concepts in the team's mental models and in existing artefacts of wisdom (e.g. drivers or concepts introduced in previous reports) within the organisation's database. Once the content is explored, it could be properly tagged and linked within the database.

Time could also be reserved for the team to interact with this new content, along with past content with the goal of either updating individual mental models of the world, trends and potential future outcomes, or producing a product that would reflect these gained insights in a summative manner. Many organisations produce a yearly report as a means to articulate to potential clients their capabilities and acquired perspective. The act of producing one such report is also a great opportunity for the team to share knowledge and reflect on the sum of past work in order to refine the acquired wisdom from database.

5.3 The Continuous Evolution of our World Model

Foresight organisations need to develop an organisational culture which promotes informal and formal activities which will allow individual foresighters to share and explore their personal mental models. These activities are needed regularly and throughout all phases as well as outside specific project cycles.

During this project we have come to look at the various phases of a foresight project in a new light. Many interviewees mentioned the *messy* attribute of a foresight process. They mentioned that each project was approached differently and that if there were any phases, they were not always done in the same order of phases we have outline here. Others mentioned they would at times be in two or more phases at once and might return to a past phase if they felt the project or research needed such a path.

What seemed to ring true was that the foresight methodology often seems to arrive at a point where it is 'more of an art than a science'. Scenarios require a creative leap, implications are drawn out from supposed outcomes from past events, and as a result the practitioners toggle back and forth between inductive and deductive reasoning. However rigorous the research process of a foresight team and no matter the amount of experts called on to the project, there remains a point at which the work requires inductive reasoning.

The mental model of the foresight practitioner, or whomever is eventually tasked with writing the creative elements of the final product, is at the heart of the process. It is with his/her mental model that the foresight practitioner will craft the creative elements of the project, the scenario and implications. The scanning phase is directed by the mental model, which then challenges and changes the model of the practitioner. The model crafting phase attempts to create a collective mental model. The artefacts created by the team during this phase is an approximation and compilation of the mental models of all those who contributed to the process. The artefacts of this phase help guide the members tasked with writing the creative elements of the next two phases. Since mental models are continually changing, the static artefacts of the model crafting inform those writing the creative elements of the buy-in they can expect from their work by the rest of their team and collaborators. The creative authors then share their work with their collaborators for approval and iterative editing. To best foster this transfer of knowledge we recommend that foresight practitioners actively engage communication tools that assist others' understanding of the mental model they themselves have created. This could include system maps, infographics or other forms of visual representation. This aids the comprehension of the knowledge across all the stakeholders, decreasing effort needed for uptake and adoption, thereby increasing likelihood of utilization.

6.0 CONCLUSION

Efficient and effective knowledge management throughout the strategic foresight process is an essential element of a successful strategic foresight engagement. All phases of the strategic foresight process are knowledge dependent. In essence, strategic foresight is a process for managing and manipulating knowledge. Despite this, we were unable to uncover substantial evidence of previous studies into how knowledge is managed throughout the strategic foresight process. Identifying this knowledge gap, we set out to shed light on how knowledge management is being conducted by foresight practitioners, including the tools, software, methods and techniques they use, and how knowledge management theory applies to the overall strategic foresight process.

We began our study by reviewing the relevant literature, gaining a solid foundation of comprehension on our two primary topics of study; knowledge management and strategic foresight. This was used to construct and execute 15 expert interviews with a variety of foresight practitioners from a variety of foresighting organizations. The data from these interviews informed us how practitioners are applying knowledge management into strategic foresight. This allowed us to define the phases of the strategic foresight process, and their complimentary knowledge management tools. The participants for our study articulated how the knowledge management tools they use allow them to

complete the strategic foresight process. By identifying the tools that aid practitioners in completing this task, and by identifying the knowledge management theory that helps define the strategic foresight process we have created a process map showing how these tools align within the process. Based upon this we have developed nine micro-recommendations for each specific phase of the strategic foresight process, which allowed us to identify areas of opportunity for future knowledge management tool development. The primary phase of opportunity for KM tool development was the Model Crafting phase. As well, we have developed three macro-recommendations towards knowledge management for the entire process. Briefly, these are the importance of using both digital and analogue methods, managing goals of foresight projects, and the importance of building and communicating models.

6.1 Next Steps

For the authors of this paper, our next steps include applying the learnings presented here into our professional lives as foresight practitioners. This includes applying the insights and micro-recommendations before and after each phase of a foresight project internally within the organizations at which we are currently employed. At the time of writing, Martin Berry has already begun to implement the insights and recommendations presented here into his real-world, day-to-day operations within Policy Horizons Canada. However Martin and Dustin plan to go beyond solely this publication. Seeing as this publication

may be hard for most to digest as it is lengthy and goes beyond what might be interesting to those that only wish to get a surface level amount of information, the authors plan to create a shortened document that highlights the key take-aways and promptly puts the process map directly at the centre of the work. A couple of the interviewed experts have already expressed interest in such a document. A format like this would make the material more digestible, shareable, and allow for a broader audience to engage with our material.

For others, our study provides the foundation for the development of a strategic foresight tool that will help to formalize the strategic foresight process. By using our research to develop future tools and formalize the strategic foresight process, we are contributing to overall advancement of the strategic foresight discipline.

6.2 Future Research

Although we believe we have presented a valuable addition to the foresight knowledge base that will assist foresight practitioners in bettering their practice, we have three main suggestions for further research and next steps. First, we would recommend that further research be completed to get the perspective of the strategic foresight process from that of corporate foresighters. As mentioned previously, we were unable to contact individuals categorized as such, but think that they would add valuable perspective on knowledge management within the

foresight process into the analysis. In addition to providing more information into knowledge management practices, corporate foresighters may provide a divergent strategic foresight process. A challenge that we encountered with recruitment for interviews that may be directly applicable to corporate foresighters is the fact that for many the foresight process is part of proprietary information, and may not want to be shared. We would recommend future researchers ensure that they conduct their study in a manner that protects the individual's proprietary process.

Second, we would recommend that future research take our work a step further and use our identified areas of opportunity to create additional tools that would aid knowledge management within the strategic foresight process. We imagine that such an endeavour would be a large project on its own, but could foresee an outcome that may have commercial viability.

Finally, we would recommend expanding our study to include more participants. Considering our resource constraints, we reached out to achieve as many interviews that was possible, however we were still left with the desire to obtain more information. This is partially due to the fact that from our 15 interviews we encountered some foresight process and knowledge management practices that were similar, as well as some that were outliers. By obtaining more data and completing more interviews we would be able to identify it the outliers are one-offs or if they are more common than we were able to identify. An interesting,

but dissimilar study would be to examine all the variations on the foresight process, identifying their similarities and differences. For this, our study would be a good starting point as on our process map one can see the foresight process as an aggregate of many individual experts' descriptions.

Regardless of other researchers using our study to ignite a new study, it is our hope that the research we have presented here will act as the foundation for future practitioners to better their own practices and develop KM tools that will further the strategic foresight discipline.

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8.0 APPENDIX

APPENDIX A - Expert Interview Guide

Semi-Structured Interview Guideline

Approximate interview time: 45 minutes
This interview guideline is intended to act as a loose frame of reference for our expert interview process.

INTERVIEW

These questions will act as a guide for our discussion with the foresight experts. We do not intend to ask each question in a rigorous manner, but to have an open conversation with each participant, using the questions as launching pads for discussion.

01/ BACKGROUND

1.1 Give a brief background of yourself in relation to the foresight field, i.e. how long you have been practicing, your position/organisation, formal education, etc.

1.2 Describe your personal view on what is foresight and what is its value.

1.3.Describe the foresight activities in your organisation, why foresight is used and how foresight might be part of a larger process of activity.

1.4 What type of deliverables/products do they produce.

02/ PROCESS

2.1 Describe the foresight process that is used by the practitioner or organisation.

2.2 Where/when/how was this process developed.

2.3 What sources inspired the development of this specific process

2.4 What unique modifications additions were developed in house

2.5 What are the sections or phases of the process
For each section
- What are the main activities during this phase?
- What are the names of various methods or elements to this phase?
- Who is involved?
- What is the role of client in this phase?
- How are the tasks divided?
- What tools are used?
- ...for recording, for research, for facilitation, for engagement, for strategic conversations
- How much time is usually attributed to this phase?

How is coordination managed?
How many times has the practitioner done this method?
Speak of different iterations and changes in the method?
What is the deliverable of this phase?

General sections of the foresight process:
Scanning
Sense-making
Insight development

03/ TOOLS

3.1 During your foresight process, what tools do you use to collect, manage, and record your data?
- Describe these tools
- How are they used

3.2 What are some of the advantages and disadvantages of these tools.

3.3 Have you heard of or used yourself any other knowledge management tools?

04/ OUTRODUCTION

4.1 Do you recommend we speak to any other people or organizations for our study?

4.2 Thank you.

APPENDIX B - Consent Form

Invitation / Consent Form

Date: **Aug. 20, 2014**
Project Title: **A Survey of The Knowledge Management Practice Within The Strategic Foresight Process**

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INVITATION
You are invited to participate in a study that involves research. The purpose of this study is to use semi-structured interviews with strategic foresight practitioners to create a survey of the methods being applied for knowledge management within the foresight process. In doing this we have contributed to the general knowledge of strategic foresight, while shedding light on the knowledge management practices being used.

WHAT'S INVOLVED
As a participant, you will be asked to have a guided and recorded conversation with one of the principal investigators discussing the knowledge management practices you apply to your strategic foresight process.
Participation will take approximately 1 hour of your time.

POTENTIAL BENEFITS AND RISKS
Possible benefits of participation include aiding the understanding of knowledge management within the strategic foresight process.

Possible risk for the participants of this study include potential concerns that sharing information on their unique methodologies may reduce their organisation's competitive advantage. You will therefore be given the opportunity to review your contributions to our research before it is included in our conclusions.

Please note that you also have the opportunity to confidentially withdraw or decline at anytime.

CONFIDENTIALITY
The information you provide will be kept confidential, i.e. your name will not appear in any thesis or report resulting from this study. However, with your permission attributed quotations may be used. With your permission you will be mentioned as a foresight expert participating in the interviews.

Data collected during this study will be stored on a secure personal hard drive by the principal investigators. Data will be kept until the final defense of the major research paper in January 2015, after which time all data will be deleted. Access to this data will be restricted to principal investigators Dustin Johnston-Jewell and Martin Berry, and their faculty advisor Suzanne Stein.

VOLUNTARY PARTICIPATION
Participation in this study is voluntary. If you wish, you may decline to answer any questions or participate in any component of the study. Further, you may decide to withdraw from this study at any time, or to request withdrawal of your data (prior to data analysis, December 2014).

PUBLICATION OF RESULTS
Results of this study may be published in reports, professional and scholarly journals, students theses, and/or presentations to conferences and colloquia. In any publication, data will be presented in aggregate forms. Quotations from interviews or surveys will not be attributed to you without your permission.

We will provide a copy of the draft research paper for your consideration and the consideration of your organisation. Upon receiving this draft copy, you will again have the opportunity to withdraw your contribution or request that changes be made regarding your contributions.

Feedback about this study will be available upon its completion and defense in January 2015. Any feedback information can be retrieved from the principal investigators.

CONTACT INFORMATION AND ETHICS CLEARANCE
If you have any questions about this study or require further information, please contact the Principal Investigators (Dustin Johnston-Jewell, and/or Martin Berry) or the Faculty Supervisor (Suzanne Stein) using the contact information

provided above. This study has been reviewed and received ethics clearance through the Research Ethics Board at OCAD University [approval # 2014-43]. If you have any comments or concerns, please contact the Research Ethics Office through jburns@ocadu.ca.

FULL DISCLOSURE

The principal investigators are completing this research in completion of the Master of Design in Strategic Foresight and Innovation program at OCADU in Toronto, Ontario Canada. Both principal investigators are practicing strategic foresighters themselves for two organizations that perform strategic foresight. At time of this publication Martin Berry is currently employed at Policy Horizons Canada and Dustin Johnston-Jewell is currently employed at Idea Couture.

CONSENT FORM

I agree to participate in this study described above. I have made this decision based on the information I have read in the Information-Consent Letter. I have had the opportunity to receive any additional details I wanted about the study and understand that I may ask questions in the future. I understand that I may withdraw this consent at any time.

Consent:

❑YES ❑NO Do we have consent to conduct this interview and use the resulting data for the purpose of our MRP project?

❑YES ❑NO Do we have consent to record the interview using an audio recording device?

❑YES ❑NO Do we have consent to quote from the recording interview directly in the research paper?

❑YES ❑NO Do we have consent to identify you as one of the participating experts contributing to the interviews?

❑YES ❑NO Do we have consent to identify you as a member of your foresight organization?

Name: _____

Signature: _____ Date: _____

Thank you for your assistance in this project. Please keep a copy of this form for your records.

APPENDIX C – Notes on Methodology

Literature Review

A literature review is an extensive overview of the historical and current knowledge on a particular topic (as well as the relevant adjacencies) in order to gain comprehension and to better understand emergences and advancements in fields, highlighting areas of conflict and discussion. Typically, as was in our case, a literature review is conducted using academic journal resources, well-known published texts, reports, conference writings, and other documented resources that act as the foundation to a knowledge base. As Webster and Watson (2002) state:

> A review of prior, relevant literature is an essential feature of any academic
> project. An effective review creates a firm foundation for advancing knowledge.
> It facilitates theory development, closes areas where a plethora of research exists, and uncovers areas where research is needed.

Expert Interviews

According to Schensul and LeCompte (2013), semistructured interviews consist of,

> Predetermined questions related to domains of interest, administered to a representative sample of respondents. They confirm study domains and identify factors, variables, and items or attributes of variables for analysis or use in a survey.
> (Schensul and LeCompte, 2013)

Process Mapping

We matched each interviewee's foresight processes described to the relevant tools they used to manage knowledge at that point of the process. As Biazzo, (1997) explains, this method allowed us to identify the relationships between the various elements of each expert's strategic foresight process and how their knowledge management practices fit within their process.

> Process mapping consists of constructing a model that shows the relationships between the activities, people, data and objects involved in the production of a specified output.
> (Biazzo, 1997)

Bias in Sampling

Any study is going to have various sampling biases, and ours is no different. Here we highlight the major identified sampling biases so that the reader can keep these in mind while digesting our findings. The identified biases are:

- English speaking – by using only English speakers we may miss variations in the strategic foresight practice.
- Use of networks – connecting through the networks of our co-workers, professors and interviewees was fruitful, however it may neglect the possible inclusion of outlier points of view.
- Lack of internal corporate strategic foresighters – the aforementioned four categories does not include corporate strategic foresighters. The primary reason for this was lack of access to such individuals, as well as resource constraints on the study. Should the study run again, this category would be a worthy addition.

Despite these identified biases we designed our MRP in a manner that attempts to represent a diversity of foresighting organizations and their processes.

Refusal of Our Interview Request

We had a single participant respond to our inquiry for an interview with a refusal to participate. At the time of the request, this individual was a principal and partner at a consultancy that performed strategic foresight as a professional discipline. In responding to our request the individual pointed out that the knowledge management practices their organisation performs for their strategic foresight process is part of their proprietary information and by taking part in our interview may unintentionally have negative impact on their business.

The possibility of a refusal to our request due to this reason was something that we predicted could happen, and hence wrote it into our Consent Form in the Potential Benefits and Risks section (see Appendix B). The fact that this point was brought up brings to light a paradoxical problem of the strategic foresight discipline: the foresight process can be furthered as a discipline if practices were shared amount practitioners, however these same practices are what make each practitioners process unique, adding value. This paradox provides a disincentive to share information, and therefore can slow the overall progression and advancement of the discipline. It is this reason precisely that makes studies such as this one important in order to share and advance the strategic foresight discipline.

APPENDIX D - Codification Process

A screenshot sample of our codification process. Each experts transcribed interview was analysed by identifying three primary categories; Process, Tools and Insights.

47		
48	**Process**	
49	Enagagement	- make sure you are providing the client what they need - determine the actual question the client is after - "sensemaking with the client"
50	Scanning	- casting a broad net - a mixture of existing items from database and new - outcome is trends and drivers
51	Analaysis	
52	Scenarios	- can be used as risk mitigation tools - visualiztion tools are important, othewise you end up drowning in words
53	Strategy	
54		
55	**Tools**	
56	Engagement	- Delphi - gather information from client
57	Scanning	- Evernte; need some type of 'hopper' that collects everything - STEEPV to ensure hit all categories - database, disadvantages include predisposition to what you will be looking at - taxonomy is important - signals become stale - signals dating is important, and tracking popularity - relevance can be context specific and therefore paradoxical - redundancy can be an issue - signals go through phases of interest - track what falls off peoples radar
58	Scenarios	
59		
60	**Insights/Quotes**	
61		- foresight almost always exists within a larger innovation process - time relevant context = paradoxical, you must deliberately track what has fallen off the radar - the overabundance of information can be come inhibiting and therefore curation is essential - you are always looing for the unknown or unsuspected and as soon it is known it is irrelevant, its a paradox - different ways of looking at the same data will lead to serendipitous matching

The Process and Tools categories where then mapped out onto an aggregated process map using a whiteboard.

Aggregating the data included bringing together various experts' descriptions of the foresight process. The following table provides contrasting examples of a sample of experts and their described process. We provide this example to demonstrate how varied the foresight process can be from expert to expert.

Expert	Described Phases of Foresight Process
1	Scanning Scenarios Strategy
2	Engagement Scanning Analysis Scenarios Strategy
3	Scanning Synthesis Sensemaking Storytelling
4	Scanning Fact Checking System Building Scanning Scenarios
5	Scanning Identifying Change Drivers Scenarios

APPENDIX E - The Division of Labour

This paper is co-authored by both Martin Berry and Dustin Johnston-Jewell. For the convenience of the graduate committee reviewing our MRP we present the following table describing how we divided the work that went into this final document.

What?	Majority By Martin Berry	Majority By Dustin Johnston-Jewell	Equal Collaboration
Research	• Literature review on Industry Scanning and Process Mapping • Interviewed, transcribed and analysed 8 interviewees working in the public domain (this gave Martin a 'public' perspective	• Literature review on Literature Review and Expert Interviews • Interviewed, transcribed and analysed 7 interviewees working in the private domain (this gave Dustin a 'private' perspective)	• Aggregating the insights and findings from the interviews • Analysis of the primary data was completed on a single weekend by locking ourselves in a room and placing all the accumulated data on a wall and performing sensemaking exercises
Paper Writing	• Background research and information for Knowledge Management	• Background research and information for Strategic Foresight • Document structure, organization and editing	• Findings Recommendations, conclusions sections

Charts and Tables	• Designed, drawn, and finalized		• Conceptualization of all charts and tables were completed together through discussion and analysis of the primary data

Please note that by working together we were able to gain much more from this MRP in contrast to if we had worked alone. Of the many benefits of working together, one of the strongest is the fact that when working with a co-author you have someone equally intimate with the work to bounce ideas off of, check your quality, and ensure that you are examining every angle.

APPENDIX F - Tools Definitions

Communication Tools (Project Framing phase)

Workshop
Foresight workshops see the foresight team take on the role of facilitators in a collaborative event where the client participates in discussions on the client's needs and goals for the project. The experts we interviewed spoke of workshops being as short as a couple of hours and as long as several full days.

Conversation
Either in person, by phone, VoIP or my e-mail, conversation is at the heart of the Project Framing phase and the relationship between the client and foresight team throughout the project.

Word Processor
Any means of producing a written document which will contain the project agreement.

Client Assessment Tools

Assessment of Needs
''Needs Assessments are used to identify strategic priorities, define results to be accomplished, guide decisions related to appropriate actions to be taken, establish evaluation criteria for making judgments of success, and inform the continual improvement of activities within organizations. Thus, from training to systems engineering, Needs Assessments play an active role in the accomplishment of individual, team, organizational, and even societal results.'' (Watkins, 2008)

Assumption Surfacing
''Reveals the underlying assumptions of a policy or plan and helps create a map for exploring them. Since people often do not recognize all their assumptions, feedback from very different individuals and groups can be sought.''
(Olavarreita, Glenn & Gordon, 2014)

Assumption Reversal
Reversing revealed assumptions in a systematic fashion in order to explore possible surprises that have yet to be considered by the client or participant.

Data Collection Tools

RSS Feed (Rich Site Summary Feeds, Readers and Aggregators)
These applications can run either from web-browsers (web based application) or directly from your device (tablet, phone or PC). These applications aggregate simplified information from

various web sources along search queries, allowing users to monitor various sources from a single platform.

Delphi
''A systematic, interactive forecasting method which relies on sequential questionnaires completed by carefully chosen groups of experts. It is frequently used in forecasting, foresight, and policy studies. In a sense, the Delphi method is a controlled debate. The reasons for extreme opinions are made explicit. More often than not, groups of experts move towards consensus; but even when this does not occur, the reasons for disparate positions become clear. Planners reviewing this material can make judgements based on these reasons and their own knowledge and goals.'' (Olavarreita, Glenn & Gordon, 2014)

Expert Interviews
Interview focusing on a subject matter for which the interviewee is considered to be an expert in his/her area of study.

Social Media

- **Twitter** https://about.twitter.com/
- **Blogger** https://www.blogger.com/about
- **Pinterest** https://about.pinterest.com/en
- **SoundCloud** https://soundcloud.com/pages/contact
- **Facebook** https://www.facebook.com/facebook/info

Bookmarking Tools

- **Pinboard.in** https://pinboard.in/about/
- **Pearltrees** http://www.pearltrees.com/

Emergent Research & Analysis Tools

- **Futurescaper** http://www.futurescaper.com/
- **HunchWorks** http://www.unglobalpulse.org/technology/hunchworks
- **SenseMaker** http://www.sensemaker-suite.com/
- **Parmenides EIDOS** https://www.parmenides-foundation.org/application/parmenides-eidos/
- **Shaping Tomorrow** http://www.shapingtomorrow.com/

Hopper Tools (database management)

- **MoinMoin http://moinmo.in/**
- **TWiki http://twiki.org/**
- **Evernote https://evernote.com/**
- **Diigo https://www.diigo.com/**
- **Google Docs Spreadsheet http://spreadsheets.about.com/od/otherspreadsheets/gr/goog_ss_review.htm**

Mapping Tools

Domain Map

We did not find any formal definition of the domain map. From our interviews, we understand this tool to be used to organise findings along domains in order to gain insight as to underlying principles attributed to each domain. The Institute for the Future offers this definition of maps which seems to use domains as elements of categorization.

''Maps can take many forms, from matrixes and mandalas to timelines and roadmaps. In their simplest forms, they may plot five or six key trends across an equal number of domains, such as people, places, markets, practices, and tools. This basic matrix provides a conceptual framework for organizing diverse signals and aggregating them up to future "hot spots" for a particular organization, team, or community.'' (Institute for the Future, n.d.)

Affinity Map

''Also called the KJ method, after its developer Kawakita Jiro (a Japanese anthropologist) an affinity diagram helps to synthesize large amounts of data by finding relationships between ideas. The information is then gradually structured from the bottom up into meaningful groups. From there you can clearly "see" what you have, and then begin your analysis or come to a decision.'' (Washington.edu, 2011)

Context Map

''Context Maps capture the themes that emerge when discussing complex problems. […] lets you begin converging on the top themes or dimensions of a particular topic or opportunity space. […] Context Maps also provide rapid reflection at project milestones.'' (Carleton, Cockayne & Tahvanainen, 2013)

Concept Map (System Map)

''A diagram that helps to organize ideas and their relationships in a graphic manner. [...] Futurists use it to package complex information into visual representations that communicate better than many words.''
(Olavarreita, Glenn & Gordon, 2014)

Insight Maker

https://insightmaker.com/

Google Docs Drawing
https://support.google.com/docs/answer/179740?hl=en

Narrative Tools

Guided Imaging (a.k.a. Guided Cognitive Imagery)
''[…] involves an imaginary time travel journey in which the participant envisions living in a number of scenes involving different culturally specific locations, both past and future. After being guided to experience the sensory inputs appropriate to each scene (as if actually living there), the participant considers one or more questions that trigger intuitive knowledge relating to a specific theme of interest.'' (Markley, 1998)

Futuretelling
''Futuretelling are short and dramatic performances that illustrate a particular user need as a scene from the future. […] To complement written explanations of your idea.''
(Carleton, Cockayne & Tahvanainen, 2013)

Vignettes
While scenarios attempt to describe the whole world in the future, Vignettes are mini scenarios or slices of a scenario that are easily developed on their own. These can be short one paragraph descriptions of a single new concept for a possible future.

Causal Chain Scenario Tools

Progression Curve
''Progression Curves represent the evolution of changes in terms of technological, social, and other filters. […] To understand the pattern of events for a particular topic and how these events have led to its current state.''
(Carleton, Cockayne & Tahvanainen, 2013)

Futures Wheel
''A way of organizing thinking and questioning about the future -- a type of structured brainstorming. The name of a trend or event is written in the middle of a piece of paper, then small spokes are drawn wheel-like from the center. Primary impacts of consequences are written at the end of each spoke. Next, the secondary impacts of each primary impact form a second ring

of the wheel. This ripple effect continues until a useful picture of the implications of the event or trend is clear'' (Olavarreita, Glenn & Gordon, 2014)

Back Casting
''A tool in which an envisioned future is linked to today by imagining sequential cause and effects steps that lead back from the imagined future to today's situation.'' (Olavarreita, Glenn & Gordon, 2014)

Janus Cones
''Janus Cones looks backwards and forwards in time to identify the timing of historical events and how timing affects potential future events.''
(Carleton, Cockayne & Tahvanainen, 2013)

Influence Diagram
''A graphical rendition of factors in a problem or situation, including arrows and signs (+ or - for polarity) to show the relationship between them.'' (Olavarreita, Glenn & Gordon, 2014)

Some of our interviewees explained they use the Influence Diagram method as a horizontal Futures Wheel. From a single event/trend/idea a tree of possible outcomes is made. The tree fans outwards to the right, as multiple first order consequences may each have multiple second order consequence and so on. To the left, past events or causal trends converge on the subject of the diagram.

Scenario Methods

2X2 or 2 Axes
''This method is based on one of the approaches used by Shell. It generates four contrasting scenarios relevant to a particular area of interest (which may be geographic or thematic) by placing a major factor influencing the future of the issue being investigated on each of the two axes, which cross to form a four quadrants […]''
(Rhydderch, 2009)

Scenario Archetype
''A technique developed by the institute for Alternative Futures (IAF) to ensure a spread of future environments within a scenario set and provide effective learning for both understanding and better choosing the future. The archetypes move through a ''most likely'' or ''official future'' (alpha) to a ''what could go wrong'' hard times scenario (beta), then to two structurally different scenarios, at least one of which should be visionary (delta).'' (Olavarreita, Glenn & Gordon, 2014)

3 Horizons

''[…] connects the present with desired (or espoused) futures, and helps to identify the divergent futures which may emerge as a result of conflict between the embedded present and these imagined futures.''
(Curry & Hodgson, 2008)

Cone of Plausibility
''The cone of plausibility is a scenario planning technique developed at Huston University, and adapted for use by the UK Ministry of Defense. A range of scenarios are developed from series of drivers and assumptions that are identified. The scenarios are based on the most likely pathways as well as the more extreme or less likely future pathways.'' (Rhydderch, 2009)

Branch Analysis
''A 'branch' process can be used to develop a range of potential futures. Starting with the top-level question, important events are identified in a systematic, sequenced way and their potential consequences are mapped onto a branching diagram. Contrasting scenarios are developed using this branching approach […]'' (Rhydderch, 2009)

Scenario Matrix
''Enables the comparison of the scenarios in a set across specific elements. Scenarios elements such as the economy, technology, health access and promotion are listed along the right side of the matrix, and each scenario is listed across the top.'' (Olavarreita, Glenn & Gordon, 2014)

Microsoft Excel
Spreadsheet software by Microsoft used by foresight practitioners to organise databases and manage matrices.
http://products.office.com/en-us/excel

Visioning Tools

QUEST (Quick Environmental Scanning Technique)
''A scanning procedure designed to assist executives and planners in keeping abreast of change and its implications for organizational strategies and policies. The procedure permits administratos and top executives to share their views and to develop a shared understanding of high priority issues, future options, and eventualities, which have implications for the institutions. QUEST produces a) a comprehensive and ample analysis of the environment and b) assigns a value and analysis capacity of the institutions and their strategic options for negotiating with the external environment. The QUEST procedure involves four stages: a) preparation b) environmental scanning workshop c) intermediate analysis and report d) strategic options workshop and follow-up.''
(Olavarreita, Glenn & Gordon, 2014)

Future Search
''Future search is a PLANNING MEETING that helps people transform their capability for action very quickly. The meeting is task-focused. It brings together 60 to 80 people in one room or hundreds in parallel rooms.

Future search brings people from all walks of life into the same conversation - those with resources, expertise, formal authority and need. They meet for 16 hours spread across three days. People tell stories about their past, present and desired future. Through dialogue they discover their common ground. Only then do they make concrete action plans.'' (Future Search Network, 2001)

Appreciative Inquiry
''AI involves, in a central way, the art and practice of asking questions that strengthen a system's capacity to apprehend, anticipate, and heighten positive potential. It centrally involves the mobilization of inquiry through the crafting of the "unconditional positive question" often-involving hundreds or sometimes thousands of people. In AI the arduous task of intervention gives way to the speed of imagination and innovation; instead of negation, criticism, and spiraling diagnosis, there is discovery, dream, and design. AI seeks, fundamentally, to build a constructive union between a whole people and the massive entirety of what people talk about as past and present capacities: achievements, assets, unexplored potentials, innovations, strengths, elevated thoughts, opportunities, benchmarks, high point moments, lived values, traditions, strategic competencies, stories, expressions of wisdom, insights into the deeper corporate spirit or soul--and visions of valued and possible futures.'' (Cooperrider and Whitney, n.d.)

Manoa Method
The Manoa School of Futures Studies has developed a method for using scenarios to help organizations move towards 'preferred futures'. This method involves seven steps: appreciating the past, understanding the present, forecasting aspects of the futures, experiencing alternative futures, envisioning the futures, creating the futures, institutionalizing futures research. (Dator, 2009)

Boulding/Ziegler Method
''Based on workshops called "Imaging a World without Weapons," initiated by Warren Ziegler and further developed by Elise Boulding, this workshop has students think ahead 30 years to consider what the world might be like if we really made progress in addressing some of the important problems that we face today. Participants think this through individually, then share their visions in small groups, and finally the small groups share with the larger group. While individuals' visions do vary, participants also find considerable overlap. Consensus-building is a lot more productive and fruitful than the participants originally expect.
After clarifying the shared vision 30 years in the future, then participants engage in another set of exercises in which they "remember" how we "got to" this future better world. They move back 5 years, then another 5 years, etc., until finally returning to the present. At this point, each participant considers his or her own contribution towards building this better world, now that the class has thought through how to get from the present to a better future.'' (St-Lawrence University, 2010)

Communication Tools (Identifying Implication phase)

Adobe InDesign
Publishing software by Adobe used for creating posters, brochures, magazines, reports, books etc...
http://www.adobe.com/ca/products/indesign.html

Microsoft Powerpoint

Presentation software by Microsoft
http://office.microsoft.com/en-ca/powerpoint/

Sign Posting
A narrative tools which places a series of events on a timeline, usually starting in the present and moving into the future, in order to demonstrate how trends might unfold. The timeline might assemble real events from the past alongside forecasts and fictitious events in the future.

Experiential Futures
''Experiential futures, design fiction, artifacts from the future or speculative fiction. […] Highly visual, often emotional, and ethnographically infused, their approach brings the future alive through videos, objects, and print media. […] Most design futures strive to create a rich, textured, often first person immersion in a credible alternate world through the use of multiple media and storytelling techniques.'' (Radford, n.d.)

Implication & Strategy Tools

Continuous Monitoring
''Continuous (or ongoing) observation of certain aspects of something. In futuring, monitoring typically focuses on selected features of the environment in which one operates, such as economic and governmental indicators.''
(Olavarreita, Glenn & Gordon, 2014)

Wind Tunneling
''Testing chosen objectives against alternative futures.''
(Olavarreita, Glenn & Gordon, 2014)

''Scenarios are particularly valuable for stretching our strategic options. They can create a conceptual wind tunnel where we can test how well our strategies will 'fly' under various conditions. They can also help us break out of our habitual thinking to inspire innovation and help build resilience.'' (Institute for the Future, n.d.)