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FUTURE STRATEGIC ENVIRONMENT ASSESSMENT: FRAMEWORK FOR ANALYSIS HANDBOOK

Prepared by Research Task Group SAS-154
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EXECUTIVE SUMMARY

Since 2014, the strategic security environment has dramatically changed driven by the rapid rate of technological, political, economic, social and environmental developments that increased its complexity and uncertainty. In order to address the complexity and rapid rate of change an in-depth understanding of the future strategic environment is required. However, NATO and individual nations or institutions often approach this issue in very different ways with small states often lacking the necessary know-how to do this. Existing frameworks on how to approach strategic foresight generally deal with only a particular phase of the foresight process (e.g. excluding planning) or provide a methodology that is not flexible enough and adaptable to different circumstances. In addition, often where suggested frameworks enable practitioners to use methods of their choice, little, if any, guidance is provided on how to select the methods to achieve the desired results. The aim of NATO STO SAS panel research task group 154 was to address this gap.

This handbook provides a generic framework of how to plan and conduct foresight, which is built on the identified best practices and is adaptable to each user's needs and resources. The **main takeaways** are:

- A **Foresight project** should consist of several **phases** with each including different activities and considerations. The suggested phases are:
  - *Initiation:* clarifying the role and purpose of the foresight project.
  - *Planning:* framing the project in terms of problem definition, time horizon, geographic scope, classification level, stakeholders; identifying available resources and matching ambition with resources; building the plan of how to undertake the foresight project (including methods selection).
  - *Execution:* there is not a universal 'right' way to undertake a foresight project in terms of methodologies / methods used. Instead, a foresight process should be tailor-made and reflect specific aspects of the project being undertaken. There are, however, some general, best practice, rules to be followed in order to ensure a robust end product. It is recommended to:
    - Use a mix of several methods (5-6) that reflect available resources (time, expertise, personnel);
    - Agree the pre-defined time horizon at the outset of the project;
    - Generate knowledge from all four sources (creativity, interaction, evidence, expertise);
    - Follow the stages of foresight (input, analysis, interpretation, prospection); and
    - Consider, at the outset and on an ongoing basis, how the strategic foresight work will inform strategic thinking and decision-making.
  - *Dissemination of results / exploitation*: creating final products that are tailor-made for clients and communicating the findings to clients and stakeholders.
  - *Evaluation & assessment*: identifying lessons learned, assessing how well the project went.
  - *Monitoring*: the ongoing process of monitoring the foresight project area for indicators and changes.

- Common **challenges** encountered throughout a foresight project include insufficient buy-in to the project and its findings; questions of relevance and quality of the work; inadequate management / leadership of the foresight process; successful communication of results. This handbook provides actionable recommendations on how to prevent / address these challenges, making the foresight project more likely to succeed. Two overarching areas that, if addressed, help with many of the challenges of strategic foresight work are to:
    - Engage **stakeholders** sufficiently at all stages of the project to ensure sufficient support. This should be planned early and explored if the engagement is below what is believed to be required for a successful outcome.
    - Ensure **diversity** of thought (personnel, sources, methods, etc.) throughout the process to overcome the risk of cognitive bias and group think, and to increase the quality and relevance of results.

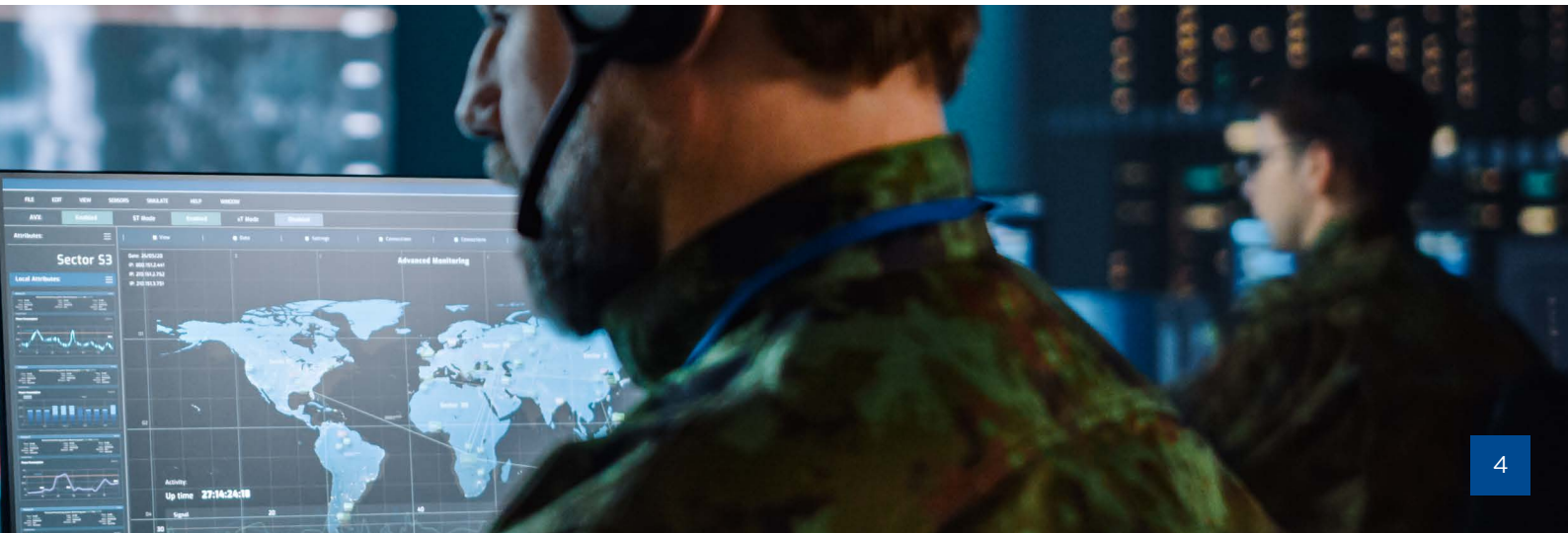
The generic framework presented in this handbook represents a code of best practice that should enable practitioners to plan their own foresight project tailored to their needs and resources. In terms of conducting foresight itself, instead of providing one single methodology (which would lack the advantage of universal use and adaptability to different circumstances), the Handbook seeks to encourage practitioners to create their own mix of methods according to specific needs of their foresight project and recommendations provided here.

ABSTRACT:

Addressing the complexity and rapid rate of change requires an in-depth understanding of the future strategic environment. However, NATO, as well as individual nations or institutions, often approach this issue in very different ways with some lacking the necessary know-how and experience. The objective of the SAS-154 research task group was to identify a code of best practice on how to undertake future strategic environment assessments to help with this issue. The work is especially aimed at those states seeking to incorporate foresight in their defence planning and strategic thinking for the very first time. This report is in the form of a handbook that provides a generic framework of how to plan and conduct foresight, it is built on identified best practices and is adaptable to each user's needs and resources. The Handbook contains practical advice on how to build a foresight project from the initial project management issues through selecting the appropriate combination of foresight methods towards delivering the results to the decision-makers. It also provides recommendations about how to prevent or address some of the most common challenges that may hinder the quality or relevance of a foresight project; highlighting especially the role of diversity and the need to engage stakeholders throughout the entire process.

KEYWORDS:

strategic environment, strategic foresight, foresight project, foresight framework, foresight methods, diversity



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LIST OF ACRONYMS AND ABBREVIATIONS

ACT	Allied Command Transformation
AHP	Analytical Hierarchy Process
ANP	Analytic Network Process
CAF	Canadian Armed Forces
CAG	Command Action Group
CALWC	Canadian Army Land Warfare Center
CLA	Causal Layered Analysis
COEs	Centres of Excellence
COI	Community of Interest
CTI	Cyber Threat Intelligence
DCDC	Development, Concepts and Doctrine Centre
DCOS	Deputy Chief of Staff
DSTL	Defence Science and Technology Laboratory
ESPAS	European Strategy and Policy Analysis System
ETID	Defence Technology and Innovation Strategy
FFAO	Future Alliance Operations
FSEA	Future Strategic Environment Assessment
FTA	Future-oriented Technology Analysis
GMA	General Morphological Analysis
GST	Global Strategic Trends
HQ	Headquarters
IGOs	Intergovernmental Organisations
IPR	In-Progress Review
IS/IMS	International Staff / International Military Staff
ISTA	Intelligence, Surveillance, Target Acquisition
JFSC	Joint Forces Staff College
LTMT	Long-Term Military Transformation
MOD	Ministry of Defence
MS	Microsoft
NATO	North Atlantic Treaty Organisation
NDPP	NATO Defence Planning Process
NGOs	Non-Governmental Organisations
NLRs	National Liaison Representatives
PESTLE	Political, Economic, Social, Technological, Legal and Environmental
PNLR	Partner Nation Liaison Representative
PREDICT	Projections and Relevant Effects of Demographic Implications, Changes and Trends
RTD&I	Research, Technology Development and Innovation
RTG	Research Task Group
S&T	Science and technology
SACT	Supreme Allied Commander Transformation
SECGEN	Secretary General
SFA	Strategic Foresight Analysis
SIPRI	Stockholm International Peace Research Institute
SMEs	Subject Matter Experts
SPP	Strategic Plans and Policy
STEEP	Social, Technological, Economic, Environmental, and Political
STEEPVL	Social, Technical, Economic, Ecological, Political, Values, Legal
STO	Science and Technology Organisation
SWOT	Strength, Weaknesses, Opportunities, and Threats
TIA	Trend Impact Analysis
TTCP	The Technical Cooperation Panel
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organisation
UoB	University of Bologna
WEF	World Economic Forum
WMD/E	Weapons of Mass Destruction/ Effects

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We would like to express our sincere gratitude first of all to number of experts who by sharing their knowledge with our RTG ultimately helped us improve this handbook.

Numerous internationally recognised experts from different states and institutions helped us to gather and diversify insights related to foresight frameworks, methods and different tools used in foresight. They shared their perspectives and foresight work with us during online workshops or virtual meetings of RTG and include Dr Hajo Lippke (Planungsamt der Bundeswehr), Mr Peter Gizewski (DRDC), Dr Andy Hines (University of Houston), Dr Ben Taylor (DRDC), Mr James Maltby (DSTL), Dr Nariman Firoozy (DRDC), Mr Koen Vegter (Might), intelligence professional Ms. Carmen Medina, Dr Gitanjali Adlakha-Hutcheon (Department of National Defence / Government of Canada), Mr Prasanna Venkatesh (SpringML), Mr Anthony Pasquesi (Google), Dr Alex Anikiev (Microsoft). Other experts were interviewed separately by individual RTG members to deepen our understanding of the topic including Dr Bastian Giegerich (IISS), Dr Andy Hines (University of Houston), Dr Cho Khong (Saïd Business School of Oxford University and formerly Shell).

Among experts who provided us direct inputs to the handbook are Dr Michael A. Rostek (DRDC), Dr Alain Auger (DRDC), Mr James Maltby (DSTL), and Mr. Jordi Serra del Pino (LISA Institute).

Along the process of writing handbook, we also reached to experts in the field to ask them to provide us feedback to already drafted parts of the handbook. Experts who provided us such comments include Dr Karlheinz Steinmüller (Z_punkt), Dr David Bengston (USDA), Dr Peter Bishop (formerly University of Houston), Dr Andy Hines (University of Houston), Dr Jaïr van der Lijn (SIPRI), Dr Robert Phaal (University of Cambridge), and Dr Ronald N. Kostoff.

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FOREWORD

Figure 1: Mehmet Kinaci.

Humanity is transitioning through an 'Age of Uncertainty' highlighted by a rapid change and growing complexity set off by accelerating advancements in technology, social movements, the visible effects of climate change and a period of geostrategic transition with power moving from the West to the East. This uncertainty in the strategic environment increases risks and presents threats as well as opportunities fuelled by the convergence and/or divergence of multiple trends. In such circumstances, a comprehensive understanding shared across a multitude of stakeholders of the current conditions and driving forces of change in multiple domains is critically important for decision-makers as they make choices, set priorities and develop strategies that are likely to shape the future strategic context. Recent strategic developments have tested most assumptions and continue to challenge how assessments of the future strategic environment are conducted. In this context, the "SAS-154: Future Strategic Environment Assessment: Framework for Analysis" study provides a code of best practices handbook that can be utilised to inform analyses and subsequently decision-making.

The future security and operating environments will be more complex and uncertain. NATO forces and capabilities need to be prepared for these emerging future challenges. This handbook of best practices aims to provide a toolbox developed through a comprehensive analysis of various approaches used to assess the future strategic environment. These approaches have been taken from NATO and other nations, international institutions, think tanks, academia and industry. The handbook provides a "North Star" for not only foresight practitioners but also for those responsible for horizon scanning, risk assessment, strategy development and scenario planning. Starting from basic concepts and the definition of strategic foresight, the handbook introduces different foresight methodologies and the management of a foresight project.

In development of this study, the Research Task Group (RTG) organised monthly online meetings to effectively overcome the challenge of different time zones due to the dispersed locations of the RTG members. These online meetings were supplemented with in-person meetings dedicated to reviewing, writing and coordinating the handbook. The RTG Members engaged experts from governments, international organisations, think tanks and academia all of whom presented their methodologies, participated in online meetings to introduce and explain their insights and, kindly, provided comments to early drafts of the study. While this handbook is dedicated to the creation of a common strategic foresight culture for defence and security professionals that supports the development of a shared perspective of the future strategic environment, it can also be used as a top-level user guide for any projects that seek an understanding of the future. The RTG Members hope that this handbook will support the continuous improvement of strategic foresight and, in turn, improve the strategic decision-making.

Mehmet Kinaci

NATO Allied Command Transformation

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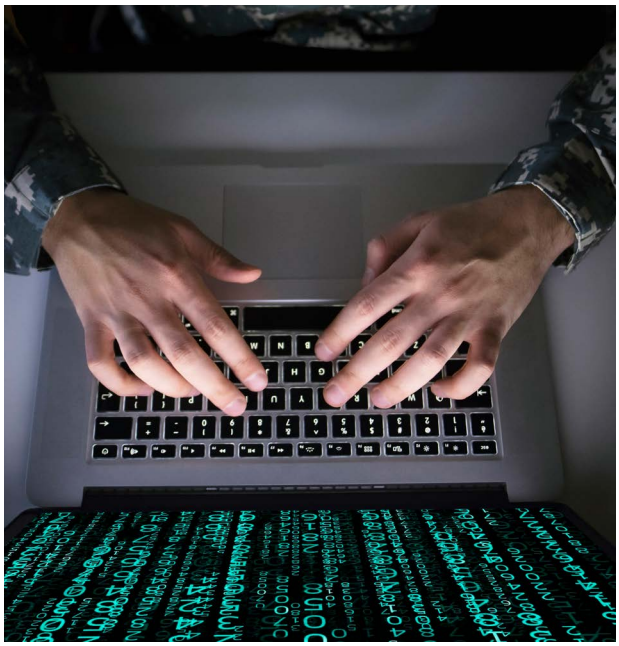
INTRODUCTION

When thinking about the future development of the strategic environment, there are many unknowns. Could there be another large scale conventional conflict in Europe in the next few decades? Could there be a conflict in the future beyond Europe that may impact us? Can we expect a new technology to emerge that will suddenly make our current military capabilities largely obsolete? Will nations still be able to recruit enough young and fit people who are willing to fight and die for their country? These are but a few of the many questions that defence and security planners and decision makers would like answers to when preparing their systems of defence accordingly. However, the first thing we must understand and accept is that strategic foresight is not able to give us those answers since it does not have the power to dissolve uncertainty and precisely predict future events. It provides insight to these and other questions. In doing so, it helps us to embrace this inevitable uncertainty and discontinuity when, as humans, we are rather wired to think about the future erroneously as the continuation of the present trends and forces that drive them. Foresight helps us to make more informed choices resulting from better knowledge of what different alternative futures *could* emerge whether they be the worst imaginable scenarios to be avoided or opportunities to be exploited. Finally, the incorporation of strategic foresight analysis helps to make our organisations and nations more robust, flexible and best prepared for change.

For defence departments and militaries, long-term thinking and planning are a must. These organisations are charged with protecting the territorial integrity and sovereignty of the state, most importantly its survival, and thus must always prepare for the worst-case scenarios under which the state can be endangered. Acquisition of expensive defence capabilities including weaponry with planned long-life cycles requires knowledge of the armed forces' future security challenges, tasks and needed capabilities and in peacetime, the necessity of defence acquisition projects are often challenged by the public and political opposition as unnecessary in the absence of a clear current threat. Moreover, in times of austerity, in many countries, defence departments are among the first where governments look to cut spending. This reality further underlines the importance of defence departments and ministries better justifying their needs grounded in an evidenced based and reasoned understanding of the future strategic environment and its implications for national security and defence.



Yet, foresight seems often to be undervalued or even ignored by strategic planners and decision makers as many countries still lack strategic foresight programs to support their defence planning process. This can be explained by several reasons such as lack of experience, lack of time or possibly by misunderstanding the role of foresight which can be viewed with suspicion as a too unscientific and imprecise tool to be used in such a serious business as that of national defence. This thinking necessarily brings along the risk of short-termism and reactive policies and planning caused by sudden shocks in the external or internal environment. Other countries might launch their foresight programs but fall short of making them a truly prospective tool that goes beyond mere trend analysis and projection. Some countries even might have great foresight programs but underestimate the importance of decision makers' buy-in and the delivery phase of the foresight project. In such cases, foresight fails to fulfil its prime role of supporting decision making.

This Handbook should serve all countries, but mostly those that are confronted with the challenge of incorporating foresight in their defence planning and strategic thinking for the very first time. The aim of the Handbook is to offer a code of best practice on how Future Strategic Environment Assessments (also as FSEA) are conducted and incorporated into a nation's overall defence planning cycle. The handbook thus contains practical advice for nations on how to build their own foresight project from the initial project management issues through selecting the appropriate combination of foresight methods

towards delivering the results to the decision makers. It is built on the work of the SAS-154 Research Task Group (RTG) operating under the NATO Science & Technology Organization. The team included experts and researchers from defence departments and defence universities including countries with rich experience with strategic foresight such as Great Britain, Canada and Finland. The work was further supported by the participation of representatives from the NATO ACT tasked with Strategic Foresight Analysis (SFA). The methodology of SFA served the RTG as a benchmark and is explained in Annex A.

In Chapter 1, we explain what strategic foresight is, and how it can support decision making and strategy development, with special emphasis on its use in the defence sector. In Chapter 2 we guide the reader through basic foresight project design with references to subsequent chapters where more information can be found on specific issues. Chapter 3 introduces four useful foresight frameworks describing a foresight process consisting of several stages for which different foresight methods will be suitable. In Chapter 4, the readers can get fundamental information about 28 essential methods used in foresight. More detailed information about the methods such as purpose, how to apply them, their strengths and weaknesses, tips for combining them with other methods, as well as best practices to be followed can be found in Annex C. We also refer the users to examples of these methods' use in the security and defence field to get a better idea of how to apply them in this area. Importantly, Chapter 4 includes advice on how to select the appropriate mix of methods to design a robust and quality foresight exercise and it offers several examples of combining methods. Chapter 5 provides recommendations and best practices including the important but still neglected topic of the diversity of thought in foresight. It summarises typical challenges in foresight projects and provides recommendations on how to address them. Altogether, this Handbook offers a complex view of strategic foresight, merging theory with practical advice. However, we urge the readers to use it with flexibility – skipping over the passages they are familiar with and hopefully finding advice and inspiration in other parts of the Handbook.

CHAPTER 1 – UNDERSTANDING (STRATEGIC) FORESIGHT

Before developing foresight work that will best support your organisation's goals and interests, it is necessary to understand what (strategic) foresight is, how it relates to strategy development, what outcomes you can realistically expect from it and what demands are beyond foresight's abilities. In this section, we define foresight, summarise the goals it can support, with particular emphasis on the field of defence, explain key terms used in futures work. On a side note, we will use the terms strategic foresight and future strategic environment assessment interchangeably, while admitting that strategic foresight is a broader approach that can be used in other areas beyond strategic environment assessment.

1.1 WHAT IS (STRATEGIC) FORESIGHT?

There are a great number of myths, misunderstandings, scepticism or even mystery surrounding the discipline of foresight. The possibilities and limits of this field are not always well understood by the stakeholders and the public. Too often, foresight is confused with predicting the future – an impossible task in the world of social phenomena where discontinuity is rather the rule than the exception. While foresight can serve many different purposes, what it cannot do – most importantly – and this should be constantly communicated to stakeholders, is predict the future understood as a singular entity. It can, however, reduce the likelihood of strategic surprise and strategic drift, and thus improve organisation's long-term adaptability and resilience against future challenges.

Foresight has been defined as "a tool for decision making and complexity reduction" [1, p. 2]. Although this definition does not reveal anything about the specific content of the discipline, it captures its essence as an approach that can help address uncertainty. The future equals uncertainty. And the farther into the future we go, the more uncertainty increases. In this regard, the key task of foresight is to reduce uncertainty by identifying a variety of plausible or possible futures. To be able to do this, we must first understand the present world and the forces that drive its unfolding. With this understanding we can then proceed to extrapolate those forces to build an image of the most probable future against which one can then imagine discontinuities that could affect those driving forces and lead to an alternate future. Foresight is a systematic and creative way of working with future uncertainty, while still being rooted in the present. According to OECD, foresight "understands the future as an emerging entity that's only partially visible in the present". [2] The present holds the seeds of the future world in the form of weak signals as well as continuities represented by the relatively stable mega-trends (see the below definitions of key terms).

Definitions of foresight are surprisingly hard to come by. Hines also acknowledged this startling lack of definitions, nevertheless, he proposed an understanding of foresight as:

> *"the study of change by using a systematic methodology to explore futures in order to make decisions today that move us towards the futures we want and away from those we don't, and ultimately builds confidence in the future in developing our capacity to avoid surprise." [3]*

In this Handbook, the notion of strategic foresight is used that aims at supporting strategy development through its input in the early phases of strategic thinking in order to "open up an expanded range of perceptions of the strategic options available, so that strategy-making is potentially wiser" [4]. In line with this approach, Conway defines foresight as "a strategic thinking capacity" or as "an organisational foresight capacity that informs the development of strategy" [5]. Strategic thinking allows exploration of different options and foresight offers tools to systematically identify and evaluate those options. However, foresight itself is not responsible for strategy development. It only informs this activity by offering multiple options for the planners and decision-makers who will later need to make the decisions required to design and implement a strategy. The task of foresight is to support this process so that leaders can make informed decisions while reducing the role of their assumptions and prejudices or at least making them explicit. We discuss the multiple advantages of using strategic foresight below.

1.2 HOW CAN (STRATEGIC) FORESIGHT SUPPORT DECISION-MAKING AND STRATEGY DEVELOPMENT?

Earlier, we have established that foresight is not intended to predict the future, rather it serves as an input to strategic thinking, which then informs strategy development by offering and exploring different alternative futures. We will now explain how knowledge of those different futures supports decision-makers in the process of strategic decision making. To do this, the different purposes of foresight as found in literature are listed below and classified into six broader areas

according to their function. We only distinguish among these functions for the sake of theoretical clarity. In practice, one purpose usually cannot be neatly separated from the others since foresight as a specific mindset serves multiple purposes simultaneously.

1. Describe and explore the current strategic environment

A foresight project starts with identifying trends and mega-trends (see below) as discernible patterns in the strategic environment as well as their driving forces (drivers). It identifies challenges for the organisation's values and interests but also opportunities that could be exploited. Interconnections between those elements should also be explored and well understood. Description of trends and driving forces helps to establish a baseline future as the most probable future that will occur should the identified trends with their drivers remain constant. However, the farther into the future we look, the less likely the future will be the baseline future; the certainty over trends and drivers remaining constant reduces.

2. Identify a range of alternative futures

Since we always need to expect discontinuity, foresight helps to identify a list of events that could change the trajectory of current trends and driving forces and thereby develop alternative scenarios for the future. We can then evaluate these alternative futures against the baseline scenario. Consideration of wild cards or other disruptive events is an essential part of thinking about the future and how it can deviate from the current trajectory. Importantly, foresight work that stops short of looking into the uncertainty that the future inevitably brings – typically by merely listing trends and extrapolating them into the future – cannot be considered foresight in the narrow sense.

3. Watch for early signs of change in the strategic environment

Looking for weak signals may help to spot emerging trends and challenges and address them before it is too late, or too difficult to respond effectively. In this regard, foresight can act as an early warning for the decision-makers. Alternatively, it can identify a set of indicators for each of the alternative futures and then establish a process to monitor which one of those futures seems to be unfolding or whether the trajectory might go in a completely new and unexpected direction.

4. Support a specific way of thinking and reduce bias

Most importantly, foresight brings with it a specific mindset – a way of thinking that sensitises the stakeholders to the fact that change is inevitable, and embracing uncertainty a necessity. To do otherwise, runs the risk that biases and assumptions will dominate our thinking about the future. The UK Government Office for Science cautions that:

> *"Policies which are based on assumptions of how the world is today can limit our choices and put us in a position of constantly responding to change, rather than creating the conditions to achieve the future we want. By considering alternative plausible future worlds, based on trends, drivers, and external insight, we can develop more resilient policies with a better chance of delivering the outcomes we are seeking, whatever the future holds". [6]*

Similarly, Shell as a pioneering organisation in using scenarios in futures thinking explains that this effort is about "encouraging leaders to consider events that may only be remote possibilities and stretch their thinking" [7]. Foresight can also expand the focus of the decision-makers towards the big picture and broader context of the organisation through methods such as horizon scanning and different analytical frames (PESTLE, PMESII or other) that prevent them from taking a too narrow view in the current globalised, interconnected world. Foresight also facilitates making latent assumption visible and thereby allowing them to be challenged.

5. Support discussion and change towards a preferred future

If the foresight is conducted as a collaborative effort, it can support the discussion and even lasting change in an organisation. This approach is exemplified by the method of "real-time strategic change" that has been developed at the Ford Motor Company to create and implement a preferred future in the organisation. The notion of "critical mass" designates the needed level of involvement and is defined as "the number of individuals within an organisation that need to be involved in the change initiative over time in order for it to be successful" [8]. It needs to be emphasised that most countries do not have sufficient power to actively shape their strategic environment towards some vision of a preferred future. On the other hand, this position does not

prevent them from actively preparing for – and seeking out and exploiting opportunities in - the future strategic environment in support of their interests and preferred future. Continuous change is required to avoid strategic drift.

6. Build preparedness and improve organisational resilience

Finally, foresight can significantly enhance preparedness and resilience of the organisation. Anticipation, a key aspect of organisational resilience, refers to the ability to detect and prepare for adverse events or developments within the organisation or in the external environment – and to adapt proactively. [9] It helps to identify a range of possible futures and the implications these would have for the organisation. Proactive anticipation increases the likelihood that organisations will survive changes in their internal or external environment; flexing and adapting to survive.

In the field of defence and national security, this ability to prepare the organisation to address the worst-case scenarios is of even greater importance. We can conclude with the quotation of van Duijne and Bishop that "strategic foresight is about better preparedness for different futures that are all possible and plausible". [10]

1.3 (FUTURE) STRATEGIC ENVIRONMENT

Strategy is about creating desired effects in the (strategic) environment or preventing undesirable ones. Yarger defines the strategic environment as consisting of "the internal and external context, conditions, relationships, trends, issues, threats, opportunities, interactions, and effects that influence the success of the state in relation to the physical world, other states and actors, chance, and the possible futures." [11] He describes it as a dynamic environment in which "some things are known (predictable), some are probable, some are plausible, some are possible, and some remain simply unknown" and whose nature makes it difficult to apply the strategy. In the military context, the term operational environment is frequently used to refer to "a composite of the conditions, circumstances and influences that affect the employment of capabilities and bear on the decisions of the commander" [12] While there is some overlap between both terms, they operate at a different level of abstraction.

Foresight has tools at its disposal that help to decipher those individual elements of the strategic environment including their interconnections as well as to assess the level of uncertainty present in the environment. A brief definition of the key terms related to the (future) strategic environment used throughout this handbook is shared below.

1. Threats and risks

Traditionally, threats have been linked with the *capability* of an actor to inflict harm on the protected values as indicated by the following citation by Keohane:

> *"Threats pertain when there are actors that have the capabilities to harm the security of others and that are perceived by their potential targets as having intentions to do so. When no such threat exists, either because states do not have the intention or the capability to harm the security of others, states may nevertheless face a security risk." [13]*

Apart from capability, an actor also needs to have the *intent* to use this capability to inflict harm. In this sense, a threat is understood as "a function of capability and intent" [14]. On the other hand, a risk is more about the *probability* that a value will be harmed. In risk analysis, the risk is typically defined by a notation comprising of an *event* – understood as a hazard, threat, opportunity or a risk source, *consequences* of the event and the associated *uncertainties*. Risk is then expressed as the combination of consequences and probabilities (see [15]).

2. Trends, mega-trends and their driving forces

Identification of trends is a key step in foresight as it enables establishing a baseline scenario by extrapolating those trends into the future. A *trend* is understood as "a general tendency or direction of a development or change over time" or "a sequential pattern of change in recorded data" [16]. Gordon [17] suggests a basic test of significance to differentiate a trend from a mere fad (or a blip) by evaluating whether the development "affects a wide range of people" and has or may have in the future "broad social, economic, or political implications". Fads, on the other hand, are "transient or narrow in scope and affect only particular social groups or regions, without long-term implications". Before a trend is formed as an indisputable pattern in the observations, *weak signals* can be detected as part of a horizon scanning or a monitoring process. These signals represent "changes indicated by limited data points and observations" [18].

Mega-trends are those developments that are "already underway and nearly impossible to

change over the coming decade". [19]. They occur on a large scale and cover a longer time horizon of at least a decade. These characteristics make them relatively stable, which means that mega-trends can be treated as almost constants in the near future. Climate change or urbanisation exemplifies such long-lasting trends.

Gordon [17] points out that a trend is just a pattern in the data. It likens it to a "candy wrapper in the wind", whose movement is dependent on the wind so that "when the wind stops, the wrapper stops". We cannot understand a trend without knowing what drives it. Extrapolation of trends depends on the identification and good understanding of *drivers* (forces of change) as "developments causing change, affecting or shaping the future" [16].

3. Types of futures

Voros has distinguished between five classes of alternative futures: potential, possible, plausible, probable and preferable. [4] When conducting a foresight project, we must know what classes of futures we are interested in since this will affect the choice of the analytical and foresight methods we need to use. Voros describes these futures using a "futures cone", which can be imagined as a cone stretching from the present and expanding in size as we move further into the future. The cone is positioned in a space filled with all *potential futures* – a class containing "all of the futures which lie ahead", whether we can imagine those or not. For the author, it is "an unknown dark area, while the futures cone is like a car headlight, illuminating the view ahead". The cone itself consists of all *possible futures* – all futures that we can imagine, even though some of them may not be feasible yet as they depend on the knowledge we currently do not possess (Voros uses the "warp drive" from Star Trek as an example). *Plausible futures* constitute a smaller sector of the cone. These are futures that could happen according to our current knowledge and thus do not depend on any future knowledge. The future that we consider likely to happen is *probable*. It relies on the continuation of current trends, which it only extrapolates into the future. Finally, we can create an image of *preferable futures* as those that we wish to happen – and are thus reliant on our subjective, emotional judgment.

In the area of defence and national security, foresight typically works with several plausible futures that are compared to the most probable future. Oftentimes, just a probable future derived from identifying, understanding and extending current trends and their driving forces is taken into consideration. However, if we do not address potential discontinuities, such an approach does not live up to the essence of foresight – which is about expanding options and stretching thinking.

4. Discontinuity and surprises

Potential futures bring along a variety of potential surprises and discontinuities. In foresight, the frequently used notion of *wild cards* is reserved for "Low Probability, High Impact Events that happen quickly" [20]. These events can occur in potential, possible as well as plausible futures. [4] Experts in foresight and risk analysis have developed several concepts to account for high-impact events. Talbe [21] brought fame to the *black swan* event, which he described as an outlier existing "outside the realm of regular expectations because nothing in the past can convincingly point to its possibility" and carrying an extreme impact. He explained that such events are truly unknowable and cannot be predicted even though "human nature makes us concoct explanations for its occurrence after the fact, making it explainable and predictable". Black swans reside in the unknown dark area of potential futures.

Grey swans and white swans refer to high-impact events that, unlike black swans, have a certain degree of predictability. Lin and Emanuel (as quoted in Manning et al. [22, p. 293]) defined the former as "high-consequence events that are unobserved and unanticipated [that] may nevertheless be predictable (although perhaps with large uncertainty)". Such an event is unlikely but can be expected based on previous experiences or some limited evidence of their possible occurrence. *White swans* occupy the realm of known futures since they are "knowable, assessable and can be mitigated for, even eliminated" [22, p. 291]. A subcategory of *dirty white swans* accounts for white swan events that are ignored by policymakers due to cognitive bias. [23, p. 27]

Similarly, the metaphors of black elephants and grey rhinos express events that are known and to a certain degree predictable, nevertheless, ignored by the decision-makers. A black elephant is an "obvious, entirely foreseeable event that almost everyone refuses to address and which, when they occur, everyone avoids responsibility for by claiming it was unforeseeable" [24, p. 200]. Wucker coined the term grey rhino to describe "something we ought to be able to see clearly by virtue of its sise", however, "we consistently fail to recognise the obvious" [25]. The coronavirus pandemic illustrates well the occurrence of such an event.

Another useful conceptualisation is the distinction between 'concentrated surprises' and 'diffused surprises'. A typical example of a concentrated surprise is a surprise attack, "a directed effort on the part of one player determined to prevent an adversary from knowing its intentions and real capabilities by concealment and fraud in order to gain an advantage" [26, p. 703]. The Russian invasion in Crimea in 2014 is a case in point. In intelligence studies, there is an abundance of literature on foresight and intelligence failures concerning concentrated surprises. Typically, less attention is paid to diffused surprises; surprises that develop spontaneously and incrementally over time. These slow dispersed and incremental changes may eventually constitute a strategic surprise or create potential for one. [26]

1.4 FORESIGHT IN THE FIELD OF SECURITY AND DEFENCE

An organisation that does not adapt to the changes in its environment is, eventually, doomed to fail. Strategic foresight supports organisations to proactively adapt. In the field of security and defence this is of particular importance. While in the business environment what is at stake is revenues, long-term profitability, investments and jobs, in security policy and defence the stakes are higher – even existential. In an environment where 'fatal error' is not just a figure of speed, adaptation – and failure to do so – carries special significance.

Hence, for the defence ministries and armed forces, looking into the future in search of potential challenges and opportunities is of particular importance since key values and interests of the state could be threatened if the country is not up to the future challenges, or it may lag behind its competitors and opponents if it fails to exploit an opportunity that presents itself.

Even, and especially, in peacetime, to have a capable military prepared for a wide range of possible threat scenarios is akin to having insurance that protects you against unforeseen events with serious impact on life, health or property. This presupposes that alternative futures, including possible strategic shocks, are explored and systematically built into the strategic thinking process.

Moreover, developing military capabilities is a process with often very long lead times: it takes usually years, sometimes decades, to have an operational capability fielded. Even if the decision-making process is swift, it takes a lot of time and resources to develop technology and produce systems, formulate concepts and doctrines and to train skilled forces accordingly. And once in use, key systems often stay in service for decades. Therefore, armed forces' future tasks require assumptions regarding future strategic and operational environment to be made on the decades ahead.

For these reasons, militaries have been among the forerunners in applying strategic foresight and today most modern militaries employ strategic foresight in some form.

While strategic foresight typically includes research aspects, it should not be viewed just as a separate research project. On the contrary, it should be deeply rooted in the strategic planning and decision-making processes. Also, strategic foresight is sometimes seen as being separate from intelligence due to supposedly more speculative nature of foresight, as well as traditional views of intelligence as exclusively 'secret' information. These, too, are problematic conceptions. Intelligence has always dealt with future and uncertainty. A good example is strategic warning intelligence function. When it comes to secrecy, foresight in defence context – similarly to intelligence - usually uses and produces both classified and unclassified information.

Therefore, strategic foresight in security and defence contexts should be seen as a cross-cutting function positioned at the junction / interface of research, planning & decision-making and intelligence (see Figure 1-1).

Figure 1-1: Positioning of strategic foresight in security and defence contexts

Below, we cite several examples of how selected states and organisations delimit the purpose of foresight in support of (national) defence.

Table 1-1: Purpose of foresight in selected states and organisations

NATO, *Strategic Foresight Analysis* (2013)	"The aim of the SFA is to identify trends that shape the future strategic context and derive defence and security implications for the Alliance to 2030 and beyond. It serves as the foundation of the Framework for Future Alliance Operations (FFAO), a strategy document to assist with preparations for the future military capabilities of the Alliance" [27] (SFA methodology is further elaborated in Annex A)
NATO, *Strategic Foresight Analysis* (2017)	"The aim of the Strategic Foresight Analysis (SFA) 2017 Report is to identify trends that will shape the future strategic context and derive implications for the Alliance out to 2035 and beyond. The SFA does not attempt to predict the future, for the future is neither predictable nor predetermined. It provides an iterative assessment of trends and their implications to understand and visualise the nature of the dynamic and complex security environment." [28] (SFA methodology is further elaborated in Annex A)
UK, Ministry of Defence, *Future Operating Environment*	"The Future Operating Environment 35 (FOE 35) document describes the potential characteristics of the future operating environment and is designed primarily to inform UK Defence and security policy-makers and our Armed Forces more broadly on the future Defence capability development; informing the debate on the future and wider conceptual force development." [29]
UK, Ministry of Defence, *Global Strategic Trends*	"Global Strategic Trends (GST) provides a strategic context for those in the Ministry of Defence (MOD), and wider government, who are involved in developing long-term plans, policies and capabilities. Without an impartial strategic context there is a risk that planners, policymakers and capability developers would assume a future that supports their assumptions and bias. This publication seeks to improve foresight and encourage better strategic choices to shape the future we want, build preparedness for alternative futures, and create an organisation that can adapt to the evolving future. Additionally, it aims to alert readers to changes that are likely to become threats but may, if addressed promptly, provide opportunities." [30]
Canada, *Future Force Design*	"Develop and design the future force through a deep understanding of the future operating environment and security risks to Canada and Canadian interests. Enhance Defence's ability to identify, prevent, adapt and respond to a wide range of contingencies through collaborative innovation networks and advanced research." [31] "Assessments of the long-term future military operating environment help to determine the likely characteristics of future conflict, warfare, and warfighting. Future operating environment analysis accounts for both adversary and allied considerations. These assessments help to maintain a measure against which Canada must pace military capability development." [31]
Spain, *Spanish Defence National Foresight Exercise*	"Determining priorities of technological capabilities of defence and relevant players such firms, universities and technological centres." [32]

These statements illustrate the key focus of such projects on the development of capabilities that should help to prepare the military for the future operating environment. This includes the wide range of challenges this environment can bring as well as broader goals such as stretching the organisation's thinking and improving its preparedness for different alternative futures.

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CHAPTER 2 – DESIGNING A FORESIGHT PROJECT

Generating foresight from the foresight project does not just happen and requires careful planning and management. While the basic phases in the Project may look familiar to those accustomed to management theory, they need to be adjusted to specifics of strategic foresight. Some recommendations to be taken into account when designing a strategic foresight project in the context of a strategic environment assessment are provided below. It also includes references to subsequent parts of the handbook as some of the aspects outlined below are further elaborated in separate subchapters.

2.1 INITIATION

At the very beginning of the foresight process, there is a need to clarify the role of foresight and position it in the overall business and planning processes. This basically means to align the project with the organisation's goals and identify the **purpose** of the foresight (why are you doing it, what do you want to achieve by it).

Additional note to the purpose: Several important functions are met by defining the purpose of a foresight project. First, it guides the project design as the selection of analytical and foresight methods is necessarily subordinated to the goal and intended outcomes of the project. The project can have one or several purposes and/or corresponding leading questions. Second, the formulation of a question derived from the stated purpose helps to guide the project throughout all steps of the process and to ensure it does not deviate from its original purpose. Finally, clearly defining the purpose helps to manage the expectations of the stakeholders and prevent them from putting unrealistic requirements on the project. The purpose should always be aligned with the organisation's goals and as such the foresight has to support its decision-making.

2.2 PLANNING

Planning involves several aspects: first you need to decide on basic parameters of your project (framing), then you need to deal with the question of resources and build a roadmap of how to conduct foresight itself.

2.2.1 FRAME THE PROJECT

The most important issues you need to decide before you proceed to any other planning include:

- *problem definition*

This involves identifying the central issue / question / problem to be explored and it should reflect the purpose of the foresight. Problem definition is a crucial step in any strategic environment assessment / strategic foresight project and most other planning and design considerations depend on it. It is often an iterative process and it can take a period of time to arrive at an agreed problem definition. One key question to consider when defining the 'problem' is what decision-making process does the project support? The linkage between organisation's core planning and decision-making processes should be made from the very beginning. At this stage, close dialogue with sponsors and clients (e.g. high-level decision makers and planning officers at MoD, Joint Staff or HQ) and the core team is of paramount importance. Without shared understanding of the aims and objectives, the strategic foresight project has dim prospects.

Additional note to the problem definition: While it is possible to think about the central issue in a single sector, such as technology or the environment, in the security arena you would typically need to approach the strategic environment holistically because of the complex interconnections between the sectors and corresponding trends. This means you might need to break down your central issue (security environment) into individual sectors for further exploration. Different approaches can be used for that purpose. One such frequently used approach is PESTLE – an acronym in which P stands for Political, E for Economic, S for Social, T for Technological, L for Legal, and E for Environmental sector. The PMESII acronym covers the following areas: Political, Military, Economics, Social, Information and Infrastructure. Finally, STEEP is used to account for Social, Technological, Economic, Environmental, and Political sector. [1]

- *time horizon (how far in the future are you going to look)*

We can explore futures in the short-, medium- or long term. The time frame is usually expressed as a round number (2035 or 2040). [1] In this handbook, we delimit the short-term by 5 years, the medium-term by 20 years and long-term projects above two decades. It is important to keep in mind that the more we expand the time horizon, the more uncertainty we decide to let in. [1] However, a longer outlook supports the foresight mindset with its acknowledgement of the inevitable uncertainty and stretching our

1 In NATO, the Strategic Foresight Analysis works with "themes" based on an adaptation of the STEEP tool. A theme refers to "a collection of similar or related trends". The following five themes are used throughout the analysis: Political, Human, Technology, Economics/Resources and Environment. Similarly, UK Global Strategic Trends organises the foresight around five thematic chapters developed specifically for the report as follows: Environment and resources, Human development, Economy, industry and information, Governance and law, and Conflict and security.

thinking accordingly. As summarised by Swanson [2]: "A longer time horizon, like 10 years, can help people abandon the notion of a single point future, consider a wider range of possibilities and recognise that the external environment is always changing in both expected and unexpected ways." On the other hand, a shorter time horizon brings more certainty as there is a smaller probability of trends changing rapidly and greater reliance on the continuity of mega-trends that, in theory, are valid for the next 10 to 15 years. Ultimately, the question of time horizon should be determined by the purpose of the particular foresight project, i.e. organisational decision-making need.

- *geographic scope*

The foresight can be delimited geographically – to a local, regional or global level. However, thinking about the security environment even at a lower level should never entirely ignore developments at the global level. As Hines and Bishop advise: "The domain and its geography just identify what is inside the domain leaving outside influences to drive those changes". [1]

- *classification level*

Think about classification level carefully and soon enough because this may influence resources (personnel involved in the project, written resources), interaction with stakeholders and exploitation. As mentioned earlier, in defence and security contexts foresight is likely to include both classified and unclassified elements, both as source material (e.g. previous planning documents and intelligence reports) and final products.

- *stakeholders*

According to Bishop and Hines, stakeholders refer to "individuals and organisations that work in and could affect the future of the domain". [1] Stakeholder analysis should form an integral part of the foresight project. The analysis should include clients as the end-users of the foresight project and experts[2] and result in a decision about what stakeholders to further engage with (and who should do this). Stakeholder engagement is understood as "the activity of involving and communicating with actors who are potentially interested in, or affected by, a policy issue." [4]

2 There are different ways of categorising the stakeholders. For instance, they can be evaluated according to their interest and power (for further guidance see Reed et al. [3]).

2.2.2 IDENTIFY AVAILABLE RESOURCES

There are different kinds of resources required for a foresight project and the following questions are useful to consider early on:

- How much time do you have to conduct foresight?
- How many personnel are available?
- What are the available financial resources?
- Do you have access to written sources?
- Do you have any tools available to conduct foresight (e.g., software)?

Answers to these questions will influence the selection of methods to conduct foresight.

Additional note on the participation (involved personnel):

There is no fixed number of people who must participate in the foresight project for it to be viable or successful. The ideal number of participants will depend on the purpose as well as the methods employed. This handbook defines three levels in terms of the number of people participating: low (up to 5 people) – medium (6- 20 people) – high (20+ people).

Methods based on interaction will generally require the involvement of a greater number of people than methods based on evidence. The use of different sectors (e.g. PESTLE) will also imply different requirements for the needed expertise and thus personnel involved. It is also important to identify effective ways to engage key stakeholders as participants. These are people who will make decisions based on the project's outcomes or that could be affected by those changes. This will determine the "critical mass" of participants the project needs; "the number of individuals within an organisation that need to be involved in the change initiative over time in order for it to be successful." [5]

In Chapter 4.3, there is more guidance provided in terms of the number of participants needed to use different foresight methods. However, most of the methods can be adjusted according to the resources the given organisation has at its disposal.

2.2.3 MATCH AMBITIONS WITH RESOURCES

Often there is a mis-match between the ambitions of the foresight work and the available resources. In such a situation it is suggested that either the ambitions are adjusted to match available resources or additional resources are secured by, for instance, looking for external resources (personnel, funding, etc.) and negotiating a longer time frame to undertake the work.

2.2.4 BUILD THE PLAN HOW TO CONDUCT FORESIGHT

A foresight process should always consist of several stages. There are several existing frameworks that outline different ways to undertake a foresight project (see chapter 3). Drawing inspiration from the Generic framework by Joseph Voros (see chapter 3.1), they can be summarised as follows:

- gathering inputs (data related to the problem to be explored)
- categorising data, transferring them into information (analysis)
- looking for deeper insights, meanings, and implications (interpretation)
- creating forward views (prospection)

Strategic foresight informs strategy development, planning and decision-making and, as such, the creation of the forward views is not the end of the process. It is important to address the "so-what" question and consider several strategic options. This is sometimes referred to as a "strategy" stage of foresight (it may sometimes be considered to be a separate phase following prospection and preceding exploitation). All stages, including strategy development, should be planned and resourced.

A key aspect of the planning is the selection of a suitable mix of methods, which should match with resources (available time, personnel, expertise) and parameters of foresight process (especially time horizon). This should also take into consideration different sources of knowledge and stages of foresight process (input – analysis – interpretation – prospection). This is further elaborated in the chapter 4.3.

Other key activities recommended (though not an exhaustive list) in the planning of a foresight project are:

- Review the need for external resources (personnel, expertise, information).
- Plan the (tentative) end products (this may have form of final report, executive summary, workshop/conference, briefing materials to senior leadership to support the decision-making, etc.). Keep in mind that strategic foresight serves first of all as input to strategic thinking.
- Schedule briefings to senior decision-makers / stakeholders (regular updates). It is crucial to brief the stakeholders regularly since the beginning of the project in order to increase their awareness of what you do and ensure their support for the project (buy-in). For more information see best practices in the chapter 5.3.
- Assign roles and responsibilities.

2.3 EXECUTION

While executing the delivery plan for your foresight project, it is advisable to maintain dialogue with key stakeholders and senior decision-makers throughout the process. This will maintain customer awareness of the work, their buy-in and enable the work to be sensitive to potential changes in customer needs or other critical conditions. This will help to minimise the likelihood of overlapping, parallel efforts starting and increase the likelihood of the final results being accepted and acted upon. And while strategic environment assessment projects should be fairly stable and not depend on everyday current events, changes in security environment or organisation's strategic direction may have an impact on the strategic foresight project. For instance, significant changes may require the foresight work to re-check its assumptions are still valid.

2.4 DISSEMINATION OF RESULTS AND SUPPORT TO EXPLOITATION

Ideally the foresight process should include a strategy development stage and a separate dissemination stage is not necessary. If this is not the case, the dissemination of results and exploitation needs to be planned and executed as a separate stage. This involves developing strategic environment assessment end products (e.g. reports, briefings, workshops) and supporting the customers in utilising relevant information and insight into planning and decision-making (i.e. exploitation). For more on how to communicate results to stakeholders see best practices in the chapter 5.3 and storytelling in the Annex D.

2.5 EVALUATION AND ASSESSMENT

Evaluation and assessment should follow any kind of project to identify lessons learnt. This can be done by means of a survey, interviewing senior leaders, etc. A key measure of the effectiveness of strategic foresight is decision-making value, i.e. to what extent it has been utilised in the organisation's decision making.

2.6 MONITORING

One of the specific features of foresight is that it should be regarded as a continuous process. It should not end by delivering and disseminating the final product. It is recommended as part of the foresight project that indicators are developed. Subsequently these should be monitored in order to understand what direction the future is unfolding (for instance, which one of the identified futures seems more probable as times go by) and whether key assumptions of strategic plans are changing. This may also inform indicators & warning intelligence. For more information on indicators/monitoring see Annex B-11.

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CHAPTER 3 – EXECUTING FORESIGHT: FORESIGHT FRAMEWORKS

There is not a unique prescribed approach to conducting future strategic environment assessments. Instead, individual researchers and practitioners have been dealing with the question of how to best execute foresight and in doing so many developed their own guidelines for the foresight process (often called foresight frameworks). Foresight frameworks represent integral approaches to the foresight process, they try to provide an answer to the question: ***how to execute foresight?*** The text below introduces some of the most elaborate foresight frameworks:

- Generic framework by Joseph Voros
- Framework foresight by the University of Houston
- Horizons foresight method by Policy Horizons Canada
- Six pillars framework by Sohail Inayatullah

Each framework describes individual stages of foresight to help practitioners conduct their own foresight process; helping the foresight work to follow a clear path. Eventually the frameworks provide advice on which methods are most appropriate for use at individual stages. Although each of the frameworks is unique in some way, they share certain similarities which emphasize the idea that there are some common principles that should be followed in foresight process to achieve good results. At the end of this section, we identify these common elements, as well as recommendations stemming from these four frameworks.

3.1 GENERIC FRAMEWORK BY JOSEPH VOROS

The Generic framework suggested by Joseph Voros [1] consists of four main elements: inputs, foresight, outputs, and strategy. Foresight itself consists of three steps: analysis, interpretation and prospection. Each element is linked to specific actions undertaken as well as methods/ methodologies. To better understand the differences between individual elements, it is useful to focus on specific questions that each element seeks to answer (see the summary in the table below). First, gather information about what is happening (inputs). In the subsequent step (foresight), this information is analysed by progressively dealing with three questions: what seems to be happening (analysis), what is really happening (interpretation) and finally what might happen in the future (prospection)? Once we identify the answers, we can think about what we might need to do (output), and how to do it (create a strategy).

For a foresight process to be complete all the steps need to be performed. Nevertheless, Voros points out that practitioners sometimes skip a few elements. For instance, if the foresight phase is missing, the strategy will be reacting directly to inputs, and is, therefore, a **reactive approach** to strategy development. Voros indicates that a "**shallow foresight process**" exists where only the first step of foresight (analysis) is included and both interpretation and prospection are missing. In this case, strategy reacts to "what seems to be happening", yet it does not look either deeper or forward; it may be responding to the wrong thing. Where only interpretation is left out, i.e. the question "what is really happening?" is omitted, this leads to incomplete results and a "**shallow/ narrow foresight process**".

Voros cautions that to achieve good results, all the steps of the process need to be performed and, importantly, they also need to be considered in advance. This will help to ensure that sufficient time and resources are allocated to the complete process.

Table 3-1: Summary of the main elements of the Generic framework as suggested by Joseph Voros

Elements/steps of the process		Action taken	Questions addressed	Suggested methods	Outcome
Inputs		Gathering information, scanning the environment	Look and see what´s happening	environmental scanning, Delphi, workshops, brainstorming	variety of data, strategic intelligence
Foresight	Analysis	Categorising data obtained (creating order)	What seems to be happening?	emerging issues, trend analysis, cross-impact analysis	trends
	Interpretation	Looking for deeper insights	What´s really happening?	systems thinking, causal layered analysis	deeper understanding of trends
	Prospection	Creating forward views and generating alternative futures	What might happen?	scenarios, visioning, backcasting	alternative futures
Outputs		Considering strategic options	What might we need to do?	workshops	strategic options (reports, presentations)
Strategy		Applying the results to deliver a strategy	What will we do? How will we do it?	strategy development and strategic planning	strategy

Created on the basis of Voros [1]

3.2 FRAMEWORK FORESIGHT BY THE UNIVERSITY OF HOUSTON

Framework foresight developed at the University of Houston consists of six steps (framing, scanning, forecasting, visioning, planning, and acting) defined by Andy Hines and Peter Bishop [2] [3] [4] (presented below). While framing, scanning, and forecasting seek to provide a picture of the future landscape, the subsequent phases (visioning, planning and acting) address the question: "so what?" They help to interpret possible futures and suggest what can be done about them. Here again, the foresight process does not stop with prospection, but it also deals with how to address these findings.

1. Framing: Domain Description

Activity: Scoping the project – describing the domain to be explored in terms of four and eventually five elements:

Domain definition	Defining the scope of the domain, what is and what is not the domain (domain description should be neither too broad nor too narrow).
Geographic scope	Defining the geographic area of the forecast (local, national, regional, global).
Time horizon	How far does it look into the future. Appropriate time horizon may depend on the domain (some domains are more apt for a long term or for short term time horizon than others).
Domain map	Visual representation of key categories and sub-categories of the domain and their interrelations (e.g., by means of bubbles).
Problem statement (optional)	A question to be answered.

Hines and Bishop suggest that each element should consist of five to ten entries.

2. Scanning

Activity: Gathering relevant information to provide a picture of the domain in the present and in the recent past. According to Hines and Bishop it consists of four elements:

Current conditions	List 5 to 10 most important pieces of information about the domain. *Methods: systems mapping, causal layered analysis.*
Stakeholders	Identify the major actors in the domain: key individuals and organisations that are involved in the domain that could affect its future.
History	The key recent events (a rule of thumb: look as far back as the forecasts will project forward).
Scanning hits	Identify and analyse the weak signals of change in the domain.

3. Forecasting

Activity: Describing most likely and alternative futures. It requires considering the *drivers of change* (trends and other drivers – the difference between them stems from the degree of uncertainty):

Trends	Relatively *predictable* drivers of change (*stronger signals of change*). They lead to the expected or *baseline future.*
Other drivers	*Weak signals of change* that carry a higher degree of *uncertainty* and may lead to *alternative futures* (they deviate the trajectory from the baseline future).

BASELINE FUTURE

Expected future stemming from the current trends with no surprises. It is more likely to occur. They identify the following **elements** that contribute to the baseline future:

Trends	Changes that develop in a specific direction over a long period of time. Both positive and negative trends from different sectors (e.g., STEEP approach) should be considered. It is recommended to list the top 5 to 10 trends. Another option is to identify megatrends out of a list of fifty or more trends.
Cycles	Predictable oscillations of some variables.
Plans	Announced intentions by key stakeholders to act in a certain way in the future.
Projections	Forecasts made by others. They may influence people´s expectations about the future and thus increase the likelihood of this future happening (self-fulfilling prophecy).

Hines and Bishop recommend identifying the top 5 to 10 of each. The baseline future is then the result of these four elements and their implications on the domain in the future.

ALTERNATIVE FUTURES

While the baseline future addresses "certainty" – how the present is likely to evolve, alternative futures result from *uncertainties*/surprises that are not easy to anticipate. As Hines and Bishop highlight, uncertainties must be *plausible* rather than possible. While almost anything is possible, plausibility is supported by some evidence (although weaker compared to the baseline) that a specific element might change the future. *Weak signals* defined during the scanning phase can serve to identify alternative futures.

Uncertainties may arise from:

Events	Events that would disrupt, change or even end the current era.
(Emerging) issues	Issues that are currently under debate or emerging issues that could become a matter of debate (if they appear on the public agenda).
Ideas	Ideas that bring new perspectives/visions of the domain.

Key uncertainties are then identified by selecting those events, (emerging) issues and ideas that would have the most significant impact on the domain, while being the least predictable (most uncertain). The most important uncertainties lead to the most important alternative futures.

A variety of **forecasting tools** can be used including scenarios, Delphi, causal layered analysis, morphological analysis, scanning etc.

4. Visioning

Activity: Choosing a preferred future and analysing implications.

Determining the preferred future = a vision (how one would like the future to unfold). The preferred future is then compared to the baseline and alternative futures.	
Implication analysis (determining implications of the baseline and alternative futures).	Choose a future (one by one).
	Choose the categories**:** e.g., stakeholders / categories in the domain map.
	Identify potentially significant implications and changes in each category.
	Use *futures wheel* to identify the implications of the implications (second-order changes).
	Identify the most important implications (with major impact) and the most provocative ones (less likely to occur but having significant impact).
	Reframe these implications as either issues or opportunities.

5. Planning

Activity: Organising to achieve the vision. Planning is the bridge between the vision and action. The objective is to develop a plan (a strategy) on how to achieve the vision (preferred future).

Hines and Bishop determine the following steps:

Prioritise the futures	Use the following criteria: How likely is the future (compared to the others)? How unprepared are we for the future? What will be the impact of the future?
Select the issues or opportunities	Focus on the issues / opportunities stemming from the future with higher priority (based on the three above-mentioned criteria). Three to six issues / opportunities are recommended.
Outline potential options for response to the issues / opportunities	Answer the questions: Why is there a need to respond? What should be done about it (describe action)? How do we make it happen (required resources)? Who is responsible to respond?

6. Acting

Activity: Implementing the plan. It includes **monitoring** (tracking the indicators of change) to see how the key uncertainties develop and as a result, which alternative future is more likely to happen. Given that indicators are specific information linked to specific alternative futures, their change (or stability) signals the changing likelihood of one alternative future or another.

The framework developed at the University of Houston is particularly strong in identifying and prioritising alternative futures, their implications and developing options about how to react. The Houston framework also stresses the importance of identifying and monitoring the indicators of change; emphasising that foresight is a continuous process and not only a one-term issue that ends with forecasting.

3.3 HORIZONS FORESIGHT METHOD

The Horizons Foresight Method was developed by Policy Horizons Canada. The process consists of seven main elements / steps (from framing the problem to identifying implications) as explained by Peter Padbury. [5] The steps are suggested as subsequent, yet during the process, it is possible to go back to the previous step if necessary. Practitioners are encouraged to use a mix of methods to maximise the utility of the output from the process. For instance, scenarios is recommended in one of the steps to explore the futures with different methods suggested for other steps. The main characteristics of individual steps are outlined in the table below.

Table 3-2: Overview of the Horizon foresight method

Step	Description
Framing	• Frame the problem: define the topic to be explored (it is recommended not to define it as too narrow). • Consider the larger systems shaping the issue. • Prepare a simple domain diagram of what is "in" or "out". • Allow it to evolve over the study.
Assumptions	• Identify current assumptions about the issue in question prevailing in the public debate and public policy. • Identify key trends people assume are true. • Summarise key assumptions as a description of the *expected future*.
Scanning	• Scan for *weak signals* that indicate a potentially disruptive change. • Conduct interviews and facilitate dialogue to understand the system.
System mapping	• Identify key elements of the system and describe key relationships. • Use a system map to identify possible areas of change and directions of further scanning for weak signals.
Change drivers	• Use insights from scanning phase to identify *change drivers* (weak signals with significant impact on the system). • Explore *multiple order implications* of these drivers and interactions between the drivers by means of cross-impact analysis.
Scenarios	• Develop scenarios to explore various futures. • Identify potential challenges and discontinuities. • Explore policy challenges and opportunities.
Results	• Test assumptions from step 2 against each scenario for their robustness (identify credible ones and revisit weak ones). • Identify key challenges and opportunities institutions need to prepare for.

Created on the basis of Padbury [5]

The strength of this framework lies especially in its ability to test assumptions about the future and identify emerging challenges and opportunities. However, in contrast to other frameworks, it deals less with the "so what" question. It also points to the possibility of iteration (when the users return to the previous step if needed), which is indeed a recommendation transferrable to whatever framework the users choose.

3.4 SIX PILLARS FRAMEWORK BY SOHAIL INAYATULLAH

Sohail Inayatullah proposed a framework of futures thinking consisting of six pillars. [6] It starts by mapping the past and present, continues by anticipating the future and creating alternative scenarios and ends by identifying how to achieve preferred future or avoid the worst-case scenario. The pillars as suggested by Inayatullah are described more in depth in the following table.

Table 3-3: Overview of the Six pillars framework

Pillar (step)	Activity	Suggested methods
Mapping	Mapping the past, the present and the future.	• *Futures workshop*: identifying the main past trends and events to construct a timeline leading to the present • *Futures triangle* (mapping three dimensions): ▪ images of the future (pulls of the future) ▪ pushes of the present (contemporary drivers and trends that will change the future) ▪ weights (barriers to the change) • The interaction of these three dimensions leads to a plausible future.
Anticipating	Anticipating future issues and their consequences.	• *Emerging issues analysis*: identifying new possibilities and opportunities as well as disrupters • *Futures wheel*: developing multiple order consequences of current issues
Timing	Looking for the patterns in history (is future linear, cyclical, spiral, or is it driven by a creative minority?)	• Unspecified
Deepening	Deepening our understanding of the future.	• *Causal layered analysis* • *Four-quadrant mapping* (inner / outer versus individual / collective)
Creating alternatives	Creating alternative futures.	• *Nuts and bolts*: a functional analysis of the organisation and identifying alternative ways of performing its functions • *Scenarios* (e.g., best case, worst case, outlier, business as usual)
Transforming	Choosing a preferred future and identifying ways to achieve it.	• *Analytic scenario* • *Questioning* • *Creative visualisation* • *Backcasting* (to identify what needs to be done to achieve preferred future or avoid the worst-case scenario)

Created on the basis of Inayatullah [6]

3.5 WHAT DO THESE FRAMEWORKS TELL US?

All the presented frameworks can be understood as meta-methods or multi-methodologies; they use different methods to successfully deliver a foresight project. As such they serve as a guidance through the foresight process, bring consistency to assessments and, as a result, help practitioners undertake a strong foresight project. Although each of the frameworks is unique in a certain way, they share some important common features and point to some of the best practices in conducting foresight.

When it comes to the *sequence of steps*, the Foresight framework developed by the University of Houston and Horizons foresight method suggested by Policy Horizons Canada include what can be called "*a pre-foresight phase*" consisting of defining the problem or area to be explored. They suggest that this area should neither be too narrow nor too broad, instead a certain balance is required. All the frameworks then contain a scanning or mapping step which seeks to identify current and recent developments or as Voros puts it: see what is happening. A subsequent deeper analysis of what is happening creates important inputs for the prospection phase. Only when we have a deeper understanding of the current environment (what is really happening as suggested by Voros), does prospection follow. All the frameworks suggest not to focus exclusively on what is expected to happen but to explore *alternative futures* as well. At the same time, once we know what might happen, we need to deal with the "so what" question: what it means for us, what should we do about it and how should we do it. The presented frameworks call this phase *strategising, acting or transforming*. This final phase should also think about continuous *monitoring* for weak signals and indicators that help identify which direction the future seems to evolve (which alternative future is more probable). Foresight should be a continuous and dynamic process and not an ad hoc activity.

Another important aspect relates to the *methods* used. All the frameworks combine various foresight methods throughout the process (some frameworks are even referred to as "meta-methods"). At the same time, most of them are not strictly pre-deterministic when it comes to methods selected, but they enable practitioners to choose from a variety of methods at each step according to their own preferences. This flexibility enables practitioners to partially adjust the framework to the foresight project. This is particularly valid for the generic framework by Voros who suggests a list of methods that can be used at each step yet leaves the final selection to the user. A disadvantage of such an approach is a need to be familiar with a variety of foresight methods, their usability and the ways they interact with each other. The methods should also be appropriately combined to balance of different strengths and weaknesses; further increasing demands on practitioners. The other frameworks are also flexible, although compared to Voros, they usually presuppose / suggest the use of a specific method in the forecasting phase (e.g., scenarios). However, scenarios may not always be suitable (especially if dealing with the short-term time horizon). Therefore, flexibility is a strength that enables the process to be adjusted to different contexts and circumstances as needed (individual foresight methods are addressed more in detail in the next chapter).

In summary, while there is no one correct way to conduct foresight there are a set of **recommendations** that it is important for foresight projects to follow. Each project should include a *pre-foresight phase* where practitioners define / frame the problem to be addressed (what is and what is not their area of interest). This should be adequately defined (neither too narrow nor too broad). Once practitioners know what they want to explore, they can gather information about the problem / topic. At the subsequent stage this data is categorised (analysis), practitioners then look for deeper insights, relations and implications (interpretation) and then create forward views (prospection). It is also important to note that throughout all the stages it is recommended to use a mix of different methods (for more information see Chapter 4). Finally, thought should always be given to how the results of the foresight work will address the so-what question(s) and ultimately be communicated to and utilised by decision makers. Two more issues need to be emphasised as best practices: first of all, foresight is a continuous process requiring continuous monitoring in contrast to an ad hoc activity. Second, iteration between different steps in the foresight process being used is encouraged. These recommendations have been implemented in the foresight project design outlined in the Chapter 2.

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CHAPTER 4 – EXECUTING FORESIGHT: METHODS

The previous chapter was focused on the steps of a foresight process as presented in existing frameworks. Although each framework suggested the use of some specific methods, none of them addressed the question of how to select them. To fill this gap, this chapter seeks to answer the question ***how to choose foresight methods?***

The issue of methods selection and their combination has been addressed by Rafael Popper, the author of widely used Foresight Diamond, which will be presented at the beginning of this chapter. Afterwards an overview of selected methods is provided as well as a short introduction to their use (for more detailed information about the methods see Annex B). The chapter then addresses the suitability of individual methods in relation to different aspects of the foresight process (such as foresight cycle, available resources, time horizon, etc.); helping practitioners decide which methods to choose to obtain good results. The final part provides examples of possible combination of methods when dealing with a specific task.

The intention of this chapter is to make it easier for practitioners to select the methods based on their specific needs and capabilities (foresight process, time horizon, level of expertise, available personnel, available time, etc.) and provide recommendations and best practices on how to use each method.

4.1 FORESIGHT DIAMOND

As Rafael Popper claims in his paper, [1] that there is neither an ideal combination of methods nor is there an ideal number of methods to be used in a foresight process (although he discovered that there are usually five or six methods combined). Popper claims that the selection of methods should reflect two main aspects: the contribution of each method to the foresight process and ways how methods can be combined.

Popper first categorised foresight methods based on two attributes: nature and knowledge base (referred to also as capabilities). The categories of both attributes and their description as provided by Popper are summarised in the table below:

Table 4-1: Categorisation of foresight methods by Rafael Popper

Attribute	Category	Description of methods	Example of methods
Nature	Qualitative	Qualitative methods provide meaning to events and perceptions. They are usually based on subjectivity and creativity.	Backcasting, brainstorming, citizens' panels, environmental scanning, essays, expert panels, futures workshops, gaming, interviews, literature review, morphological analysis, questionnaires/surveys, relevance trees, scenarios, SWOT analysis
	Quantitative	Quantitative methods measure variables and apply statistical analysis. It is assumed that they use or produce reliable and valid data.	Bibliometrics, modelling / simulation, trend extrapolation
	Semi-quantitative	They quantify subjectivity by means of mathematical principles.	Cross-impact/structural analysis, Delphi, key technologies, multi-criteria analysis, stakeholder mapping, roadmapping
Knowledge base (capabilities)	Creativity (exploratory methods)	Combination of original and imaginative thinking. Creativity-based methods rely on innovation and inspiration.	Science fiction, wild cards, simulation gaming
	Expertise (advisory methods)	Expertise-based methods require skills and widespread knowledge and expertise in the area of focus (the use of subject-matter experts). They often support top-down decisions, provide advice and recommendations.	Expert panels, Delphi, roadmapping, relevance trees, morphological analysis
	Interaction (participatory methods)	Interaction-based methods include participatory and inclusive activities, collaboration between people having different expertise.	Workshops, citizen panels, voting / polling, stakeholder analysis
	Evidence (explanatory methods)	Evidence-based methods rely on reliable documentation and means of analysis (mostly quantitative methods supported by statistical data).	Modelling, scanning, extrapolation

Created on the basis of Popper [2]

Popper then used a diamond consisting of 44 different methods to visually represent his findings. [2] [3] [4] Each of the four sources of knowledge represent one pole of the diamond. The location of a method in the diamond indicates the dominant source of knowledge it uses. The boundaries between these four categories are not so strict and a method can be composed of several sources of knowledge with some being more dominant than others. The different nature is distinguished by a different font style (bold, italics and normal) in the diagramatic version of the Diamond.

Why is this important in terms of selection of methods? It has been suggested by Popper and proven in practice (see the case study below) that a foresight process should use at least one method from each category in terms of knowledge base. This helps practitioners to avoid distorted results. When it comes to the nature of the foresight, Popper noticed that qualitative methods are preferred by futurists although he does not provide any specific recommendation in this context. Authors of this handbook believe that inclination towards qualitative methods might be related to inherent uncertainty of the future (depending on how far out the look is).

Popper´s **recommendations** when it comes to the selection of methods can be summarised as follows:

1. Choose a mix of several methods for one foresight project (5 to 6 should be enough).
2. Select at least one method from each knowledge base category / each pole of the Foresight Diamond to ensure a suitable mix of methods.

Besides the above mentioned two attributes (nature and knowledge base), Popper researched how the selection of foresight methods is influenced by the following criteria as well: foresight cycle (high influence for some methods), time horizon (moderate influence – some methods seem to be more suitable for longer time horizon and vice-versa), territorial scale (sub-national, national and international level – moderate influence), domain/sector (low influence). He also studied how methods are usually combined. For instance, he found that some methods such as literature review, expert panels or scenarios are highly combined with most of other methods (for more details see Popper [1]). These findings served as valuable inputs to our own thinking about foresight methods.

Popper´s findings suggest that practitioners need to be familiar with various methods, their benefits and specifics of their use. To support this, the following subchapter provides an overview of foresight methods with identification of best practices - other recommendations related to the methods are available in Annex B. The objective is to help practitioners decide which methods to use at individual stages of foresight, and how best to use them.

CASE STUDY

Nemeth, Dew and Augier [5] applied the generic framework (Voros, 2003) and Foresight Diamond (Popper, 2008) to diagnose reasons why the Hungarian MoD despite having come to the right conclusions in its foresight process in terms of identified threats, it seriously underestimated their probability and time horizon when they might occur. Although foresight is not about prediction, in this case, the authors argue, the pitfalls could have been prevented. The foresight was undertaken by the Hungarian MoD in 2013-2014 and was focused on identifying threats and opportunities for 2015-2030. The foresight process started with information gathering and was followed by an analytical phase. The latter consisted of identification of trends and drivers, their prioritisation (only those with the highest probability as well as impact on Hungarian defence were considered) and the creation of thematic groups of prioritised drivers and trends. This process led to the identification of both "resurgent Russia" and "migration crisis" however they were not expected to take place in the 2010s and, as the authors state, the analysts believed mass migration was an unlikely event.

The authors try to explain this failure first by looking at the process of the foresight itself. For that purpose, they apply the **generic framework** of Joseph Voros (see chapter 3.1). They found out that Hungarian MoD missed interpretation and prospection of the foresight phase which led to what Voros calls a shallow foresight process. Inputs were systematically gathered and analysed (prioritised and categorised) which is the first step of foresight phase suggested by Voros. The analysts thus addressed the question "what seems to be happening?", however, they did not deal with the questions "what is really happening?" and "what might happen?" As a result, only the most probable future based on the current trends was considered thereby not leaving space for any alternative futures.

Next the authors had a closer look at the methods used by applying Popper´s **Foresight Diamond**. Popper recommends using at least one method from each category of the knowledge base (creativity, expertise, interaction, evidence). However, the Hungarian MoD used only two categories (evidence-based and expert-based methods). Moreover, both of these categories emphasise verified knowledge and facts thus not leaving space for imagination. By doing so, they missed the two categories that would be especially useful for interpretation and prospection phases of the foresight and would help explore alternative futures. Authors interpreted it by the fact that the foresight process was strongly intelligence-oriented and thus over-relying on facts instead of imagination. As a result, it was more focused on the continuation of current trends based on evidence instead of looking for alternative future possibilities.

This case study supports some of the recommendations / best practices identified above: ***need to complete all three stages of the foresight process (analysis, interpretation, prospection) and include at least one method based on creativity, expertise, interaction, AND evidence.***

It is important to stress that this is one case study and there are many others that make similar errors with their foresight work.

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4.2 INTRODUCTION TO SELECTED METHODS

This chapter introduces selected methods focusing not only on practical advice on how to use them, but also on best practices, strengths and weaknesses while also providing examples of their use in the security and defence field (only a short introduction to the methods is provided below while the full description of the methods can be found in Annex B). Although not all are foresight methods per se, they can be used in the foresight process, for example to gather or analyse data. To do the prospection, practitioners first need to collect and process data, which could be created using research as well as foresight methods.

The list of methods contained in this chapter is not exhaustive. The methods were mainly selected by analysing how different governments, academic institutions, and private companies (mostly although not exclusively those acting in the security and defence field) experienced in future strategic environment assessments approach the foresight process. These case studies served to identify the most relevant foresight methods, especially in the security and defence field. Annex B provides some of these examples, illustrating how individual methods have been used in the security and defence field.

BACKCASTING

Backcasting is a method of developing a specific vision for the future (usually although not exclusively the preferred future) and then describing what needs to happen for that vision to come true. This method is therefore based on the so-called reverse logic of inference. Instead of using the current situation as a starting point, the future is defined first and then practitioners focus on how to connect it with the present (identify variables, events and policies that caused the outcomes).

What is it used for? Backcasting is usually used to create scenarios and determine possibilities of their implementation. [1] These might be best case scenarios (preferred future) or even worst-case scenarios – we might want to identify the causes of potential future success or failure. Backcasting might be especially helpful in cases where prevailing trends seem to lead towards an unfavorable future that we want to avoid [2] or simply if we know where we want to go but are uncertain of how to get there. It is also useful when thinking is narrowed too much, for instance by too large a focus on today's concerns. This risks being unable to see opportunities and how things could be different. Finally, it can be helpful when searching for solutions to larger issues (e.g., social, economic and civilisation changes, technological development, sustainability) given that its major asset is for long-term perspective. [3]

BRAINSTORMING

The method is based on a systematic, rapid discussion amongst people from different backgrounds and is aimed at stimulating creative ideas and new solutions to problems. To work at its best, there needs to be respect for different points of view and an open effort to remove internal barriers that may prevent participants from coming up with unexpected ideas.

What is it used for? Brainstorming is usually used at the beginning of a foresight process to generate diverse thoughts about any kind of topic and obtain a broader picture of it. However, it can also be used spontaneously at any point of the process when a group feels "stuck" and needs new ideas to decide how to move forward. The method is aimed at generating as many ideas as possible, which makes it more likely to find the most relevant ones. It also helps to mitigate conflict of opinions and find consensual solutions.

CAUSAL LAYERED ANALYSIS

Causal Layered Analysis (CLA) is a method that aims to provide a deep insight into the area being explored and is a key feeder into creating alternative futures. It is concerned less with predicting a particular future and more with opening up the present and past to create alternative futures. CLA improves understanding of the human aspect of the area being explored. It helps to identify deep seated societal beliefs that may be driving opinions about the future. In doing so, the method lays the foundation for rigorous thinking about the future and, for instance, policy making.

What is it used for? Causal Layered Analysis is particularly useful where a deep understanding of a situation from multiple perspectives is beneficial. For instance, in policy and strategy development, CLA proves useful in ensuring they are robust, efficient, and effective as well as deeper, more long term and inclusive. CLA's five most common uses are mapping the present/future; critically unpacking an issue; creating a preferred future; deconstruction and reconstruction from an alternative worldview; mapping of multiple perspectives leading to a transformed future that integrates difference; and a gaming, role-playing.

DELPHI

The Delphi method is a controlled debate based on a questionnaire inquiry conducted in two or more rounds with a panel of anonymous experts. The objective of the method is to promote a real discussion, which is independent of the personalities of the experts. This objective is achieved both by maintaining the strict anonymity of the participating experts and by providing feedback. All opinions, ideas and suggestions from other panel members are made available to allow each participant to correct, reassess or affirm their own position. The method is implemented in a distance-based manner, today, usually using e-questionnaires or e-mail.

What is it used for? The Delphi method is very effective for exploring the long-term future. In foresight it is used to forecast future developments, find out whether something is desirable (should we want it to happen?), identify the means and strategies to achieve or, conversely, avoid a future condition (what to do and who should do it so that a future situation does or does not occur).

DRIVER ANALYSIS

Drivers of change are major factors (trends and other changes) shaping the future, they are the forces causing a change. Drivers may include trends, projections, plans and potential events. At the same time, three categories of drivers can be distinguished in terms of timeframe: (1) weight of the past (drivers that have resisted change, that are holding us back and create a barrier to a change), (2) push of the present (current trends pushing the present towards particular future), (3) pull of the future (vision about how the future could be different might affect our current decisions and behaviour in order to make that vision come true). Different combinations of these drivers of change result in multiple futures to be considered.

What is it used for? Drivers are used in foresight to map possible futures and anticipate discontinuities by identifying leading forces that could affect the domain or world in future. They are used to identify what features or aspects will have the biggest impact on the future. It is used to better understand the dynamics of change and the spectrum of possible futures. It helps to provide a clearer picture of the future landscape.

EXPERT PANELS

Expert panels are a way to solicit expertise and opinions to inform the foresight process and the products it produces. These panels can be used at any stage of the foresight process. The expertise the panellists bring to a particular aspect of the foresight analysis work can help ensure that a more informed debate is generated around the issue(s) being considered.

What is it used for? In foresight work, utilising expert panels assists in ensuring the inclusion of subject matter knowledge that contributes to developing a more comprehensible and defensible product. As well, the exposure of the core foresight team to expert panellists' insights and knowledge should help facilitate broader as well as more refined thinking in the development of the foresight products. Expert panels are also useful when open-source data on the topic being examined is scarce.

EXTRAPOLATION

Extrapolation is a quantitative method, which is based on extending a trend that has been taking place into the future. This is a traditional and widely used method, which is based on the assumption that the influence of factors and the regularity of their action, which shaped the observed trend in the past, will develop in a predictable or unchanging way and that the trend observed so far will continue to develop in the future.

What is it used for? Extrapolation is practicable only if it is possible to identify the patterns of the past development and all relevant variables that influenced it. Extrapolation is a very popular and relatively easy to use method wherever the above-mentioned patterns can be mathematically described, or, respectively, where the mathematical function that defines these patterns can be identified. Typically, extrapolation is applied in forecasting macroeconomic trends, demographic or environmental development, etc. It is widely used in the preparation of long-term industrial, business, and research strategies in the private sector or in the academic environment, but it also has its important place in the process of creating strategies and conceptual documents of states and international organisations. Typical applications include, for example, the fields of monitoring of the development of global climate change, international migration, population development, economic performance, health situation, etc.

FUTURES WHEEL

Futures Wheel is a structured brainstorming or organised thinking process that leads to a graphical visualisation (a map) of direct (primary) and indirect (secondary and tertiary) future implications of any issue (change, trend, event, decision, technological innovation, new policy, etc.).

What is it used for? Futures Wheel can be used for a variety of purposes: identifying possible impacts of a change; organising thoughts about the development of an event/trend; visualising interrelationships of the causes and consequences; identifying opportunities when assessing how a situation may develop; contributing to strategy development (to promote positive implications and avoid undesirable ones); or creating forecasts within alternative scenarios.

FUTURE WORKSHOP

Future Workshop (also known as Scenario Workshop) is a participatory method specifically conceived to work with people without futures studies training. It takes participants through different steps to analyse, reflect or generate future related content.

What is it used for? Future Workshop can serve several purposes: (1) To engage with a community that is affected or connected to the subject under future research. (2) To generate future data with knowledgeable people without futures studies background. (3) In projects with a strategic angle, it can be used to generate consensus and momentum. (4) To bring in different collectives in a futures research project. And this, in turn, can have different, not excluding, functions: to enrich the perspective, to check some preliminary conclusions, to add contending views, and to comply with participatory requirements. (5) To generate visions for a community or an organisation. (6) To let participants understand the implications of different future options.

HORIZON SCANNING

Horizon scanning is about systematically exploring the environment for signals of change as part of the very first phase of the foresight project (sometimes referred to as the scanning phase) [4]. It helps to better understand changes in the environment and thus identify potential challenges or opportunities [5]. It can either take the form of a one-time project focused on a specific domain and/or period, or – and ideally – it can be a continuous, year-round process [6].

What is it used for? The method allows to track early changes in the environment, which helps to better anticipate and prepare for future developments, identify opportunities that could be exploited and avoid potential harmful surprises. Scanning for weak signals of change is also a form of gathering intelligence as part of early warning [7]. Importantly, horizon scanning helps to expand the organisation's strategic thinking by looking beyond the current trends toward potential change in the future by addressing the question "How will the future be different?" [5].

INDICATORS/MONITORING

Indicators is a method reflecting the assumption that "uncertainties resolve themselves into a singular present as the future gets closer" [8]. It helps to assess towards which one of the alternative futures the present is unfolding itself. They can be quantitative as well as qualitative. Monitoring is a term used for the process of tracking indicators.

What is it used for? Indicators are mostly used to monitor signals of change to assess which of the alternative futures the events head towards. As such, they are the next logical step in a foresight project following scenarios. You can also use indicators to identify and prevent unexpected threats or events as part of warning/indications intelligence. Hines and Bishop differentiate between scanning and indicators, with the former being a broad and open-minded process looking for any signals of change, while the latter are "very specific, targeted pieces of information with a clear link to one alternative future or another" [8].

INTERVIEW AND SURVEY

Survey and interview are methods of collecting data by asking respondents questions for the purpose of analysis. They provide inputs to the foresight process.

What is it used for? A survey is used to gather large amounts of data, generally for subsequent statistical analysis (though they can also capture qualitative information too). As a tool, surveys are mainly used to measure peoples´ opinions about a certain issue. The results can serve as an important input for discussions or research. Interviews aim to gather detailed information about an area of interest (usually interviewing an expert in the given field), enabling a deeper understanding of the area under study.

KEY TECHNOLOGIES

Key technologies, referred to also as "critical technologies", is a method seeking to identify the most important technologies and research developments which may have a significant impact on a certain issue (quality of life, national competitiveness, defence, etc.). It can be also understood as a meta-method using several other techniques.

What is it used for? It aims to identify research and development priorities, and accordingly formulate recommendations / advice to policy makers. It allows informed decisions about research and technological developments to be made that support agreed priorities, for instance,

competitiveness, economic growth, security and improved quality of life. It can be also helpful in long-term strategic planning which also needs to consider potential supply chain issues and vulnerabilities.

LITERATURE REVIEW

Literature review is a survey of published sources on a specific topic. It provides an overview of the current state of knowledge or recent trends related to a given topic.

What is it used for? It is typically used as the first step of research to obtain a better understanding of the topic under study, acquire a picture of where the current state of knowledge stands and gather inputs for subsequent analysis. The objective is to collect and review the existing state of knowledge (already published data and information), and identify different approaches to the issue in question, different perspectives, major topics, problems, eventually gaps in the existing knowledge. It provides inputs for further research, but it also helps to decide the direction of the research, situate the research within existing knowledge, and see how it addresses a gap or contributes to a debate.

MEGATREND ANALYSIS

Megatrends are large, transformative global forces that define the future by having far reaching impacts on global society. Megatrends are typically slow to form; persist for a long time (circa. 10-15 years); occur at a global or large scale; and are visible and well known to everyone. They are the underlying forces that drive trends. Examples include climate change and aging populations.

What is it used for? The method is used to identify megatrends to be explored further with respect to their impact. Megatrend analysis allows a long-term strategy to be created that is proactive, rather than reactive. Given the scale of impact and duration of megatrends, strategy will be fit for the future by taking megatrends into consideration.

MORPHOLOGICAL ANALYSIS

Morphological Analysis (also known as General Morphological Analysis – GMA) is a method for structuring and investigating the total set of relationships contained in multi-dimensional problems. [9] [10]. It provides a structured way to consider wicked problems by breaking them into number of smaller units. Combinations of different units then lead to different scenarios.

What is it used for? GMA is used to "explore possible futures systematically, based on a study of all the combinations of the various elements found in breaking down a system". [11] It is often used in problem solving to map possible solutions and future possibilities. In foresight, it provides a means of generating scenarios.

RELEVANCE TREES

Relevance trees is an analytical method that disassembles a complex issue into increasingly smaller units (sub-topics). The output is a graphic representation (hierarchical or tree structure) of a larger subject enabling a better understanding of different layers of complexity. [12] It is similar to a structured brainstorming or Futures Wheel, yet compared to the later, it has a broader applicability given that it shows any kind of connections, not only cause-effect.

What is it used for? Relevance trees are a useful analytical and planning tool used often but not exclusively in technology foresight. Relevance trees are used to graphically represent a complex issue or a system by decomposing it into individual parts connected by cause-effect or any other relationships. It is often used to analyse and better understand larger problems / challenges or implications of a decision. It helps to identify possible solutions and options and thus can be useful in problem-solving. It is also used to study a goal or objective by decomposing it into partial objectives and tasks, thus helping to create strategies of achieving specific goals.

RISK ASSESSMENT

Risk assessment is a method that serves to determine the level of risk by analysing probability and consequences. Consequence (or impact) refers to the extent to which a risk event may affect a community/enterprise/environment etc. Likelihood represents the possibility that a given event will occur. Risk is then the function of consequence and likelihood.

What is it used for? Risk assessment helps answer the questions: "What can go wrong? What is the likelihood that it would go wrong? What are the consequences?" [13] As a result, it is used to prioritise risks faced by a society, organisation or a state; evaluate risks before deciding whether any treatment is necessary; or to prioritise investments (for acquisition).

ROADMAPPING

Roadmapping allows an entity to identify how to get where it wants to go to achieve its objectives. In more scientific terms, it is based on "the application of a temporal-spatial structured strategic lens" [14] and it usually,

but not necessarily, produces a roadmap. The *roadmap* is defined as "a structured visual chronology of strategic intent" [14]. It visually portrays relationships between capabilities and requirements. As a visual representation of the roadmapping process, it serves as an important communication tool for the strategic intent and plans. *Technology roadmapping* (abbreviated as TRM) is a popular subtype of this method, which has, broader applicability such as "product" or "strategic" roadmapping.

What is it used for? The method has very universal use in support of an organisation's strategy development, strategic planning and innovation. It is popular in the industry, where it helps organisations to forecast science and technology developments as well as to align technology with organisational goals and thus survive and thrive in today's competitive environment. The defence sector usually employs the method to support the technological development of the defence industry.

SCENARIOS

Scenarios help guard against predictions that are too tame or too wild. They give us an informed view into what may happen in the future and in doing so allow us to plan against eventualities. They can capture a wide range of possibilities, identify trends and allow for better informed decision making. They can provide descriptions of alternative futures. Finally, they are not a predictive tool, but rather one that can describe possible futures and identify emerging challenges.

What is it used for? Scenarios are used to identify such things as emerging trends and technologies as well as the security challenges they pose. They can help decision-makers understand and plan for future possibilities by, for instance, testing current assumptions about the security environment, current capabilities and strategies against future threats; identifying gaps that may exist. By presenting new possible futures, scenarios can also be used to encourage the adoption of new ways of thinking about challenges and the opportunities they may offer.

SCIENCE FICTION

Science fiction offers a way to write about realities that differ from our own and that result from such things as new scientific discoveries, new technologies, or different social systems. It then looks at the impact of this change on us. In foresight development, science fiction offers a method to explore numerous aspects of the future whether they be scientific developments, societal changes, climate change, etc. Science Fiction in foresight work takes the form of future oriented stories based on an evidence-based study of such things as future geopolitical trends, technologies, etc.

What is it used for? In foresight work science fiction offers a way to incorporate change across the entire spectrum of our lives, including those in defence and security. Through incorporating technological, climate, defence, social, etc. changes into a narrative that posits how those changes will impact our future, defence planners are able to both see what future challenges may emerge and with this knowledge plan against them. Change and its impacts woven into a narrative form may help planners better visualise what the future may look like.

STRUCTURAL ANALYSIS

Structural analysis is a way of analysing mutually interacting factors (variables) typically by means of cross-impact analysis. The name of the method stems from the fact that it reveals the structure of a system consisting of impact and dependency between variables. The objective is to represent interrelations between the variables and to identify variables that are crucial for the development of the system.

What is it used for? It is used to identify factors essential for the system´s evolution. It is especially helpful to deal with complex issues when a large number of variables need to be taken into account (internal, external, major actors). Moreover, it can help to create a common understanding of a complex problem / issue among a heterogenous group of experts.

SWOT ANALYSIS

SWOT is analytical method used to identify and classify important internal and external factors that are either favorable (strength, opportunities) or harmful (weaknesses, threats) to an organisation (or state or another subject). *Strengths* are understood as qualities inherent to the organisation that create a competitive advantage or areas where it performs particularly well. *Weaknesses*, on the contrary, are those features inherent to the organisation that could improve. *Opportunities* refer to chances for improvement arising from external environment, while *threats* are anything from the external environment that can negatively affect the organisation.

What is it used for? The objective of SWOT analysis is to raise full awareness of the situation and provide a list of major issues that should be considered when drawing a strategy for an organisation (profit from what the organisation

does well, address the shortcomings, minimise risks, and exploit opportunities). It is used to help match the resources and capabilities of an organisation to the environment in which it operates. It enables the question, 'where are we and where can we go?' to be addressed. It thus helps a decision maker choose the most effective course of action. In the security and defence field, it is usually used to assess the current environment, formulate strategies, but it can be also used for evaluation in the battlefield.

TREND IMPACT ANALYSIS

Trend impact analysis is a method invented by the futurist Ted Gordon. He defined it as "a forecasting method that permits extrapolations of historical trends to be modified in view of expectations about future events" [15]. The method follows the assumption that trends change over time and as such challenges the validity of mere extrapolation of trends into the future without considering how unexpected events can alter them.

What is it used for? The method allows us to account for unanticipated events and to evaluate their impact on current trends. By outlining possible future trajectories of the present trends, it provides a foundation for scenario development. It can also help to evaluate how a new technology could affect a certain field, business or company, which makes it particularly useful in the field of armed forces' development.

TRENDS ANALYSIS

Trends analysis is an analytical approach to studying trends – a continuous, incremental change of a variable over time, a general tendency or trajectory of a development over time. Trends can be increasing, decreasing or stable. Their form can be expressed in mathematical functions (linear, exponential, logistic, cyclic, etc) and it is possible for them to encounter random changes if the mean or median value remains constant. Functions can also be combined, such as an increasing trend with cyclic oscillations around the trend value. Due to this characteristic, it is possible to forecast probable development of observed phenomenon by extrapolating trends into the future although there is no guarantee that past trends will continue.

What is it used for? Trends analysis is used to observe and understand main trajectories of development in economic, social, technological or another sector. It enables the identification of probable future developments if no surprises were to occur. In security and defence, trends analysis can be used to identify and understand developments that may shape the future strategic or operation environment and demands on the armed forces of a particular state. It is possible for trends analysis to be used to assess the development of an actor's military capabilities.

WARGAMING

Wargaming is a simulation of a given scenario where opposing sides engage in a series of moves with the overall goal of improving planning. RAND describes wargames as "analytical games that simulate aspects of warfare at the tactical, operational and strategic level. They are used to examine warfighting concepts, train and educate commanders and analysts explore scenarios and assess how force planning and posture choices affect campaign outcomes." [16] Peter Perla writes that wargaming is "a warfare model for simulation that does not involve the operation of actual forces, and in which the flow of events is shaped by decisions made by a human player or players." [17]

What is it used for? Wargaming is used primarily to improving planning. It allows for testing ideas and "what if" analysis as well as to gain insights into how an opposing force would react to actions one may take. It is also used to identify options available to planners and to help them identify risk.

WILD CARDS

Wild Cards refer to low-likelihood (or high uncertainty, hard-to-predict) and high-impact events, events that occur fast and unexpectedly (no time for warning to allow the system to adjust) and provoke fundamental implications. Wild Cards are often categorised according to their plausibility. For instance, Mendonça with colleagues distinguish between: (1) certain surprises: known events, it is certain they will occur, but we do not know when (e.g., earthquakes); (2) imaginable surprises that are probable (e.g., an oil price shock); (3) imaginable surprises that are improbable (a global nuclear war). [18] A separate category consists of unimaginable surprises (unknown unknowns, there is no precedent for them, they are beyond our imagination), yet they are referred to as black swans instead of Wild Cards. In this context Wild Cards are closer to the concept of so-called gray swans: rare but scientifically tractable events. [19]

What is it used for? Wild cards help to better understand uncertainty and to cope with it. They extend the space of possible futures and consequently the option space. They might

reduce strategic surprises. Wild cards challenge to consider very unlikely events and by doing so, complement established scenarios and assessments.

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4.3 METHODS SELECTION IN RELATION TO DIFFERENT ASPECTS OF FORESIGHT

The previous chapters concluded that the selection of foresight methods should not be random, but it should reflect certain specifics of the foresight process. Moreover, as Popper suggests, one method for a foresight exercise is by far not enough. Instead, a mix of five to six methods should be used, at least one from each pole of Popper's Diamond (knowledge base). This chapter seeks to help practitioners decide which methods are suitable for their foresight project.

It is focused on how the selection of methods is influenced by various aspects of the foresight process: stages of foresight process, time horizon, resources (level of proficiency to apply the method, minimum number of personnel and time required to get a good result), and source of knowledge (taking inspiration from Popper´s Foresight Diamond). For each aspect we pre-defined the following categories:

The stages of a foresight process:

- *Input*: can this method be used as the very first part of the foresight process (usually used for gathering data)?
- *Analysis*: does this method enable the transfer of data into information (to put context to the data – categorise them, etc.)?
- *Interpretation*: does this method enable deeper understanding of context and identification of implications, relationships?
- *Prospection*: does this method enable creating forward views?

The project design in chapter 2 suggested that strategic foresight should not end by prospection, but considerations should be always given to addressing a so-what question(s) – a "*strategy*" stage of foresight. However, at this stage, you already have your findings, you only need to think about how these findings can help stakeholders to plan, make decisions, inform strategies. This does not necessarily require generating new knowledge by applying new foresight methods (not to mention that most methods, and especially those used for prospection, already serve to a certain extent to inform strategic options). As this stage will not necessarily influence the process of methods selection, it will not be addressed when dealing with the question how to select methods to do foresight.

Time horizon (how far in the future you want to look):

- *short term* (less than 5 years) – *middle term* (5-20 years) – *long term* (more than 20 years)

Level of proficiency to apply the method:

- low – medium – high

This refers to specific knowledge or know-how you need to have if you want to use a specific method (for example the proficiency needed for interviews is assessed from the perspective of interviewer not the interviewee). Moreover, some methods are classified in two categories because they can be used either in a simple (basic) way or you can opt for a more sophisticated approach which will increase the level of needed proficiency.

Minimum number of personnel / participants to get a good result:

- *up to 5 – 6 to 20 – more than 20* (this number takes into account not only personnel needed to execute the method but also number of participants you need to get involved – e.g., for a survey it also includes the number of respondents needed).

Minimum time required to get a good result:

- *hours – days – weeks* (this also includes preparation time needed to execute a specific method)

Source of knowledge:

- This addresses the question of 'how is the knowledge generated'? Through *evidence, expertise, creativity* or *interaction*? (for a description of these categories, see table 4-1).

Table 4-2: Value of methods in relation to the stages of foresight process

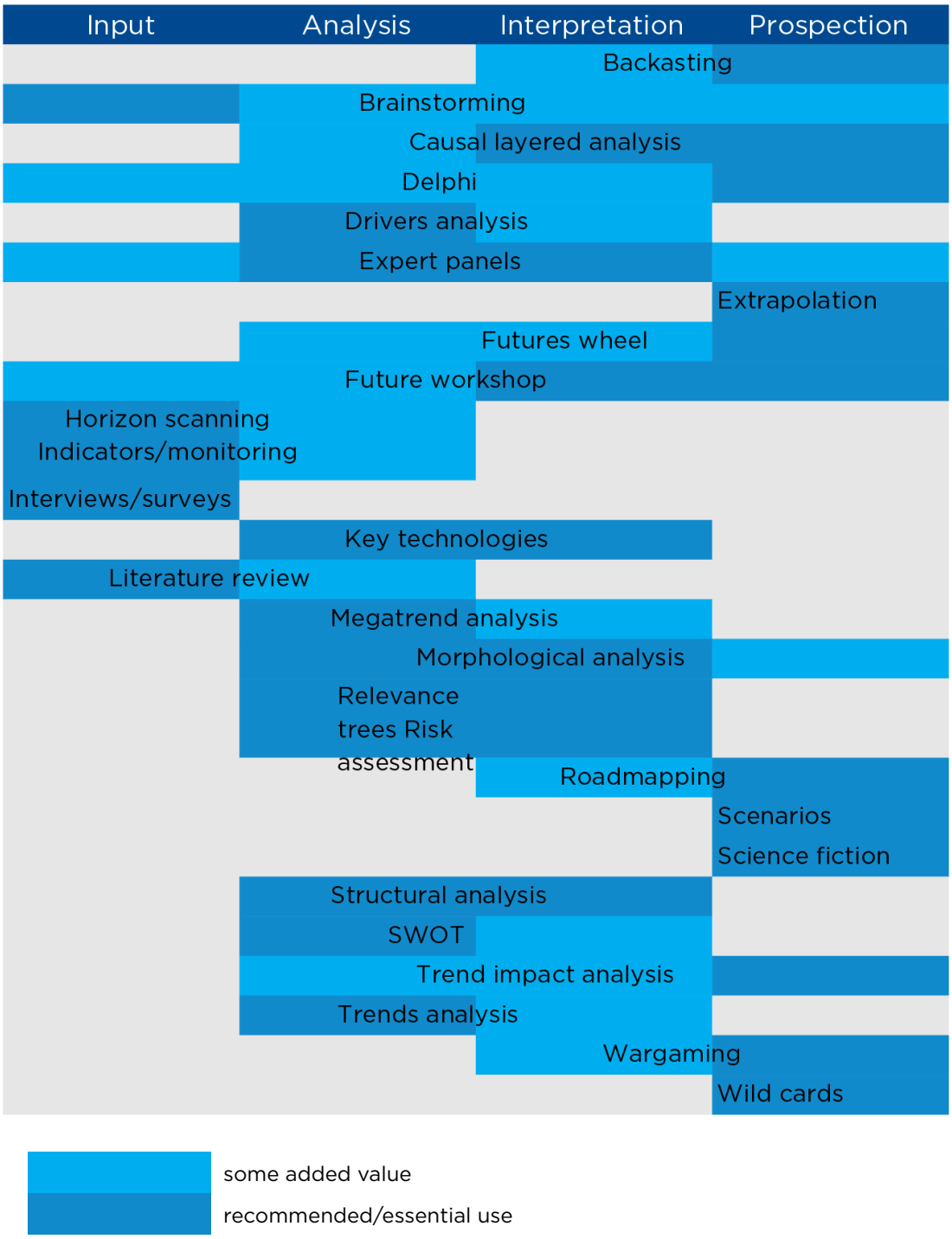
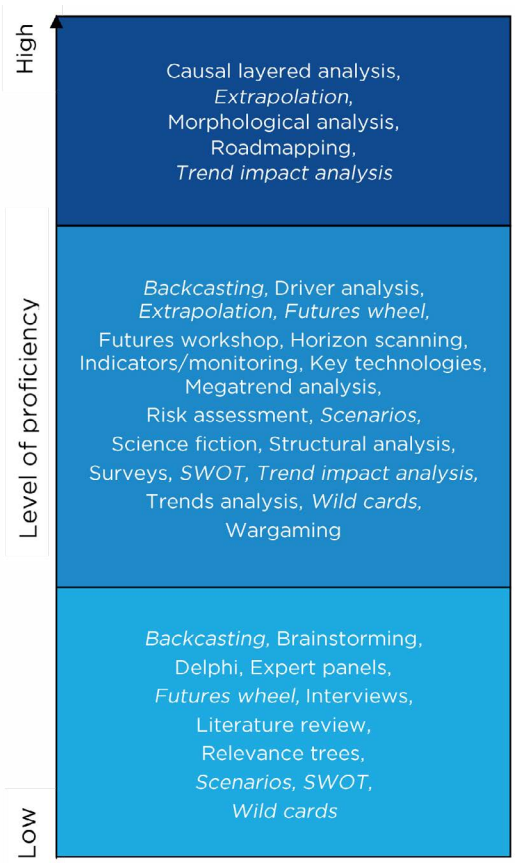


Table 4-3: Usability of methods in relation to the time horizon

*If the value is the same for all three categories, it means that time horizon does not matter and the method can be used for any time horizon with more or less the same success.

no added value
some added value
recommended/essential use



Italics: the required proficiency can vary based on the approach chosen

Figure 4-1: Level of proficiency needed to apply the method

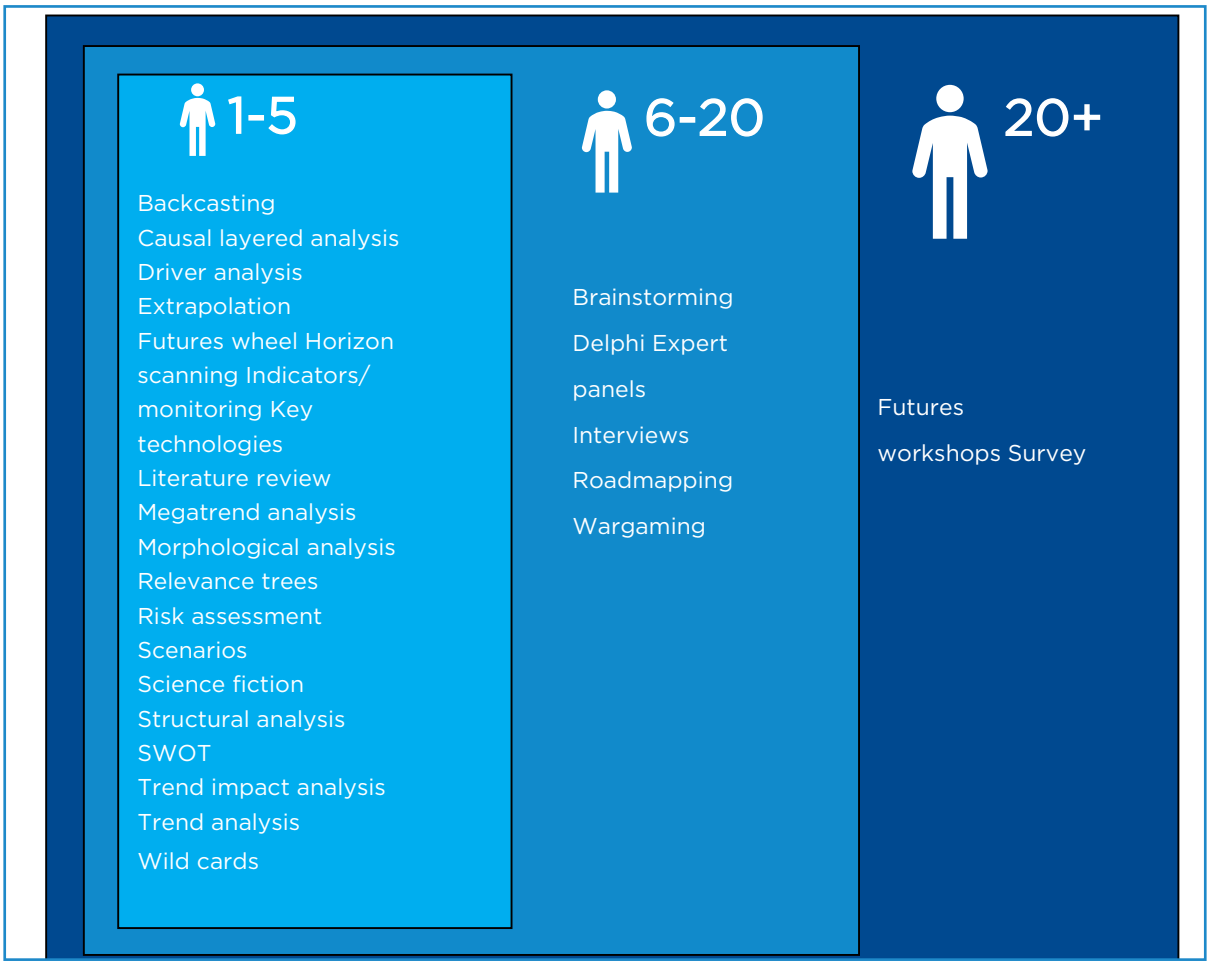
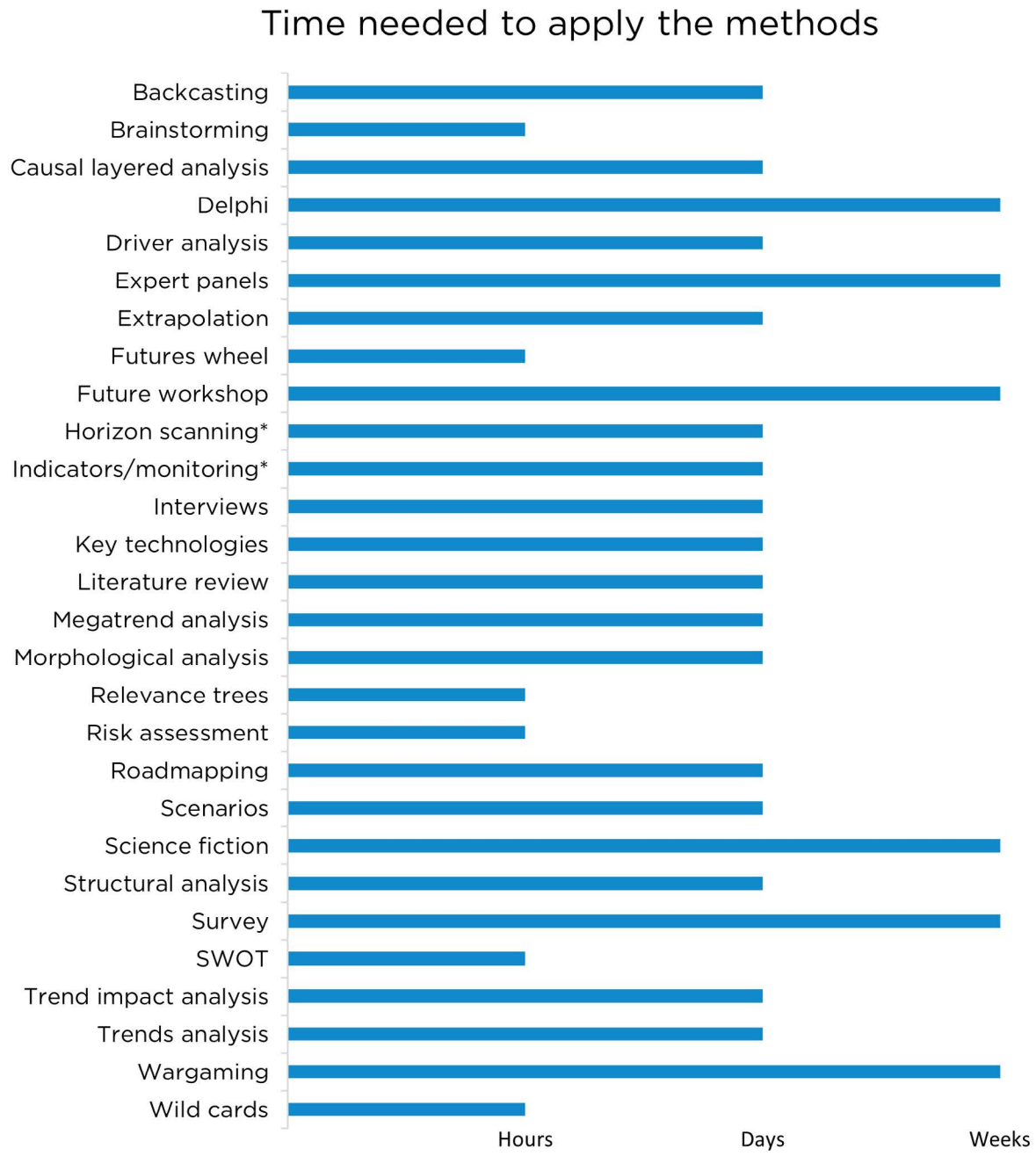


Figure 4-2: Minimum number of personnel/participants to get a good result



* Horizon scanning and indicators/monitoring should be approached as a continuous process.

Figure 4-3: The minimum time needed to apply the method

Table 4-4: Methods in relation to the sources of knowledge

	Source of knowledge			
	Evidence	Creativity	Expertise*	Interaction
Backcasting		■	■	
Brainstorming		■	■	■
Causal layered analysis	■	■	■	
Delphi			■	■
Driver analysis	■		■	
Expert panels			■	■
Extrapolation	■		■	
Futures wheel		■	■	
Futures workshop		■	■	■
Horizon scanning	■		■	
Indicators/monitoring	■		■	
Interviews and surveys			■	
Key technologies	■		■	
Literature review			■	
Megatrend analysis	■		■	
Morphological analysis	■	■	■	
Relevance trees		■	■	
Risk assessment	■		■	
Roadmapping		■	■	
Scenarios		■	■	
Science fiction		■	■	
Structural analysis	■		■	
SWOT		■	■	
Trend impact analysis	■	■	■	
Trends analysis	■		■	
Wargaming		■	■	■
Wild cards		■	■	

■ This source has a primary role in generating knowledge.
■ This source has a complementary role in generating knowledge.
■ This source is typically not used to generate knowledge.

* The application of all the methods requires some expertise, however for some methods it is not perceived as the primary source of knowledge, instead, it serves to increase credibility and relevance of findings obtained from other sources (creativity or interaction) or better interpret results obtained through evidence.

The figures and tables reveal that some methods are more suitable for some categories than others. As a result, the mix of selected methods should reflect specific aspects of the foresight process.

Stages of a foresight process: to make the foresight complete and achieve good results you should follow all the stages of foresight (input, analysis, interpretation, prospection) by using at least one method recommended (or that at least has some obvious benefit) for each stage. At the very first step one can use brainstorming, literature review, horizon scanning, interviews or surveys for the purpose of data collection. Then one categorises the gathered data, for instance by means of drivers analysis, trends or megatrend analysis. For a deeper understanding of environment, one can then use, for instance CLA or relevance trees. Implications can be identified e.g., by a futures wheel. Forward views can then be created by means of backcasting, roadmapping, scenarios, science fiction, wild cards, wargaming, etc. Some methods are most beneficial when used at only one specific moment of the foresight process (e.g., science fiction for prospection), while other methods can be used at several different stages and still lead to good results. So, when selecting methods make sure to include at least one suitable method for each stage of foresight. This will make the foresight process consistent and it will make sure you do not skip any stages.

In foresight it is unusual to start by, for instance, writing a science fiction novel. First a different method needs to be applied (not necessarily a foresight method per se) to gather data (about the current or recent developments), then information is created from this data, bringing context to it (e.g., identifying trends). Afterwards it is recommended to dive deeper in order to improve understanding of the context (e.g., identify implications of these trends). Only then, when there is an adequate understanding of the current environment, can work on creating forward views start (e.g., write a science fiction novel). Following all these steps will help increase quality and relevance of the final product, in this case a science fiction novel.

Time horizon: some methods are more suitable for a short-term time horizon (e.g., SWOT, trends analysis, indicators) while others may be more fit for long-term forecasting (e.g., science fiction, backcasting, CLA). In these cases, it is important to choose a method that corresponds to your selected time horizon. On the other hand, there are some methods where time horizon does not really play a role and they can be used regardless of how far in the future you want to look (relevance tree, morphological analysis, brainstorming, interviews).

Resources: for the purpose of this chapter, a distinction is made between three different types of resources:

- **Level of proficiency to apply the method:** this aspect can be helpful especially for those actors/institutions that lack sufficient expertise or know-how in foresight methods, hence they need to apply those methods that do not require excessive proficiency in terms of their application. On the other hand, the methods which require deep specialised knowledge include for instance CLA, roadmapping, and morphological analysis. At the same time there are some methods that can be used both in a simple or a more sophisticated way, hence the level of proficiency would depend on the approach you chose (e.g., SWOT).
- **Minimum number of personnel to get a good result:** this aspect can help especially those organisations that lack enough personnel for their foresight project and thus seek methods that can be done by a few individuals (up to 5) and still achieve satisfying results. Yet in fact, most of the methods can be done by only a few individuals and lead to a satisfactory result, it is thus easier to focus on those methods that do not belong to this group. For a survey, for example, it is recommended to have more than 20 respondents to obtain valid results (although the questionnaire can be prepared by a few individuals). Moreover, methods requiring higher participation usually include those requiring interaction among several participants. For futures workshops, for instance, it is recommended to involve more than 20 people (although not necessarily to organise a workshop, but to conduct it properly, the number of participants should be higher). More than 5 and up to 20 people are recommended for expert panels, Delphi or wargaming (methods where interaction also plays if not crucial then complementary role to generate knowledge). If you do not have enough personnel and still want to use the method, you may need to look beyond your institution. Moreover, for methods such as surveys, futures workshops and expert panels it is common to include a wide variety of people with different backgrounds coming from different organisations to enhance diversity. Yet at the same time engaging people from beyond your institution may increase costs of the foresight process which not all institutions can afford. Therefore, this question should be addressed during the planning stage to adjust methods to available resources.

- **Minimum time required**: this aspect can be particularly useful if you have limited time to do a foresight project. In that case it makes no sense to use a method that normally requires a longer period (counting in weeks) to achieve good results (including time needed for preparation). Of course, you can reserve more time to apply any method, but the point of interest for us here is what is the shortest possible time frame to apply a method successfully. We distinguish between hours, days and weeks. Methods that can be used quite fast (and spontaneously without any specific preparation) include for instance brainstorming, futures wheel, and risk assessment. On the other hand, there are methods that are much more demanding in terms of time such as Delphi or wargaming. Yet most methods are somewhere in between, and their application requires at least days. At the same time, there are methods such as horizon scanning, and indicators/monitoring the application of which should be seen as a continuous process.

Financial costs were not defined as a separate category although it is definitely an issue that would affect the foresight process. However, when it comes to the methods themselves, costs can significantly differ even for one method depending on whether for instance you organise an in-person or online workshop, etc. Costs of deploying a method can be to a great extent adjusted to existing financial restraints. As a result, available financial resources will not influence the selection of methods for a large proportion of those shared. Instead, it might influence how the methods will be deployed (online or in-person; ability to hire subject matter experts or the need to rely on in-house expertise; use of software).

Source of knowledge: following Popper´s findings we recommend using at least one method from each category of the source of knowledge. The knowledge can be generated either by evidence (e.g., indicators, trends analysis, horizon scanning), creativity (e.g., scenarios, science fiction, wild cards), expertise (e.g., expert panels, morphological analysis, Delphi), and interaction (e.g., brainstorming, futures workshop, wargaming). Each source of knowledge has its own advantages. Creativity encourages thinking out-of-the box and may be especially useful when developing alternative futures; interaction benefits from diversity of views; evidence helps to reduce subjectivity and bias as it relies on exact statistical approaches; while expertise is based on deep insights. The best results are obtained if the mix of selected methods benefits from all of these areas. This helps to avoid, for instance, excessive reliance on intelligence analysis during the foresight process which then does not leave space for any creativity and more out-of-the-box thinking, and vice versa. As a result, you would risk omitting important aspects to be considered which might ultimately lead to distorted results.

When you want to select methods for your foresight project, we recommend you think first about all the above enumerated aspects. You should know how far into the future you will look (your time horizon) as well as what your resources are for the project in terms of time, in-house personnel, and expertise. Only then do we recommend you select methods accordingly. At the same time, bear in mind that you should pick methods from all four sources of knowledge, and that you need to cover all stages of the foresight process. The figures and tables above show how individual methods fit to each category and thus they should help you create your own mix of methods based on your resources and specific aspects of the foresight process (datasets are also included in the Annex C). All together you should use at least five different methods to satisfy all the criteria. An adequate mix of methods fit for your foresight project will increase a chance of achieving good results.

4.4 EXAMPLES OF METHOD COMBINATIONS

This part seeks to provide examples of what methods could be combined to accomplish a specific task. The task has been defined as follows: How will the defence sector need to adapt to technological development? There is no unique way in which to approach this task, therefore the examples provided below are a few of a number of possible ways to address it.

Task: How will the defence sector need to adapt to technological development over the next 20 years?

Example 1:

Method	Purpose
Horizon scanning	To collect data
Key technologies	To generate list of key technologies
Structural analysis	To prioritise key technologies in terms of their impact on defence sector
Futures workshop	To discuss and validate the findings
Wild cards	To identify potential disruptions to the development
Futures wheel	To identify implications of wild cards

These methods do not have to be used subsequently, but they are often used in parallel – one method is used to deploy / complement another one. For instance, during a workshop participants can use wild cards to identify potential discontinuities. Not to mention, that there are various methods that may help you identify key technologies (brainstorming, Delphi, expert panels, etc.).

To verify if this combination satisfies our criteria, the table below has been filled:

Method	Stage of foresight process	Source of knowledge
Horizon scanning	input	evidence
Key technologies	analysis	expertise/evidence
Structural analysis	interpretation	expertise
Futures workshop	interpretation	interaction
Wild cards	prospection	creativity
Futures wheel	prospection	creativity

The table shows that this combination and sequence of methods corresponds to the sequence of individual stages of foresight process and it employs all four types of knowledge sources. These two criteria are thus satisfied.

Example 2: Science & Technology Trends 2020-2040 (NATO Science & Technology Organisation)

A similar task was approached by NATO STO. The findings are presented in the report "Science & Technology Trends 2020-2040". The purpose of the report is "to increase the level of understanding within the Alliance of the potential for S&T developments to enhance or threaten Alliance military operations". [1] The scope is global with the long-term time horizon. Their approach is outlined in the table below (for more information about their methodology, see the full report).

Method	Purpose
Literature review	Overview of the S&T development. Identification of EDT areas that are expected to significantly impact NATO over the period 2020-2040.
Horizon scanning	Continuous identification and documentation of potentially disruptive science or technology.
Trend analysis	Consideration of critical potential synergies between emerging disruptive technologies.
Drivers analysis	Outline the broad strategic context and strategic drivers that will impact defence S&T development.
Trend impact analysis	Evaluation of how S&T may affect the capabilities of the Alliance and potential adversaries in the future.
Workshops	Identification and assessment of the disruptive impact of current and emerging technologies

Method	Stage of foresight process	Source of knowledge
Literature review	input	expertise
Horizon scanning	input	evidence + expertise
Trend analysis	analysis	evidence + expertise
Drivers analysis	interpretation	evidence + expertise
Trend impact analysis	prospection	expertise + creativity
Workshops	prospection	interaction + creativity

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CHAPTER 5 – BEST PRACTICES AND RECOMMENDATIONS: MAKING FORESIGHT ACTIONABLE

Practitioners in foresight often encounter challenges that may hinder relevance or value of their findings. One of the issues that might influence the success of any foresight project is the issue of diversity of thought. The role of diversity in foresight has been underlined in the previous chapter given that most of the methods contained in the Annex B struggle with bias, subjective judgements, group think, while diversity of thought could help overcome these risks. Given the important role diversity plays in foresight, this issue is elaborated separately below. The final part of this handbook then summarises four common challenges often encountered by foresight practitioners and provides a few very concrete recommendations on how to best avoid them and thus make foresight more actionable.

5.1 DIVERSITY OF THOUGHT

This chapter explores the importance of having diversity of thought as part of future strategic environment assessments (FSEA). The future is inherently uncertain and the inclusion of diverse perspectives helps to ensure that a broad view of the how the future may unfold is considered; ensuring the outer edges of the Cone of Possibilites are considered[3]. This in turn will help to ensure stronger risk mitigation and prepardeness for a wide range of possibilities. Without diversity of thought, consideration of the future environment risks being less well considered and more constrained in thinking.

This section will share what diversity of thought means in the context of FSEA, why it is important and share some examples of it in action. The focus is on identifying as broad a range of insigths about the FSEA as possible and the chapter will not explore how to encourage decision makers to take action on the insights generated. The wider handbook provides details of how challenging this can be and shares some lessons around how to improve this.

WHAT DIVERSITY OF THOUGHT MEANS

Diversity of thought refers to a broad range of factors that leads people to think differently from each other. Our thinking is shaped by our culture, background, experiences and personalities amongst other things. Diversity of thought recognises, and values, that there is more than one way to think about something.

It is generally accepted that having diversity of thought leads to more robust & resilient assessments and less strategic surprise. This is because, for instance, it helps to:

- Guard against groupthink and expert overconfidence.
- Ensure broader consideration of issues, increasing the scale of new insights.
- See things that may be blind to others & imagine different futures.

There are also **different perspectives** on why we need divesity of thought

Intelligence

The importance of having diversity of thought is well established within the intelligence world. *"Diversity means different backgrounds, but also various perspectives and ways of thinking, which are not optional but imperative in intelligence."* [1] Seminal work by Grabo [2] higlights the risks of not listening to minority views through to a detailed discussion by Chiru et al. [1] of the importance of Diversity and Inclusion. Carmen Medina, a distinguished intelligence professional, also discusses the importance of diversity of thought. [3] These are just three examples of independent voices that argue very strongly for diversity of thought in intelligence work.

Futures

Futures and Foresight is a collaborative process and there is an underpinning assumption of diversity of thought. This is evident, for instance, with the right hand dimensions on the Foresight Diamond being about participation from a wide range of people. More broadly, the recommendation that all foresight work utilises methods from each area of the Diamond; all foresight work will therefore include multiple perspectives.

Participatory methods bring a wide range of people, including citizens, together to think about the future. New technology offers an opportunity to do this at greater scale, involving more people in foresight work (especially at the input stage). Work conducted in the UK on particiaptory futures highlights the benefits of having diversity of thought in futures work and the increasing importance of this as the world becomes more complex. [4]

3 The Cone of Possibilites is a tool used in futures and foresight work to highlight that there are a range of possible futures. Some of these are an extension of today (probable) where others are possible and some may be preferred. Diversity of thought helps identify more of the possible futures, highlighting those potentially more disruptive.

Finally, the inclusion of a diverse range of thoughts helps to produce a better futures product, such as robust alternative futures storylines. [5]

Psychology

Heuristics and biases are 'mental short cuts' people make to help with decision making; but they can lead to inaccurate judgements. Examples of some are provided below and the inclusion of a diverse set of participants in FSEA work should reduce the risk of them occuring.

- *Group think* – occurs where individuals in cohesive groups are motivated to reach a consensus, rather than presenting alternatives, critiquing a position, or expressing an unpopular opinion. [6] This often results in a less desirable decision being made. This is less likely with a set of diverse views, noting the importance of effective mangement of possible 'diversity tension'.
- *Availability bias* – when making decisions, individuals are more likely to use an example, information, or recent experience that is readily available to them, even though it may not be the best to inform the decision. Having a diverse set of people balances this risk off as what comes to mind is more likely to be varied, reducing the likeihood of a potential over or under emphasis on what may be salient to the foresight work.
- *Mental model* - this relates to a picture we have of how things are, which guides how we interpret all things around us because it influences our expectations and how we behave. Diversity of participants and sources creates a broader mental model and, with foresight work, helps with identification of what may appear to be unusual factors. It also helps surface unstated assumptions about the area being explored.
- *Anchoring effect* - the tendency to rely too heavily on either pre-existing information or the first piece of information (the anchor) when making a decision. There is a tendency to focus on this one anchor rather than taking into account other information. Diversity of thought will help to reduce the likeilhood of this and / or at least ensure there is a broader set of views considered before an anchor of reference point is settled on by a decision maker.
- *Social norms* - the accepted standards of behaviour of social groups. People are influenced by those around them to either fulfil a desire to do what it is believed others are doing, or because of wanting the approval of others (conformity). This is less likely to occur with a diverse set of people, noting the importance of postively managing the diversity tension, to ensure that this is less likely to happen.

WHEN IN THE FSEA PROCESS IS DIVERSITY OF THOUGHT MOST IMPORTANT

As discussed in previous chapters there are different aspects to the FSEA 'process':

- *Input*: first part of the foresight process where the focus is on 'data' collection.
- *Analysis*: bringing context to the 'data' by, for instance, creating information from it.
- *Interpretation*: creating a deeper understanding of the context and identification of implications.
- *Prospection*: creating forward views.
- *Strategy*: addressing the so-what question, informing the strategic thinking and decision-making.

Diversity of thought is important at each aspect and most especially at the input, interpretation and strategy stages. This is where data is collected, which everything else is built from, insights are generated and forward decisions are informed.

WHAT EXAMPLES ARE THERE OF DIVERSITY OF THOUGHT BEING INCLUDED IN FSEA?

There are a number of examples of where a diverse range of participants and, hence diversity of thought, is included in future strategic environment assessments currently undertaken. Below three examples are provided.

NATO Futures

The NATO futures team use a broad network of contacts to provide input to their work, ensuring they have a wide range of perspectives. This includes engaging with different nations, think tanks, industry and academia as an example. The NATO team also recognise the importance of diversity in their development work. For instance, in their work exploring the use of Artificial Intelligence (AI) to support strategic foresight they work with large, global leading companies as well as small start-ups working on AI and Machine Learning data analysis tools. This highlights that it is possible to achieve

diversity of thought in different ways; organisations of different sizes will have different perspectives.

DCDC Global Strategic Trends

The established UK Global Strategic Trends work is a multi-faceted process and at each step of the process diversity of thought is included in both the nature of participants and source material used. For instance, the Strategic Trends work engages a significant number of participants in its input phase (referred to as 'scoping' in the GST process) to ensure as diverse a set of thinking as is practicable is included at the outset of the work. This includes diversity in the nature of organisations (i.e. different parts of government, industry and academia) that participants are from as well as the inclusion of different nations. This highlights the importance of diversity of thought at the input stage and this can be achieved by engaging across a national government as well as more broadly.

Finnish Foresight Forum

Könnölä et al. [5] provide details of a foresight project undertaken in Finland that included 50 experts from across different stakeholder groups and 60 post graduate students. The work was designed to provide "an open-ended instrument for facilitating the generation, dissemination, and assimilation of information in support of innovation activities". Moving forward to present day, Finland so values the inclusion of a diverse set of voices in its foresight work that it established a national foresight approach to ensure a wide range of perspectives in its national foresight work.

SOME ADDITIONAL CONSIDERATIONS

- The concept of divesity of thought refers to written material as well as the people involved in participatory methods. All inputs to the FSEA 'process' should come from as diverse a range of sources as possible.
- The nature of the work undertaken by NATO member countries sometimes means it is difficult to have a diverse range of participants involved in an assessment. However, it is suggested that, we challenge ourselves to what diversity of thought means in the context of a particular piece of work. How can it be harnessed? If going outside the organisation is not possible, is it possible to go across the organisation? Work within the constraints of any given piece of work to include as diverse a set of thinking as is possible. Where the possibility to include diversity of thought is very challening, it is important to be cognisant of the limitations of the work undertaken as a result of this.
- A final, and important point, the environment the FSEA is being conducted within is important too. Having gathered a diverse set of thinkers, the 'safe space' needs to exist to enable the perpectives, that may be counter to the norm, to be shared[4]. Without this, the benefits of having a diverse set of thinking as part of the Future Strategic Envrionment Assessment will not be fully realised. This is explored a little further in the the chapter 5.3 on specific challenges.

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4 Diversity tension refers to the 'stress and strain that accompanies mixtures of differences and similarities. The goal is to harness this difference for the positive, rather than to look to minimise positive tension. Some suggestions on how to effectively manage it are provided by Marshall Goldsmith [6].

OTHER RECOMMENDED SOURCES

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5.2 CHALLENGES AND RECOMMENDATIONS

The foresight project may encounter several challenges and this chapter seeks to help practitioners prevent some of the most common issues; making foresight more actionable.

The most common challenges were identified in four main areas: (1) support for the foresight process and products, (2) relevance and quality, (3) management (leadership of the foresight process), (4) communication of results. A list of recommendations and best practices to address these challenges is provided below.

CHALLENGE 1: INSUFFICIENT SUPPORT FOR THE PROCESS AND PRODUCTS (BUY IN)

As a key benefit of strategic foresight is in its ability to support organisational decision-making, lack of commitment on behalf of the decision-makers themselves is detrimental for the success of any foresight process. Insufficient support for the process often results from the lack of decision-makers' involvement in and awareness of strategic foresight (or its importance) in general and the specific strategic environment assessment project in particular, and it can cause the project to be side-lined by stakeholders (assessed not as a priority). If the senior leadership and other customers do not understand or have faith in the strategic foresight process, there is a high risk of the products / end results being neglected. There are different reasons why this might happen (it can be related even to the lack of resources and time). We provide several suggestions of how to prevent such a development:

1. Engage the key stakeholders actively at all stages of the project (and especially before the start and after you have the product) to ensure you have sufficient support for the foresight project. There are various ways to do this:
    - Support the customers in problem definition and identifying decision-making needs. This stage is easily neglected, as there may be an assumption that "customer is always right". However, analytical support for problem definition is advisable, as well as advice on limitations and possibilities of the project. In practical terms, in the initial phase of the project, a workshop with key customers and other stakeholders can be organised in order to agree on the purpose, aims and objectives and in order to raise general awareness among the clientele.
    - During the project, provide customers with briefings, progress reports, invite customers (both senior leadership and planning officers) to participate in some of the analytical activities (it should be adjusted to stakeholders' availability and your foresight project design). Involvement and other forms of customer sensitisation will also facilitate the exploitation (strategy development) stage as customers are already informed on at least some of the contents.
    - Prepare well in advance for the reporting and exploitation stages by preparing good-quality briefing material (summaries, presentations). Also be sure to offer senior decision-makers (and potentially other stakeholders such as the intelligence community) an opportunity to comment on draft final products before launch.
    - Document the meetings and share the most relevant documentation.

Engaging the key stakeholders will ensure they are well aware of your project and that it is attributed adequate attention. Make sure they know why it is important and have sufficient knowledge about the project. Increased awareness especially at the initial phase of the project will increase trust in the process and its results. Sufficient support for the project also helps to avoid internal competition and turf battles.

2. Sometimes the right terminology makes a big difference, therefore, use vocabulary and language appropriate to local context and professional culture. Foresight itself might be replaced with more acceptable terms (e.g., future strategic environment assessment). Using appropriate language is also part of positioning the foresight project into the organisation's core decision-making and planning processes.
3. Address the discrepancy between the urgency of now (usually promoted by decisionmakers) and the need for long-term views. This can be done by demonstrating the decision-making horizon (e.g., analyses on capability lifecycles), demonstrating the lead times (governments need more time for implementation of legal frameworks etc.), or by demonstrating the impacts of not doing the long-term thinking.

4. Increase diversity to avoid cognitive bias – or accusations of them. By avoiding accusation of bias, diversity also contributes to credibility and buy in. In working with the military for instance, it is often beneficial to include participants / subject matter experts from different services and branches, to avoid accusations of bias. Diversity also helps to avoid a generation gap which otherwise might lead to a different understanding of some specific issues (pitfalls of a generation gap can be addressed also by encouraging constructive dialogue).
5. Customers may want to know how your foresight product compares to strategic assessments by other states and organisations. It is advisable to map different foresight products and compare them with your product to ensure complementarity between different competing products (prepared at national or NATO level, by private companies, NGOs, think tanks, etc). The unity of effort can be also ensured by a central leadership where possible.
6. Address organisational memory challenges (lack of continuity of leadership as a result of election cycle or military staff rotation) by continuous stakeholder engagement, effective information management and documentation (knowledge transfer), building consensus among the end-user community, maintaining awareness and sustaining support for foresight. It also helps to keep continuity between the steps of the foresight process.

CHALLENGE 2: RELEVANCE AND QUALITY ISSUE

Any analytical work supporting strategic decision-making has to meet at least two conditions, and strategic foresight is no different. First, the analytical work must be of good quality (meaning the results are defensible and credible). Second, the product must be fit for purpose, i.e., correspond (be relevant to) the decision-making need of the organisation.

7. Ensure a shared understanding of the purpose and scope through active dialogue and good documentation.
8. Make sure you understand the role of the process in the overall system. Incorporate the foresight process into the wider planning and decision-making process.
9. There is usually a certain risk of compiler bias and the effect of subjective judgements associated with any foresight work. The risk can be reduced in part by enhancing diversity (including the diversity of expertise). To encourage diversity, seek broad representation and then analyse and continuously expand the diversity of your network.
10. The process requires openness of thought; leave space for creative thinking and sharing multiple ideas (divergence) while only later bringing them in and judging them (convergence).
11. During the process use at a mix of different methods pertinent to individual stages of foresight process (input, analysis, interpretation and prospection) as well as covering all four sources of knowledge (creativity, evidence, expertise, interaction), and adequately reflect on your available resources.
12. Do not end with prospection, but as part of the process, address the "so-what" question(s), e.g.: How will your findings inform strategy building, decision-making and planning? What strategic options can be drawn from it? In order to do so, this stage needs to be taken into account and resourced during the planning stage.

CHALLENGE 3: MANAGEMENT (LEADERSHIP OF THE FORESIGHT PROCESS)

Strategic foresight requires different approaches to / aspects of management and leadership to be employed compared with standard pieces of work. By its nature, foresight work is uncertain and benefits from encouraging wide participation. Those leading and managing foresight work benefit from feeling comfortable with uncertainty and having an ability to create a trusting environment to enable different perspectives on the future to be shared. Although foresight work follows a process that needs to be managed the how this is managed to enable quality outputs to be produced is important.

13. Frame of the foresight process needs to be carefully planned and discussed beforehand (including for instance the classification level to get the required clearance).
14. Include resources (time, people, money) in the foresight planning. Address resource constraints through stakeholders buy in, or by matching the level of ambition to resources.
15. Seek to incorporate foresight in the formal planning processes (you might need to describe the foresight process and communicate its value). In case official incorporation is not an option, at least identify, describe and communicate the inputs and outputs.
16. Ensure proper timing and sequencing of the foresight product in relation to other strategic documents. Also consider the update intervals of the foresight product (consider developing indicators to support the revision process).

17. Conduct risk assessment as part of your foresight process and maintain awareness of near-term developments of the security environment (monitoring, indicators) to enhance flexibility and adaptability to sudden changes within the organisation and the security environment.
18. Align different planning perspectives (operations planning x capability development planning) by demonstrating that foresight will support planning at various levels, establishing links (if possible) between the planning documents, and comparing different strategic assessments (short-term and long-term).
19. Think about the specifics of managing a foresight project: diversity, creativity and uncertainty come in to play. It requires openness to differences and an atmosphere of trust.

CHALLENGE 4: COMMUNICATION OF RESULTS

If results of the foresight process are not effectively communicated to customers / clients, the effort risks becoming futile. Communication of results is not an individual act, it is a continuum that begins from the first steps of the foresight process. Moreover, it is not just the act of communicating, but also preparing the ground for communicating the results.

20. Include resources for communication (time, people, money) in the foresight planning process.
21. Increase trust and confidence with your audience (stakeholders) through knowledge transfer by participation. You can use different participatory methods (futures workshop, wargaming).
22. Avoid information overload (think about limits of absorptive capacity) through mixed-method communication. Beyond just one all-encompassing, major final report, it is recommendable to consider product portfolio and tailor-made products, addressing different purposes and customer groups, taking into account the appropriate level of detail and security classification. Immersive approaches such as wargaming or virtual reality are recommended if possible.
23. Consider storytelling as a means of communicating results in a more digestible way (for more information about storytelling see Annex D).
24. Try not to oversell foresight (communicate its limits, clarify that it is not prediction).

5.3 CONCLUSION

This handbook provided a generic framework for conducting future strategic environment assessment based on identified best practices in the field. It deals first of all with foresight project design, which consists of several phases that are common in general management theory (initiation, planning, execution, dissemination of results / support to exploitation, evaluation & assessment, and monitoring). The handbook provides recommendations on how to adjust this process for foresight project management.

In strategic foresight it is crucial to first define the purpose, then frame the project, identify available resources and match them with ambitions. One then needs to build the plan of how to conduct the foresight (including methods selection). This handbook paid special attention to the execution phase (and its planning) which consists of the following stages (adjusted on the basis of Generic foresight framework by Voros):

- Input (data collection)
- Analysis (bringing context to the data)
- Interpretation (deeper understanding of context and identification of implications, relationships)
- Prospection (creating forward views)

However, for a strategic foresight project to fulfil its purpose, prospection should be followed by a strategy stage addressing the "so-what" question(s) (e.g., what strategic options result from your foresight? How does it inform decision-making and strategy building? etc.).

Although there exist a number of foresight frameworks or meta-methods, they often rely on specific methods and are less adaptable to different needs of their users. And even though some of them are rather generic and encourage practitioners to use different methods, they give only a little if any advice on how to select the most appropriate ones. However, the selection of methods is one of the crucial phases of planning that should not be underestimated because it can significantly influence the quality of results. This handbook tried to fill this gap by providing recommendations on how to proceed when selecting the methods for a foresight project. It argues that methods have different qualities, as a result of which they are more suitable for different tasks (collecting or analysing data, forecasting, etc.), they rely on different sources of knowledge (creativity, interaction, evidence, expertise), they may be more fit for a different time horizon, require different levels of proficiency, number of personnel or amount of time to achieve good results. As a result, the selection of methods should be guided by all these aspects. The suggested criteria for selecting a mix of methods (five to six) are:

- The methods should span across the stages of foresight process (input, analysis, interpretation and prospection).
- The mix of methods should generate knowledge from all four sources (creativity, interaction, evidence, expertise). Avoid over-relying on a single one while ignoring the others.
- They should be suitable for your pre-defined time horizon.
- They should reflect your available resources – time, personnel, proficiency (financial resources do not necessarily have to influence the selection of methods, but rather how you use the selected methods).

The handbook demonstrates that there is no unique way to approach foresight in terms of the methods used and argues against the creation of only one methodology that is applied universally in any foresight project. Instead, it recommends that the methodology and selected methods should reflect the above-stated specific aspects of the foresight process, which are usually different for every project.

The foresight product must be then created and properly communicated to pre-identified stakeholders. In this context (and not only), the handbook also provides further recommendations applicable to all foresight projects to overcome some of the most common challenges. It provides advice on how to secure adequate support from stakeholders, how to ensure that results are relevant and sufficiently credible, how to address the issue of leadership and finally, how to communicate the results. One of the issues that kept appearing in addressing effective foresight practices was the need for diversity of thought. Diversity was identified as an issue that practitioners should think about at the very beginning of their foresight project. Inclusion of diversity should factor in the planning phase when deciding who will get involved in the process (yet it should not be limited to participation only, as diversity is important also in terms of sources (of knowledge) used, etc.).

To sum up, this handbook concisely presents the best practices in how to approach strategic foresight in a broad sense (from the very initial phase to the communication of results) with a particular focus on the question of how to select methods and successfully execute foresight. It also provides advice for specific methods, their use, best practices, as well as examples of how methods can be best combined in order to make it easier for practitioners to choose their own mix of methods for their foresight project. Authors of this handbook hope that it will help especially the practitioners with less experience in foresight to consider the most important questions early enough to avoid challenges in the later stages of their foresight project.

ANNEX A – METHODOLOGY OF THE STRATEGIC FORESIGHT ANALYSIS (SFA) 2013-2017 REPORTS[5]

The world is changing in profound ways at an unprecedented rate. These changes will significantly alter how NATO will fulfil its role in the future. Rapid rates of change, complexity, and interconnectedness are making an increasingly uncertain world even more multifaceted and dynamic. Preparing for the future requires an understanding of the future security environment in which the Alliance will be required to operate. The ACT Long-Term Military Transformation (LTMT) programme addresses the full range of security challenges, applies a unifying vision, and advances a conceptual framework for forces and capabilities required to succeed in future operations .

The first component of LTMT, the Strategic Foresight Analysis (SFA), provides a trend analysis that describes the future security environment in order to derive defence and security implications for the Alliance over a long-term environment (15+ years). The second component of LTMT, the Framework for Future Alliance Operations (FFAO), uses the SFA as a foundation and provides the Strategic Commanders' best military advice concerning how the Alliance might transform to be successful in the future security environment. This paper outlines the methodology used to develop the SFA.

A-1 RESEARCH & ANALYSIS

The SFA is an iterative process that examines the trends that are influencing the global environment. The results of this examination are captured every four years in a stand-alone SFA report. Additionally, in between the main reports, at two-year intervals, there are update reports that provide current trend analysis and emergent trend identification. Update reports are delivered especially after a series of disruptive developments change the direction of travel of certain key trends.

SFA reports are based on recent national and international studies that address the timeframe extending at least 15 years into the future. For the first full document, the SFA 2013 Report, an in-depth analysis of more than 60 open-source documents was conducted that focused on the themes, trends and drivers that could influence the future security environment. The goal of the research and analysis was to identify commonalities and differences in future analyses that have been prepared among nations of the Alliance as well as think tanks, academia, and international organisations.

The SFA report focuses on areas with common concerns and interest to the Alliance, in order to create a shared perspective of the future security environment, while still maintaining a global view. Regional differences and their implications at global, regional and local levels are also considered in the analysis. If there are trend areas where nations of the Alliance may have different perspectives, these areas would still be included but with an effort to ensure the area is studied and reported in a manner that is based on compromise and not contradiction. Additionally, to avoid an outcome based on biased views of the Euro-Atlantic region, the views of Partners and many non-NATO countries are also taken into consideration. In this context, future studies from India, China, Australia and Japan within the Asia-Pacific region were reviewed and relationships established to include Global Partners.

A-2 STAKEHOLDER ANALYSIS

As part of the ACT Programme Management Tool, a "Stakeholder Analysis" is conducted to identify the main stakeholders and their role in development of the SFA. The stakeholder list includes the ACT Command Group, Nations, Partners, NATO HQ (IS/IMS), NATO Command and Agencies, Centres of Excellence (COEs), think tanks, international organisations, industry, academia and non-NATO countries. ACT works in close coordination with all stakeholders in order to maintain their involvement and support. The next step focuses on identifying risks posed by these stakeholders and their potential power, interest and ability to influence the development of the future security environment study results.

5 The SFA 2013-2017 Methodology was used as a benchmark in development of STO-SAS-154-RTG: Future Strategic Environment Assessment: Framework for Analysis. It doesn't reflect any recent changes including effects of the NATO Warfare Capstone Concept, Warfare Development Agenda and changes in NATO Defence Planning Process. HQ SACT SPP will update/develop Future Operating Environment methodology that will reflect all these changes in the Futures programme and SFA respectively.

Stakeholder Analysis Matrix					
Stakeholders → Interest Areas	A	B	C	D	E
Authority					
Mandate					
Customer					
Financial/Budget					
Workshop/Conferences					
Project Input					
Engagement					

Figure A-1: Stakeholder Analysis Matrix

After a review of this analysis, a good understanding of the most important stakeholders is developed to help guide efforts to attain their involvement, consent and support. This process helps identification of potential members of the SFA Community of Interest and their contribution in development of any deliverable (report, study, analysis) that would contribute to building the SFA. Stakeholders are classified by their power/ influence and by their interest in the project (see Figure A-2). Plotting each stakeholder position on an analysis map identifies the level of interaction that would occur with each of them. For example, High Power / High Interest stakeholders (top right square) would need to be fully engaged while ensuring the greatest efforts were made to satisfy their interests. High Power / Low Interest Stakeholders (top left square) require enough work to be done with them to keep them satisfied, but not so much that they would become bored with the message conveyed by the project. Conversely, Stakeholders of Low Power / High Interest (bottom right corner) need to be kept adequately informed and regularly consulted to ensure that no major issues arose. Lastly, Low Power / Low Interest Stakeholders (bottom left corner) need to be monitored but not overwhelmed with excessive communication.

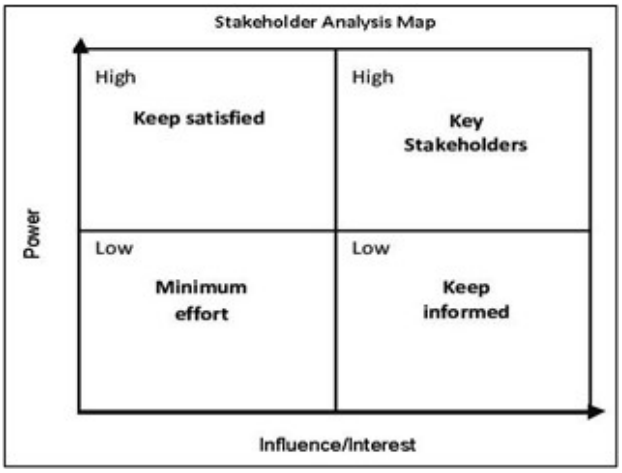

Figure A-2: Stakeholder Analysis Map

Applying grid positions and colour coding, this map indicates whether stakeholders could be expected to be blockers and critics or advocates and supporters of the project. The Alliance Nations are the most important customers, so in order to keep them informed of the SFA project and solicit their support, a solid communication effort was made through their respective National Liaison Representatives (NLRs), who maintained National interaction within the SFA community of interest.

A-3 TERMINOLOGY

The SFA describes the future in terms of themes, trends and implications. For the purpose of the reports, themes, trends, and implications are defined as follows:

a. **Theme**. A theme is a collection of similar or related trends;
b. **Trend**. A trend is a discernible pattern or a specified direction of change; and
c. **Implication**. An implication is the result of at least one trend significantly affecting the defence or security of one or more NATO Nations.

During the initial development of the SFA structure, the term "driver" was included in the descriptors of the future. A driver is defined as a major force or trend that could positively or negatively shape or influence the future. Drivers have a complex relationship with one another; some drivers are an outcome of other drivers, some are reasonably predictable, and others are uncertain. Eventually, it was decided to exclude the Driver section in the trend analysis as it opened far too many areas for controversy. While many members of the Community of Interest (COI) could agree on the SFA trends, there were many disagreements on which drivers were influencing the trend. For example, there was general agreement that the world was undergoing a climate change, but opinions varied concerning whether it was a natural climate cycle of the planet, whether it was purely being caused by humans, or a combination of both. For this and many other trends, it was decided that a description of the trends in detail was sufficient for the sake of determining defence and security implications for the Alliance.

A-4 SFA STRUCTURE

The SFA uses a standard format of chapters for each study area, with an introduction, executive summary and conclusion section to inform the reader and capture the findings. The first chapter describes the general 'Characteristics of the Future'. This chapter sets the 'starting off' point for the analysis of the future, and it was deemed necessary to identify key characteristics of the future security environment if the SFA was going to be successful at capturing how the world was likely to develop over a 15-year horizon. The subsequent chapters examine each of the principal themes, discussing the main trends of global change within that field. Each trend then produces resultant implications for NATO. Lastly, the report summaries the findings and presents them in both paragraph and tabular form for review.

A-5 THEMES

During the initial research and analysis process, several themes and trends were identified within various futures-research papers. To organise the results, a widely-accepted categorisation of themes, the PEST (Political, Economic, Social, Technological) structure, was utilised during the first SFA workshop as a starting point for discussion on how to capture the categories of thought.

Another foresight method that was considered was a method taught on the Houston University Strategic Foresight course that is commonly referred to as STEEP (Social, Technological, Economic, Environmental, and Political). STEEP is used by futurists as a starting set of categories to organise future scanning. It was considered as a foundation for SFA because it offers flexibility as it can be modified to suit the needs of a particular project, such as adding a "C" category for Competitive, or STEEPED, which adds Energy and Demographics as factors in the external environment. Sometimes it is represented as PESTEL (the L and the E stand for Legal and Environmental) or STEEPLE (same as PESTEL with the addition of Ethical). The challenge was to identify those themes which will have security implications and influence future Doctrine, Organisation, Training, Materiel, Leadership and Education, Personnel, Facilities, and Integration (DOTMLPFI) requirements of the Alliance and to then select theme titles that were the best descriptions of the contents.

As an outcome of the discussions in the first two SFA Workshops, PEST was discarded as not being broad enough in theme topics. The STEEP method was adopted but workshop findings recommended that for clarity and alignment with Alliance defence and security frameworks, the themes for the SFA 2013 Report should be titled as Political, Human, Technology, Economics /Resources, and Environment. These themes are defined as follows:

a. **Political**. Includes geopolitical power shifts; regional vs. global interests; concepts of power and security; role of governments, Intergovernmental Organisations (IGOs), Non-Governmental Organisations (NGOs), multinational corporations, and other international institutions;
b. **Human**. Includes demographic changes (age, gender, ethnicity); nationalism; globalisation of information; migration; urbanisation; wealth distribution; ideology; culture; religion;
c. **Technology**. Includes industry; technological advancements (space industry and exploration, miniaturisation, robotics, biotechnology); proliferation of Weapons of Mass Destruction/Effects (WMD/E); communications; computer networks;
d. **Economics/Resources**. Includes globalisation and financial networks; the availability and scarcity of resources (rare earth elements, water, food, energy); decreasing defence expenditures; and
e. **Environment**. Includes climate change; desertification; deforestation; water stresses; natural and man-made disasters.

A-6 TRENDS

A trend is defined as a discernible pattern or a specified direction of change. For example, within the Environment Theme is the trend Environmental/Climate change. The trend is characterised by increasing global temperatures, rising sea levels and warming oceans, receding glaciers, frequent droughts and extreme weather events. Within each theme, trends were identified and then characterised to describe the change that was being seen.

Initial discussion within the ACT Futures Team lead to identifying several trends in each theme. The trend list evolved over time with the inputs from Nations, NATO HQ, NATO command and Agencies, COEs, think tanks and academia during the research, workshops and through the writings of various organisations and institutions conducting foresight efforts. The final SFA 2013 Trends are detailed in the Annex B of the Report. Although these trends aim to provide a baseline analysis of how selected trends are expected to evolve over time, they also provide a menu of choice that could be used by the members of the Alliance to depict their strategic visions.

The SFA 2013 Report does not attempt to provide any analysis on how these trends may interact with one another. Though it was discussed at length, it was decided that there were too many potential variations of trends that could interact to produce vast numbers of outcomes. For simplicity, it was decided to maintain the structure of developing individual defence and security implications from individual trends.

During the second workshop, a large number of trends were developed and discussed. In order to keep the number of trends manageable, and for a trend to be considered as a viable SFA trend, it had to be expected to remain within a future "Cone of Uncertainty." The idea of including trends in a cone of uncertainty comes from the method of describing the future as explained by Dr. Paul Saffo: "A cone of uncertainty delineates the possibilities that extend out from a particular moment or event. The most important factor in mapping a cone is defining its breadth, which is a measure of overall uncertainty. In other words, the forecaster determines what range of events or products the cone should encompass." Therefore, each trend was analysed individually with workshop syndicates in order to reach consensus as to whether or not it would remain within a plausible cone of uncertainty. If not, aspects of it were blended with another trend or it was discarded completely.

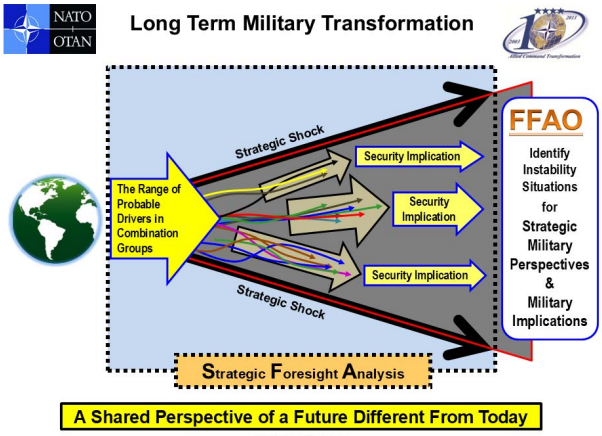

Figure A-3: Cone of uncertainty

Other topics within foresight studies are scenarios known as strategic shocks or black swans. Strategic shock or black swan events are high impact, unanticipated events that can rapidly change the future. These were not included in the SFA for two main reasons. First, the method chosen by the SFA of using trend analysis to derive implications avoids attempting to predict future events or provide scenarios, and thus there was no reason to include them. Secondly, the aim of SFA is to help prepare the Alliance for the future security environment. By the nature of their definition, strategic shocks or black swans are events that an organisation was not prepared for because they fell outside a reasonably conceivable future. Thus, there was little reason to analyse such events beyond highlighting the importance of flexibility and adaptability the Alliance would require should such an event occur. Such events fall more within the realm of the FFAO.

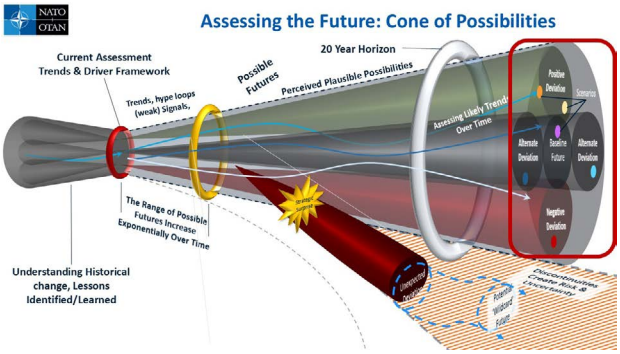

Figure A-4: Cone of possibilities

The SFA report provides a baseline assessment of the future security environment. It does not depict alternative scenarios that further elaborate on potential deviations. Scenarios, alternative outcomes (alternative futures) and/or unexpected events can be described in a think tank, academia or national document. Creating possible future scenarios or alternative futures would make it extremely difficult to achieve the SFA aim: an Alliance-shared perspective of the future. While the SFA 2017 Report does not include scenarios, it includes alternative views on certain issues that represent diverging views on how the future will present itself.

A-7 IMPLICATIONS

An implication aims to answer the "so what" question of what a trend means. An implication is the result of at least one trend significantly affecting the defence or security of one or more NATO Nations. While trends provide the global context, defence and security implications are derived from the global context with a specific focus on NATO as an Alliance or as individual members. Defence and security implications are used to develop policy options to meet challenges posed by a rapidly changing security landscape. Originally, the SFA used the title Defence and Security Implication in that respective section. However, following many discussions concerning implications (whether they needed to be defined as a Defence Implication, a Security Implication, both or something else like an implication involving crisis management), it was decided to simplify the title to solely Implications. Additionally, although

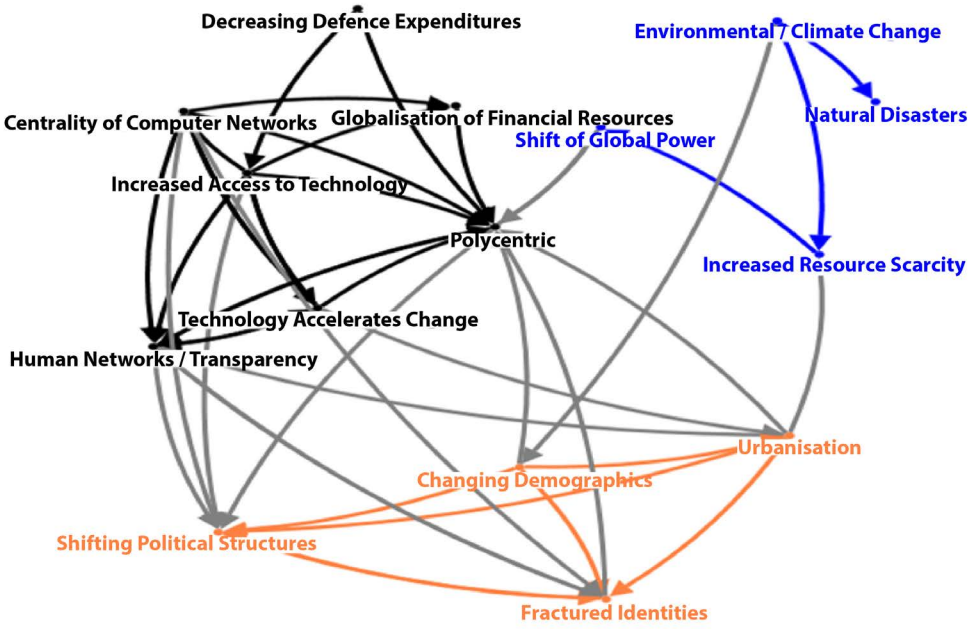

Figure A-5: Implications identification technique

implications are meant foremost to address defence or security challenges, or identify areas of opportunity, for the Alliance, titling them solely as Implications meant they could also be used for long-term planning by Partners, industry, academia and other international organisations, thus keeping these latter participants interested, active and engaged in the COI.

Implications were identified through a robust but rather simple process: cluster analysis that involves grouping different sets of ideas by using alternative analysis techniques. As depicted in the above diagram, this analysis includes identifying links between different entities, which aids the understanding of how one trend might create implications in connection with other trend(s). This process helps to increase where convergence and divergence of trends/implications are materialised.

A-8 CROWDSOURCING AND CONTRACTING ACADEMIA

During development of the initial SFA 2013 Report, the Wikistrat consulting company was contracted to provide a wide range of different perspectives, ideas, insights and understandings of the future security environment. Wikistrat used several analysts and strategic thinkers to evaluate strategic alternatives. It explored alternative global futures that highlighted various challenges and opportunities for NATO over the next two decades. These global futures expressed as 131 individual scenarios distributed across four 'master narratives' were based on a combination of 11 baseline trends identified in coordination with NATO analysts. Though Wikistrat was helpful in the initial development stages of the futures project, now that SFA and FFAO have reached maturity, it is unlikely there will be any need for additional contracting.

The SFA 2013 Report highlights the important trend of changing demographics that will be driven by diverse effects and thus increasing risks of conflicts. A University of Bologna (UoB) project team was tasked to conduct a study that would provide an in-depth analysis of demographic factors that have the potential to cause or exacerbate tensions between nations. The outcome of the UoB study, The Projections and Relevant Effects of Demographic Implications, Changes and Trends (PREDICT) Report, identifies variables that explain changes in demographics; and provides an overview of other demographic studies in order to ascertain commonalities and differences. Considering the existing memorandum of understanding between ACT and UoB, should the need for another in-depth analysis arise that is beyond the expertise or capacity of the Strategic Foresight Branch, UoB is an excellent source for specific research.

Additionally, the Innovation Hub was used as another means to obtain inputs and exchange views with external stakeholders. At the request of the Strategic Plans and Policy (SPP) Directorate in support of SFA, the Future Solutions Branch led a workshop, leveraging crowdsourcing, social media, online collaboration tools and videoconferencing. The first phase of this effort focused on building a broad community of subject matter experts and

involved them in online discussions forums. The second phase, the Exploitation Videoconference, had the objective to elaborate on and synthetise the forum discussions. It brought experts from academia, industry and think tanks from all over the world, both onsite and online. In the third phase, these inputs were collated for reporting. This report provided a summary of the main points expressed during the workshop and constituted the bulk of the response to the SPP request.

A-9 WORKSHOPS

Workshops serve as one of the most important tools for the development of the SFA. When developing the SFA 2013 Report, three separate workshops were dedicated to themes, trends and defence and security implications. These workshops enabled the SFA Team to exchange views on the findings of the research and capture different perspectives from participants that included Nations, NATO Command and Agencies, COEs, think tanks and academia.

The SFA Workshops were used as a platform to gather experts from various areas, all the nations and the whole community of interest. The workshops also allow the interaction with the futures community of interest to be maintained while introducing new ideas to the key stakeholders of the report. These occasions are the vehicle to express ideas, raise concerns and link knowledge. Every workshop has a clear aim that is related to the respective phase of the SFA Report development process. Depending on the step in this iterative cycle, the aim changes appropriately to support either the theme or trend analysis, the derivation of defence or security implications, or the exploration of the characteristics of the future. Regardless of the aim, the organisation or the value, SFA Workshops are based on four prerequisites:

a. **Structure**. The event breakdown mirrors the structure of the SFA Report. Therefore the working syndicates/breakout sessions are aligned with the SFA themes to support the discussions and the analysis. This technique allows participants to focus on specific contents and enables them to draw upon their experience, thereby boosting the debates, creativity, and ideas;
b. **Stakeholder**. The invitation to the SFA workshops is aligned with the earlier mentioned "Stakeholder Analysis". This allows the SFA team not only contact the right entities and experts, but to closely coordinate the progress of the SFA over its complete development cycle. Every stakeholder has the opportunity to be involved, to support the work and to get the best result for their own use;
c. **Allocation**. The allocation of the participants to the different themes and syndicates is based on their responses to an online registration survey. The registration includes a skill survey in regard to the experience in the themes and trends as well as English language skills. It is an internal task to balance the set-up of the working syndicates in regard to knowledge and speaking skills to actively involve every participant; and
d. **Survey**. In final preparation for the workshop, every registered participant is sent an online survey that is based on the planned content of the workshop. This survey gives an opportunity for the stakeholders to influence the content of the event. It also provides a methodological step to test and review the planned working sessions and to prepare the enabling moderators and Subject Matter Experts (SME). Two examples of survey results are depicted below that were used in development of the SFA 2017 Report.

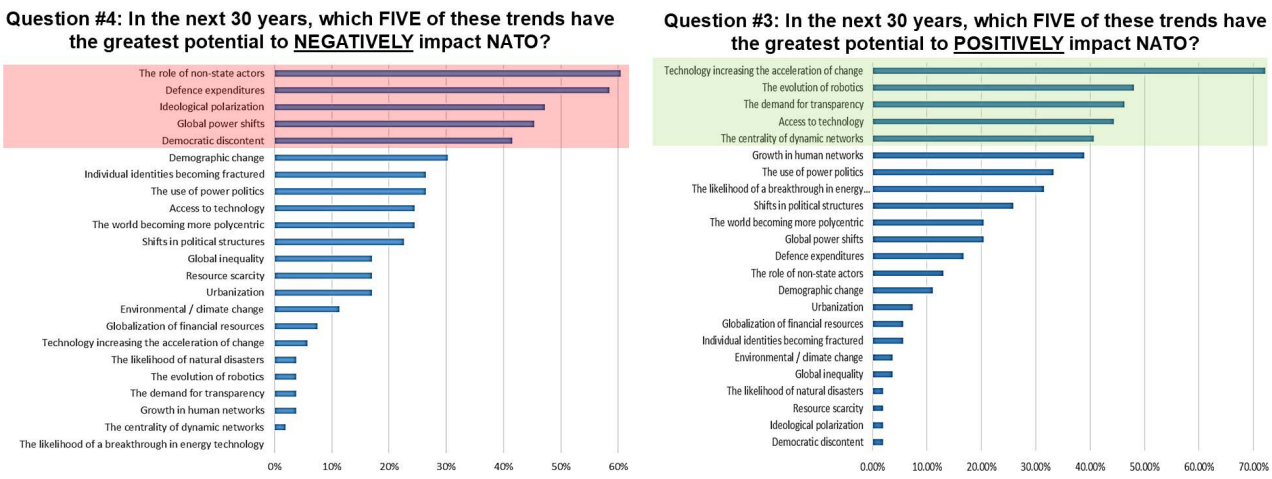

Figure A-6: Examples of survey results used in development of the SFA

The moderators and SMEs facilitate the SFA workshops in their practical execution. It is their responsibility to guide the discussions in regard to the workshop aim and the needs of the SFA development team. Whereas the SMEs are Strategic Analysts or other experts from within ACT, the moderators are mostly experts from academia. This ensures not only up-to-date input for the work within the groups, but also a working process at the appropriate academic level.

To increase participation in discussions and to benefit from each participant's expertise, several brainstorming methods were used during the workshops. These methods were introduced by representatives from the Operational Analysis Branch and used by Moderators and SMEs. Additionally, real-time, online survey tools are used to identify group perspectives, views and tendencies on specific subjects. The Operational Experimentation Branch provided the real-time survey tools for the workshops.

Following each workshop, an update on the progress achieved is provided by the Branch Head to the Deputy Chief of Staff of SPP. This is followed by a formal workshop report that is normally distributed to NLRs, PNLRs and other members of the COI within two/three weeks of the end of the workshop. These workshop reports should be read as a reflection of the discussions during the workshop and breakout sessions but should not be perceived as the views of the Alliance or ACT on any particular subject. The SFA methodology includes three main components: input, development and output. The output involves writing, review and approval processes, including national comments and STRATCOM activities such as a launch event as depicted in the diagram below.

A-10 WRITING

The writing phase includes workshops, a concept test executed by the UK MoD Development Concepts Doctrine Centre (DCDC) or an external entity such as Economist Intelligence Unit, and reviewing comments received from NATO and Partner Nations, NATO Command and Agencies, COEs, think tanks, academia, international organisations and other stakeholders. Throughout the writing process, crosscutting inputs are received from the ACT Directorates. Defence planners also are actively engaged in the writing process.

Concept Test: A group of analysts at the UK MOD DCDC reviewed the first draft of the SFA 2013 Report. The DCDC team looked into the document to identify assumptions, contradictions, logic breaks, and factual mistakes. They also reviewed the number of ideas in each paragraph while also examining the cause-and-effect relationship in and between sentences. The schematic below shows one chapter of the document. The centre indicates

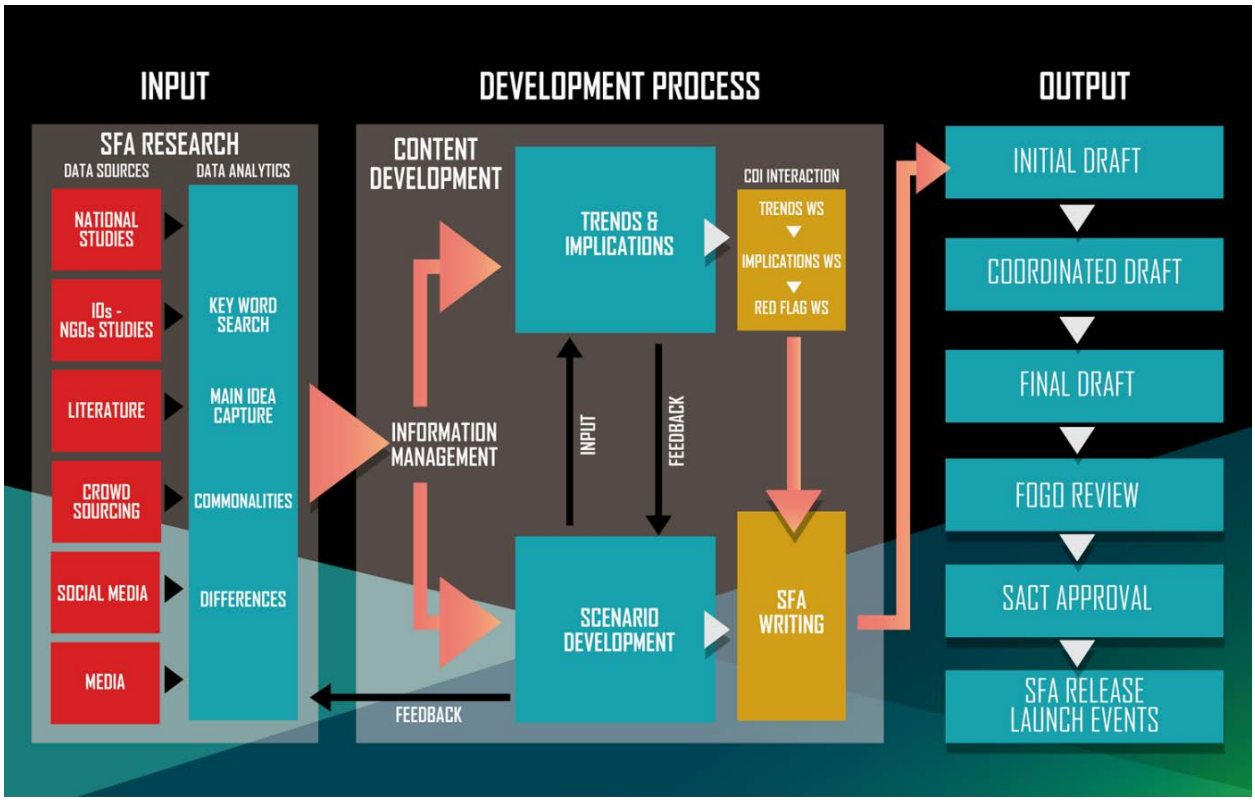

Figure A-7: Components of the SFA methodology

the aim of this chapter. Each box surrounding the central box indicates a paragraph related with the main aim. The circles in each box indicate how each sentence is linked. Those circles outside of the boxes indicate orphan ideas that are not associated with the main idea of the paragraph. The DCDC team was able to identify any orphan ideas (an idea out of place in a paragraph) as well as paragraphs that contained more than one central idea. The DCDC Team provided a feedback presentation and mapping of each theme that included a cause- and-effect relationship, as well as orphan ideas in each paragraph. Their valuable feedback was of great use in refining the content and flow of the report.

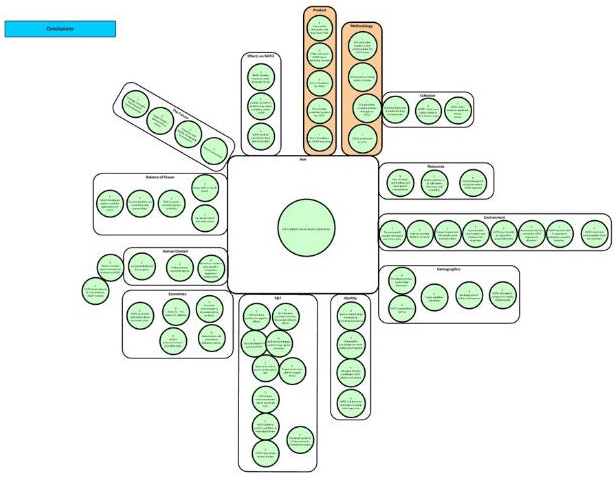

Figure A-8: A schematic of the concept test

Circulation for Comments: The whole process was open, transparent and collaborative in nature. The SFA 2013 Report was circulated twice for comments. A standard format comment matrix was utilised and distributed with detailed instructions, including on how to make comments. Returns to the SFA team could then be quickly and easily captured within a consolidated matrix for review. In order to have an objective view of the comments, a separate Review and Adjudication Team of four individuals from outside the SFA team was established to review comments and provide recommendations to the SFA writing team.

To achieve an uninterrupted review work effort, an isolated location was chosen for the review. In the case of the 2013 Report, two breakout session rooms at the Joint Forces Staff College (JFSC) were used, one for the writing team and one for the adjudication team. In development of the SFA 2017 Report, the Blue Heron conference at Little Creek base was utilised to avoid daily work distractions. The review process used a focused method similar to DCDCs concept test procedure where a document is reviewed one paragraph at a time in great detail. To accommodate a coordinated review team's effort, each paragraph of the report was printed off on a separate piece of paper and posted in order on the walls of the adjudication team room. The comment matrix was then printed out and all comments related to individual paragraphs were posted adjacent to their relative paragraph. By this method, the review team was able to see all comments received for each paragraph and thus take them all into careful consideration before recommending any changes to the writing team. A liaison officer was designated to establish the link between the review team and the writing team.

In order to increase buy-in and national ownership of the report, all comments were integrated when it was recommended by the review and adjudication team. Any comment that was rejected would receive a detailed justification from the Adjudication team. Final decisions on whether to include any comments remained with the writing team/SFA team lead.

A-11 FOGO REVIEW

When the draft SFA 2013 Report reached the level of maturity to be reviewed by ACT FOGOs, a new task was created in the HQ Tasker Tracker system to get comments and concurrence by the HQ SACT divisions. At this stage, the Command Action Group (CAG) was informed and kept abreast in development of the SACT Foreword. In order to get SACT's approval, CAG was involved much earlier than the decision briefing. Their comments were included in the document, and CAG Director/ Members were invited to visit the Joint Forces Staff College during the review process.

At the same time, the document was also forwarded to a professional editor for review and feedback. As soon as this feedback was incorporated into the document and the Deputy Chief of Staff (DCOS) concurrence accomplished, the draft was presented to COS ACT, and an SACT IPR was scheduled. As soon as the In-progress Review (IPR) was scheduled, CAG was provided with the slides and a draft Foreword that was finalised in coordination with them. SACT was presented the document and his approval obtained. The SFA 2013 and 2017 Reports were forwarded by SACT to NATO Secretary General (SECGEN) before it was released to the NLR/ PNLRs.

A.12 DESIGN & PRINTING

In parallel to this process, the SFA 2013 Report was forwarded to Fort Eustis to a professional designer. The SFA 2017 Report was designed by Graphics section of the HQ SACT. The documents were reviewed several times by the SFA Team to avoid

any mistakes while it was prepared for printing. Funds should be made available for professional design and printing in order to make sure future SFA documents are properly developed and provided to the community of interest and Nations.

A-13 SFA UPDATE REPORTS

The main SFA reports, released every four years, support the NATO Defence Planning Process (NDPP) during Step 1, development of the Political Guidance. Reflecting the process of Update reports in general, the aim of the SFA 2015 Update Report is threefold: first, to review existing trends identified in the SFA 2013 Report; second, to identify any emergent trends that will be further developed in the SFA 2017 Report; and finally, to maintain the transparency of ACT futures work through open collaboration with NATO, Partner nations, academia and industry. In development of the SFA 2015 Update Report, a Gap Analysis workshop was conducted to identify emergent trends whilst providing a review of the trends identified in the SFA 2013 Report. Additionally, ideas that require further analysis for the SFA 2017 Report were also captured. The summary of findings and existing/emergent trends were included in the SFA 2015 Update Report.

ANNEX B – METHODS USED IN FORESIGHT

B-1 BACKCASTING

Backcasting is a method of developing a specific vision for the future (usually although not exclusively the preferred future) and then describing what needs to happen for that vision to come true. This method is therefore based on a reverse logic of inference. Instead of using the current situation as a starting point, the future is defined first and then practitioners focus on how to connect it with the present (identify variables, events and policies that caused the outcomes).

What is it used for?

Backcasting is usually used to create scenarios and determine possibilities of their implementation. [1] These might be best case scenarios (preferred future) or even worst-case scenarios – we might want to identify the causes of potential future success or failure. Backcasting might be especially helpful in cases where prevailing trends seem to lead towards an unfavorable future that we want to avoid [2] or simply if we know where we want to go but are uncertain of how to get there. It is also useful when thinking is narrowed too much. For instance, by too large a focus on today's concerns, which risks an inability to see opportunities and how things could be different. Finally, it can be helpful when searching for solutions to larger issues (e.g., social, economic and civilisation changes, technological development, sustainability) given that its major asset is for long-term perspective. [3]

How to use it?

Step 1: Defining a specific vision of the future (usually the preferred future). This can be given by the customer or created ideally by a diverse set of people. It is usually based on the organisation's long-term goals.

Step 2: Describing what needs to happen for that vision to be achieved. First, determine what makes the vision different from the present. Then identify all possible variables that may affect the outlined future and establish the causal relationships between them. This will help you to create a timeline of variables (you can even develop the timeline into a fishbone diagram – identify issues that need to happen for a variable to occur).

Step 3: Creating the action plan for the vision to come true. Finally, you can prepare one or more plans on how to achieve the vision (eventually how to avoid it in case of worst-case scenario) and make the necessary changes happen (what you can do to influence those variables that you can control or how to increase (or decrease) the likelihood of the variables out of your control). The final plan will constitute a relatively accurate forecast of the future development, the end result of which will be the future outlined at the beginning.

Strengths

Backcasting helps to distance thinking from the immediate considerations of the today and near future. It supports creativity and non-linear thinking about the future, which can lead to surprising, non-standard ideas. As a result, it avoids the pitfalls of simply extrapolating the present conditions when talking about the future.

Weaknesses

Starting from the future vision may lead to unrealistic plans and expectations disjointed from organisational realities (e.g., resource constraints, or organisations ability to shape its environment). Moreover, there is a risk of not including a variable with significant impact which might affect the outcome. To avoid this problem, deep knowledge is expected from participants. Moreover, to keep it relevant, it may need constant updating (yet as a result it can be demanding on resources and time).

What other methods is it usually combined with?

Backcasting usually goes hand in hand with roadmapping, which is especially useful when planning the path from today to the future vision. Different visions of the future can be developed for instance by futures workshops, science fiction, or Delphi analysis. Identification of variables/changes necessary to make the future happen usually benefits from scenarios.

Is any software or other tools required?

No specific software is required, however multi-scenario simulation software can be helpful [4].

Best practices (recommendations and tips how to best employ the method)

It is recommended that backcasting is applied to general assumptions in the distant future (for long-term time horizon). When developing visions of the future, it can be beneficial to involve people with a high level of creativity (e.g., science fiction writers are distinguished by such skills). It is also

recommended to engage stakeholders already at the early stage of the process when developing the preferred vision of the future. Identifying variables then requires involvement of people with deep knowledge in the given field. It might also benefit from a diverse set of participants who will have a broader view on potential variables.

At the same time, the resources and influence of the organisation using backcasting needs to be considered. In the context of strategic environment assessment, individual nations or even alliances are usually not in the position to plan a path towards a preferred future or even change the future strategic environment. Hence, it is usually more practical to begin with defining the organisation's own long-term vision (e.g. future defence concept as the starting point). To be meaningful, this requires close dialogue with and involvement of the organisation's leadership.

Example of use in the security and defence field

Jamie Collier used backcasting to identify hypothetical hazards in the cyber threat intelligence (CTI) industry. [5] The objective of his study is to highlight potential hazards and pitfalls and consider how to avoid them and thus improve CTI. The author based his study on the vision of turbulent 2020s leading up to 2030 with the CTI industry having almost completely collapsed. Then he discussed reasons behind this development (e.g. intelligence in isolation, distorted threat landscape, talent shortage, market conditions). Subsequently, the author provides recommendations on how these identified pitfalls can be addressed to avoid the outlined scenario (the fall of CTI). The actionable steps include providing practical advice in marketing and intelligence reports, adopting a collaborative approach, embracing intelligence as an educational tool, providing better guidance for future talents. Although the author considers the provided vision of 2030 as highly unlikely, still, he believes that the reasons behind the scenario should be taken seriously to enable CTI to thrive. His example shows how backcasting can be used not only to achieve a desired future, but also to avoid worst case scenarios.

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B-2 BRAINSTORMING

The method is based on a systematic, rapid discussion among people with different backgrounds and is aimed at stimulating creative ideas and new solutions to problems. To work at its best, there needs to be respect for different points of view and an open effort to remove internal barriers that may prevent participants from coming up with unexpected ideas.

What is it used for?

Brainstorming is usually used at the beginning of a foresight process to generate diverse thoughts about any kind of topic and obtain a broader picture of it. However, it can also be used spontaneously at any point of the process when a group feels "stuck" and needs new ideas to decide how to move forward. The method is aimed at generating as many ideas as possible, which makes it more likely to find the most relevant ones. It also helps to mitigate conflict of opinions and find consensual solutions.

How to use it?

In the preparation phase, first define the purpose of brainstorming and the main topic to be discussed and then identify the participants, date, place and form of discussion. Discussion itself is the key activity of brainstorming. It should follow several rules: (1) No criticism or condemnation of ideas. (2) Participants can express themselves freely and without any constraints. (3) All ideas and suggestions are constantly recorded and on display for everyone (e.g., on a flip chart or posted on the wall). [1] The session is led by a facilitator / moderator who not only explains the rules but also helps to maintain the dynamics of the session, encouraging participants to come up with ideas. The facilitator / moderator also plays a key role in ensuring that everyone is able to participate and to manage over dominant participants.

Finally, the ideas are evaluated ideally a few hours or days after a brainstorming session. After this time lapse, the participants will comment on the suggestions and ideas brought up during brainstorming. They do not continue discussing them, but comment on their quality or validity, for example, by scoring or prioritising them.

Strengths

The method is cost-effective in terms of time as well as financial resources and is applicable to any kind of topic under discussion. It enables a large number of diverse and original ideas and suggestions to be generated fast and encourages experimentation with new ideas; often leading to unexpected solutions. It can be used quite spontaneously when needed. Brainstorming encourages all the participants feel involved in the process through their involvement in the problem solving and, often, sharing the responsibility for the outcome. A properly guided brainstorming session is a stimulating and enjoyable (and fun) activity for the participants, taking place in an open and creative atmosphere. Dedicated brainstorming sessions provide mental space that supports free expression of ideas and divergence. It is possible to make an online brainstorming with participants all over the world, however, it might be quite challenging to conduct brainstorming virtually with the same level of success.

Weaknesses

The effectiveness and results of brainstorming may be influenced by negative attitude and reluctance of participants to engage openly in the discussion, e.g., due to the negative relationship with the moderator, negative attitude to the session, inappropriate composition of the group, dominance of some participants over others, etc. There is also a risk of groupthink. Moreover, the effect of brainstorming is largely reduced if the discussion involves negative criticism and condemnation of some ideas.

What other methods is it usually combined with?

Brainstorming is an alternative to brainwriting (when ideas are first written down) and mind mapping (visual representation of generated ideas). It can be used at the beginning of process before any other method to collect ideas. In fact, brainstorming is very flexible meaning that it can be used with most other methods to generate ideas.

Is any software or other tools required?

There are many available online tools to enable virtual brainstorming[6], however it cannot really substitute the benefits of a face-to-face session. Wikistrat's platform for instance can be used to reach and brainstorm with a large group of experts regardless of their geographic location.

Best practices (recommendations and tips how to best employ the method)

Preferably 6-12 people should participate at brainstorming (during the selection process think about diversity). If possible, try to conduct physical sessions instead of virtual ones. A room with seats in a U shape and a flipchart in the middle is recommended. At the same time, the setting

6 Examples of such tools can be easily found online, see for instance Norlyn Opinaldo [2] or Jessica Day [3].

should enable everyone to move freely. The overall time of one brainstorming session should ideally not exceed 30 minutes. To achieve the desired effect, brainstorming should be conducted in a relaxed, comfortable and stress-free atmosphere, where participants can fully concentrate on solving the problem. Evaluation and critical judgement of collected inputs should only be allowed at the final stage of the discussion (ideally after a certain time lapse) in order to prevent disruptions to the flow of ideas, the impact of possible prejudices, and not to discourage others from expressing their thoughts.

Example of use in the security and defence field

In person brainstorming is a common practice to stimulate thinking on security and defence issues. Security Jams is an examples of an organised online global security brainstorm, which aims to bring together stakeholders and experts in security and defence (representatives from governments, armed forces, NGOs, civil society, academia, journalists, and others) from all over the world. On this unique online platform participants look together for solutions to contemporary issues. Several moderated sessions on different topics run in parallel for several days to enable people from all over the world to join and share their ideas and solutions. The ultimate objective is to come up with "recommendations and innovative ideas on how to make our world a safer place" which are then to be presented in a report. [4]

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B-3 CAUSAL LAYERED ANALYSIS

Causal Layered Analysis (CLA) is a method that aims to provide a deep insight into the area being explored and is a key feeder into creating alternative futures. It is concerned less with predicting a particular future and more with opening up the present and past to create alternative futures.

CLA improves understanding of the human aspect of the area being explored. It helps to identify deep seated societal beliefs that may be driving opinions about the future. In doing so, the method lays the foundation for rigorous thinking about the future and, for instance, policy making.

CLA explores issues at four levels: litany; systemic perspective; discourse / worldview; and myth / metaphor. There are some differences between the different layers, such as:

- The time to enact change is different at each layer with litany mainly short term and myth / metaphor potentially long term, i.e. generational.
- Who addresses the issue(s) at each layer is different. At the litany level it is generally a government or organisation moving through to partnerships, including individuals and voluntary associations. In comparison to the myth / metaphor level where it is likely to be leaders or artists.

What is it used for?

Causal Layered Analysis is particularly useful where a deep understanding of a situation from multiple perspectives is beneficial. For instance, in policy and strategy development, CLA proves useful in ensuring they are robust, efficient, and effective as well as deeper, more long term and inclusive. CLA's five most common uses are mapping the present/future; critically unpacking an issue; creating a preferred future; deconstruction and reconstruction from an alternative worldview; mapping of multiple perspectives leading to a transformed future that integrates difference; and a gaming, role-playing.

How to use it?

Causal layered analysis needs a clearly expressed purpose or question to ensure that the entire process is focused and is generally undertaken in a workshop setting. Suggested steps to take are:

Step 1: Define the issue to be explored.

Step 2: Brainstorm each of the four layers of CLA in sequence. For instance, onto post-it notes and clustering these into themes for each layer. The list below provides an example of how the nature of what is shared and captured at each layer differs.

- Layer 1 (litany): Analyse the litany of current events, trends and conditions.
- Layer 2 (systemic perspective): Analyse the causes, such as STEEP factors, the intent of government, relationships and systems.
- Layer 3 (worldview): Explore the world view. These will be deeper matters of discourse, values and cultural structures.
- Layer 4 (myths): Explore metaphor, or myths. These are emotive, less-specific, heart-felt issues and archetypes.

Step 3: Discussing what has been shared.

Step 4: Creating a scenario: Select/create an alternative myth. Then work in reverse order, upwards, through the layers to create the scenario with more brainstorming.

Strengths

A key strength of CLA is the depth of understanding it provides about an issue. Much of this is realised due to its collaborative nature and the diversity of perspectives it includes. This enables deep and rigourous thinking about the future. As a result, CLA is able to support the development of more comprehensive policies and strategies. Increasing the likelihood that policy actions generated are sustainable.

Weaknesses

CLA is fairly complex to understand. Some of the weaknesses related to CLA are that it:

- needs a clearly expressed question to be prepared,
- requires participants to be willing to share their perspectives and challenge their assumptions about the area being explored,
- may constrain action through 'analysis/ paralysis',
- may reduce individual creativity since it categorises reality instead of allowing for a free–for–all visioning,
- needs time,
- requires experienced facilitator.

What other methods is it usually combined with?

CLA may also become part of a larger foresight process. For instance, in the Six Pillars model, CLA is used in the deepening process. [1] It has also been used in conjunction with emerging issues analysis, scenario development, backcasting and visioning.

Is any software or other tools required?

No specific software is required.

Best practices (recommendations and tips how to best employ the method)

CLA is useful to explore a topic as its strength is in providing a deeper understanding of a situation. This, in turn, increases the richness of subsequent output. For instance, with scenario planning, CLA scenarios will enable a rich set of scenarios to be created at different levels of the situation. Litany–type scenarios are more instrumental, social level scenarios are more policy–oriented, and discourse/worldview scenarios attempt to capture fundamental differences. Myth/metaphor–type scenarios are equally discrete but articulate this difference through a poem, a story, an image or some other right–brain method. Taking the example of parking spaces in urban centres, CLA will help to create scenarios such as:

- a short-term scenario of increasing parking spaces (building below or above),
- a scenario which examines telecommuting,
- a scenario which distributes spaces by lottery (instead of by power or wealth),
- a scenario which questions the role of the car in modernity (a carless city?), or deconstructs the idea of a parking space, as in many Third World settings where there are few spaces designated "parking".

Example of use in the security and defence field

Example 1: Cybersecurity: Mapping

CLA was used to map the issue of national cybersecurity from the worldviews of police, consumers, Internet providers, civil liberty organisations, the government and citizens. This resulted in a much clearer understanding of the different perspectives related to national cybersecurity and led to an appreciation of why national cybersecurity strategies were failing. Citizens, for example, did not consider the federal strategy urgent and important; privacy advocates challenged the legitimacy of the national strategy as they believed it to be "a fairy tale" employed to gain additional state powers; and police felt they were continuously falling behind as failure became routine. The use of CLA identified that actions required to address the challenges with the cybersecurity strategy included taking onboard the different worldviews. [2]

Example 2: A Layered Approach to Horizon Scanning: Identifying Future Issues in Military and Veterans' Health

The Centre for Military and Veterans' Health, Australia undertook a horizon scanning process to identify issues in military and veterans' health services delivery for a series of future scenario workshops. This involved the use of CLA amongst other methods to explore the issues. The work concluded that ,the CLA approach to futures studies can usefully be applied to the preliminary activities of horizon scanning and issue identification'. In particular, the work valued hearing the different worldviews and the ability to get behind the facts and figures. [3]

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B-4 DELPHI

The Delphi method is a controlled debate based on a questionnaire inquiry conducted in two or more rounds with a panel of anonymous experts. The objective of the method is to promote a real discussion, which is independent of the personalities of the experts. This objective is achieved both by maintaining the strict anonymity of the participating experts and by providing feedback. All opinions, ideas and suggestions from other panel members are made available to allow each participant to correct, reassess or, on the contrary, affirm their own position. The method is implemented in a distance-based manner, today, usually using e-questionnaires or e-mail.

What is it used for?

The Delphi method is a very effective method for exploring the future in longer time horizon. In foresight it is used to forecast future developments, find out whether something is desirable (should we want it to happen?), identify the means and strategies to achieve or, conversely, avoid a future condition (what to do and who should do it so that a future situation does or does not occur).

How to use it?

Preparation phase includes a definition of the problem / topic to be discussed by the participants. It is followed by the selection of participants and the preparation and distribution of the questionnaire for the first round.

Execution phase consists of conducting several rounds of questions. If the first round results in a consensus of a significant majority of the panel members, the final stage of the method is reached. As a rule, however, no consensus is reached after the first round, and therefore the questionnaire and the obtained responses are sent again to the panel members, who are able to adjust their positions based on them. Each participant provides opinions on the responses of others, regardless of the possible extreme nature of their positions and opinions. The questioning may involve several rounds over a longer time horizon until consensus or synthesis of ideas of the panel members is reached. In the subsequent rounds you can even slightly adjust your questions based on received responses (e.g. first ask participants to identify certain factors, then provide them the list of all identified factors – duplications removed – and ask them to choose top ten). Finally, provide participants with the list of the most important factors and ask them to rank them, which enables the identification of priorities. [1])

Summary: after the questioning is completed and consensus is reached among panel members, the responses and suggestions obtained are summarised and usually a report is drawn up.

Strengths

Clearly, the major strength of the method is its ability to explore objectively and without emotion the chosen issue, where consensus needs to be reached. This method is ideal for obtaining information on future general trends or the desirability of a particular phenomenon or condition and formulating strategies to achieve it. The strength lies also in anonymity which ensures that opinions are heard without bias (the influence of the position and reputation of the expert is removed) and it helps to prevent the risk of groupthink. Moreover, written form usually makes respondents to answer to the point, and be clear in expressing their ideas. Given that it can all take place in the virtual world, it decreases costs significantly.

Weaknesses

The success of the method is critically dependent on the choice of participants or their professional qualities, the scope of their interdisciplinary insight and their willingness to participate in a time-consuming process. Presence of one or more panel members who insist strictly and without change on their (especially extreme) views can have a negative impact and make it difficult to achieve consensus and synthesis across the panel. A major weakness of the method is the tendency for it to become quite time consuming. Depending on the range and complexity of the studied problem, the questionnaire can be distributed in several rounds and the length of the entire process can be in the order of weeks or months (one round typically takes 3 weeks, a three-round Delphi process from 3 to 6 months, including summarising and drawing up the final report).

What other methods is it usually combined with?

The Delphi method is usually conducted by means of survey. It is useful in combination with scenario writing or roadmapping. An expert panel or a workshop can be organised at the later stages of Delphi either to replace a round (although at the expense of anonymity) or to present, verify and discuss the findings.

Is any software or other tools required?

A software can be used to conduct Delphi and analyse results, e.g. Stat59 (https://www.stat59.com/about/delphi-method-software) eDelphi (https://www.edelphi.org/), welphi (https://www.welphi.com/en/Home.html) although it is not a prerequisite and it is possible to execute Dephi via email.

Best practices (recommendations and tips how to best employ the method)

When you are selecting participants, think about diversity. The panel should include 15-35 participants, yet you should anticipate the return rate of the questionnaires between 35-75%. It is thus highly recommended to select more potential respondents than you actually need responses. They should be experts in the researched field (practitioners or academics). To achieve best results, it is recommended to maintain certain time intervals between the rounds and not to try to accelerate it too much. The time lapse enables respondents to reassess their answers, and it decreases the risks that respondents would be subject to some external influences.

Example of use in the security and defence field

In the Czech Republic, the method was applied by European Values Think-Tank to generate scenarios for the development of the political and security environment from the point of view of the interests of the Czech Republic (2016-2019). In 2016, the Think-Tank reached out to one hundred potential respondents – leading experts from the Czech security community (academia, state – relevant ministries, intelligence services, Police, Armed Forces, etc.; and non-governmental sector). Selection of respondents was based on their knowledge in the field of security policy in general. At the end, twenty-four of the addressed experts replied to the questionnaire. This was done through a private section on the website of the Think-Tank where each respondent was given their individualised access while maintaining anonymity.

First the respondents were asked to list and justify factors that influence the fulfilment of the Czech interests as identified in the Czech strategic documents. The research team then selected the ten most important ones (based on their relevance and severity) and prepared five alternative developments for each of them. In the second round, respondents were asked to assess these developments by assigning them a probability of occurrence (in percentage) before April 2019.

The alternatives assessed by respondents as the most likely enabled research team to create possible scenarios. In the third round, respondents assessed the probability of occurrence for each scenario. The outcome of Delphi were five scenarios for the development of security environment selected according to probability of occurrence and severity of impact on the Czech interests. [2]

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B-5 DRIVER ANALYSIS

Drivers of change are major factors (trends and other changes) shaping the future, they are the forces causing a change. Drivers may include trends, projections, plans and potential events and three categories of drivers can be distinguished: (1) weight of the past (drivers that have resisted change, that are holding us back and create a barrier to a change), (2) push of the present (current trends pushing the present towards particular future), (3) pull of the future (vision about how the future could be different might affect our current decisions and behaviour in order to make that vision come true). Different combinations of these drivers of change result in multiple futures to be considered.

What is it used for?

Drivers are used in foresight to map possible futures and anticipate discontinuities by identifying leading forces that could affect the domain or world in future. They are used to identify what features or aspects will have the biggest impact on the future. It is used to better understand the dynamics of change and the spectrum of possible futures.

How to use it?

To identify drivers of change you can scan the environment for weak signals and indicators of what is changing and then identify what is driving these changes. This is about understanding the causal relationships. You can also focus on identifying trends, projections, and plans with a potential to influence directions of the future.

If the number of identified drivers is too high, you may need to select the most significant ones by e.g. impact-and-uncertainty analysis (drivers of highest priority are then those with high certainty of outcome and high impact). You can also use a domain map outlining the elements of a system and then assess the impact of the driver on each element of the domain.[7] Another approach to selecting drivers is through a cross-impact matrix, which enables the interaction between the drivers and their impact on the system under study to be explored. [1] The objective is to select those drivers that have a major impact on the system or may cause the most significant change.

After selecting the most important drivers, analyse them further by answering the questions: are they slowing down or accelerating, in what direction might they evolve, will they interact with each other, what might their impact be? A cascade diagram can be used to analyse a change driver: place the driver in the centre, then write to the left the factors amplifying the driver and to the right its potential consequences of multiple orders. Eventually, a Futures Wheel can be used to explore multiple order implications of a driver.

Once you have identified and analysed the most important drivers of change, they can be used to build scenarios.

Strengths

Drivers of change are able to connect the dots between the trends and uncover the patterns of change. They are thus very strong in trend analysis and scenarios building. By identifying multiple driving force and their multiple order implications, they enable the creation of several alternative futures.

Weaknesses

Identifying drivers is a largely intuitive process which requires to know the system very well. It can be further complicated by the effect of various interrelationships across the issue. Moreover, the impact of drivers may not be obvious immediately and may only be recognised after years or even decades. [2]

Evaluation and interpretation of data can be shaped by researcher's experience and cultural history. As a result, assumptions made along the process can eventually lead to biased conclusions if they are not addressed critically. Failure to adequately explore and reveal misguided assumptions and biases can potentially cripple any foresight work including driver analysis.

What other methods is it usually combined with?

Drivers can be identified by literature review, horizon scanning, trends analysis, futures wheel (e.g., to study implications of a driver). The output can be used to inform scenarios (creating alternative futures) or SWOT analysis.

Is any software or other tools required?

Useful software includes:

- MS Excel Spreadsheet which allows for the simple recording of scans which produce trends and by extension drivers;
- Personal Brain (https://www.thebrain.com/) which is a unique mind mapping software which creates a searchable database (another common mind mapping tool used by foresight practitioners is Coggle (https://coggle.it/)

7 An example of a cross-impact matrix, a domain map as well as a cascade diagram can be found in Horizons Policy Canada. [1]

- Diigo (https://www.diigo.com/) to collect, annotate and analyse searches;
- Bookmarking sites: Evernote (https://evernote.com/), Stumble Upon (https://www.stumbleupon.com/); Specialised software/data mining, databases and 3rd Party Services, e.g., Trend Watching (https://www.trendwatching.com/)

Best practices (recommendations and tips how to best employ the method)

To get started with this method ARUP´s Drivers of Change[8] is a useful guide and is used by many foresight practitioners. When identifying drivers, it is useful to take a broader perspective (look back as well as forward) and to explore drivers through the lenses of STEEP, PESTLE or a similar approach. It is also recommended to be rather specific than too general when naming the drivers (e.g., instead of demography say decreasing birth rate, etc.).

To mitigate bias, it is important to first explore assumptions in the team (for that, there are a number of team building exercises and personality tests, e.g., Insights, Myer-Briggs) and how this influences what participants view as important in the external world. It is important to try to open their minds to a wider range of sources, perspectives, and interpretations.

Example of use in the security and defence field

Researchers at *Harvard University* used a survey to identify drivers of change in nuclear security policy of selected states. They focused on states in possession of either nuclear weapons or enough weapons-usable nuclear material (all together 26 countries out of which 16 replied to the survey). The objective was "to examine whether countries have made significant changes in their nuclear security and accounting practices in the past 15 years, and what the major drivers of change and the major constraints on change have been." [4, p. 1] The survey was used to identify among other things what caused the changes in nuclear security policies. Respondents were asked to rate factors on the scale 0-4 scale, with zero being "not important at all" as a cause of change, and four being "the dominant cause" of change. Factors with rating 1,6-2,0 were classified as drivers of medium importance and below that were drivers of least importance. [4]

In addition, very often institutions that use scenarios include drivers of change in their methodologies. When *Shell* is creating scenarios, they first look at a range of drivers to explore how the world is changing politically, economically, technologically and socially. It helps then to outline potential futures. Similarly, *International Institute for Strategic Studies* identifies drivers by means of trend analysis and then use them to inform scenario building.

Finally, drivers analysis is often used in peace and conflict studies to detect forces that may endanger the peace or affect the dynamics of conflicts. *RAND corporation* conducted an empirical analysis of past conflict patterns and identified key trends in conflicts as well as drivers of change in their patterns which they used to outline future conflict projections. [5]

8 "The Drivers of Change programme investigates the key global issues and trends driving change in the built environment. From climate change to urbanisation to poverty, each set examines the top 25 drivers of change impacting our societies and markets." [3]

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B-6 EXPERT PANELS

Expert Panels is one means to solicit expertise and opinions to inform the foresight process and the products it results in.[9] These panels can be used at any stage of the foresight process. The expertise the panellists bring to a particular aspect of the foresight analysis work can help ensure that a more informed debate is generated around the issue(s) being considered.

What is it used for?

In foresight work, utilising expert panels assists in ensuring the inclusion of subject matter knowledge that contributes to developing a more comprehensive and defensible product. As well, the exposure of the core foresight team to expert panellists' insights and knowledge should help facilitate broader as well as more refined thinking in the development of the foresight products. Expert panels are also useful when open-source data on the topic being examined is scarce.

How to use it?

Once a topic is selected, expert panellists who have knowledge of it can be drawn from any part of society, such as private industry, government, and academia. In selecting experts, their knowledge needs to be germane to the topics being examined and this includes experts from different fields, like media, government, and industry. Those coming together expertise should have some connection to the foresight work under development and more importantly to the specific issue being discussed. To get the most benefit from expert panels, their participation needs to be focused on a pre-selected topic and a set of questions that can generate discussion and debate. Consideration may be given to including a discussion moderator to keep the panel on topic and on time. From this expert discussion, new avenues of thought may be identified that could strengthen the overall development of the foresight work.

A decision will have to be made on when to allow the core foresight working group to interact with the expert panel. It may be beneficial to allow the expert panel to first work alone to discuss and generate ideas about the topic under examination. Following this expert only discussion, a follow up session that includes the core foresight team allows for follow-up questions, challenges to the experts' thinking and conclusions as well as an overall enlargement of the debate. Hopefully this mix of expert and non-expert interaction will improve the foresight conclusions and product. If, however, time is a factor then it may be more desirable to bring the expert panel together with the foresight team from the start, although this may constrain the expert discussion as they will be asked questions and for clarifications instead of just being allowed to freely talk.

Whichever option is chosen, a decision on how much time will be given to this method needs to be determined before the panel begins its work. A means of capturing the debate, discussion, new ideas and conclusions of the expert panel (e.g., electronic recording, taking notes, etc.) should be pre-arranged to ensure nothing is lost.

Strengths

Any phase of the foresight cycle can benefit from expert panels. Expert panels can help to both challenge thinking and to broaden the discussion. The inclusion of an expert panel brings specialised knowledge and experience from recognised authorities in the field under consideration, which strengthens the credibility of the foresight exercise as well as its conclusions. Adding additional voices and intellect to foresight work enriches its outcomes through helping to ensure numerous points of view are considered and insights are generated. Expert panels can be also held virtually (if unclassified). It may help if budgets are tight and to gain access to a geographically dispersed set of experts.

Weaknesses

Potential drawbacks of expert panels include the fact that some panellists may be biased towards their ideas and therefore refuse to engage in meaningful debate that may see their ideas being challenged. Some experts may possess a strong personality that could overwhelm some or all of the panel's other members, thereby limiting discussion and debate. If the experts work in the field of foresight analysis, they may have a conflict of interest in that they are trying to "sell" their particular brand of how foresight should be done and therefore may not be open to considering other avenues of analysis. As a result, it could stifle creativity, i.e., new ideas that come from fresh thinking. Finally, assembling an expert panel may be expensive if the participants have to be paid for the time/travel (it can be partially counter balanced by making it virtual).

What other methods is it usually combined with?

Expert panels can be used with most other foresight methods and at any step in the process. For instance, it can be used in place of

9 In contrast to Delphi, experts participating at expert panels are not anonymous to each other and their interactions are direct (they see and hear from each other).

a second round of Delphi. Expert panels could also be employed to help assess how scenario development may be best utilised.

Is any software or other tools required?

While software cannot replace an expert panel, discussions can be captured electronically and the panel could be held virtually.

Best practices (recommendations and tips how to best employ the method)

Preparation of the topic and questions that the experts will discuss is key to getting the most value from the panel. Consider using a moderator to guide the discussion and limit the negative impact any domineering personality may have on the group. Experts may be expensive to engage, so conduct as much preparatory work as possible before they arrive to ensure their time with your foresight team is focused strictly on the debate of ideas and generating insights. It is worth considering the expert panel in line with other approaches and also at what point in the foresight project it may add most value (in order not to stifle creativity).

Example of use in the security and defence field

The use of expert panels is commonplace in security and defence. Academics are probably the most common type of expert used when outside thinking is required on a security or defence topic. In fact, many militaries have their own defence colleges or universities as well as partnerships with non-military academic institutions. Expertise with think tanks is also frequently utilised by defence and security organisations.

Spain used a panel of experts in foresight on renewable energy in combination with a Delphi method. An expert panel was first set up to develop a questionnaire. They included professionals from different sectors with a broad understanding of the topic. The objective was to analyse and select different hypotheses of the future that would form the basis for the subsequent Delphi method. The outcome was a questionnaire based on 95 hypotheses related to the most significant trends in the field of renewable energy to occur in the coming years. The questionnaire was then distributed to respondents of the Delphi survey. The panel of experts then discussed the results instead of the second round of Delphi. [1]

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B-7 EXTRAPOLATION

Extrapolation is a quantitative method, which is based on extending a trend that has been taking place into the future. This is a traditional and widely used method, which is based on the assumption that the influence of factors and the regularity of their action, which shaped the observed trend in the past, will develop in a predictable or unchanging way and that the trend observed so far will continue to develop in the future.

What is it used for?

Extrapolation is practicable only if it is possible to identify the patterns of the past development and all relevant variables that influenced it. Extrapolation is a very popular and relatively easy to use method wherever the above-mentioned patterns can be mathematically described, or, respectively, where the mathematical function that defines these patterns can be identified. Typically, extrapolation is applied in forecasting macroeconomic trends, demographic or environmental development (global climate change, international migration, population development), economic performance, health situation, etc. It is especially useful to forecast the demographic development of the population, as input data and mutual relations and dependencies between the examined variables are usually known, e.g., the number of children born, average age, life expectancy, migration balance, etc. This type of data is collected and published by state institutions and international organisations on a long-term basis and it is widely available.

The range of possibilities for applying the method of extrapolation is quite wide [1] [1]. For instance, it is widely used in the preparation of long-term industrial, business, and research strategies in the private sector or in the academic environment, but it also has an important place in the process of creating strategies and conceptual documents of states and international organisations.

How to use it?

The initial step of extrapolation of a particular trend, or future behaviour of the monitored variable, is to determine a hypothesis, theoretical statement, or assumed model that explains the relevant relationships and correlations between the monitored variables (such as global temperature growth, GDP growth rate, population growth, defence spending, etc.) and a specified period of time (year, decade, or a different period). The value of the variable over time and the influence of the identified factors on this variable are then expressed by a mathematical function (from simple equations, calculation of the variable's coefficient, to complex mathematical models). Most often, extrapolation is performed by applying linear (the most common and simplest type), exponential, or periodic mathematical functions. The validity and accuracy of the function is verified retrospectively using historical data. If the mathematical expression of causality between the monitored variables corresponds to the actual historical development, it can be assumed that it is possible to calculate the future values of the variables and identify the trend of their further development. Afterwards, the trend projection obtained in this way is interpreted or supplemented with knowledge using other methods.

Strengths

Extrapolation can be applied to any social, economic, environmental, security, and other phenomena and events that can be described through a large amount of long-term hard data, which allows for relatively accurate long-term forecasts. If the data series is not disturbed by any abnormal and unforeseen fluctuation, it can be used to forecast development even in the more distant future.

Another advantage is the fact that the method enables relatively fast processing of forecasts by importing the necessary data into a mathematical model. It is also suitable for quick modelling of alternative futures, which can be achieved by deliberately modifying some of the variables used or altering the mathematical relationship. The advantage of the method is also in the easy visualisation of the outputs, which makes it easy to highlight the forecast trend and effectively convert the used complex and numerous data into a simplified form of a chart, curve or line "stretched" into the future.

Weaknesses

Extrapolation is the most accurate in forecasting the time horizon of up to 5 years, but it is also often used in the horizon of decades, with extrapolations for an entire century not being an exception. However, the more distant the horizon, the lower the accuracy of extrapolation due to the fact that unexpected and irregular factors or disturbances ("black swans") may enter the forecasting process. There is also an increasing influence of errors and deviations that vary the actual development from the trend from its ideal expression. The more complex the mathematical function or model used and the more data and variables input into the projection, the less reliable the long-term extrapolation is, or, it deviates more significantly from the actual future situation. The use of extrapolation can also be problematic when forecasting phenomena for which the

patterns of development can be difficult to express mathematically, there is not enough data, or the available data to describe too short a period of time.

What other methods is it usually combined with?

Extrapolation is often combined with other forecast methods, yet it goes hand in hand especially with trend analysis. Also, the findings are most often interpreted using trend impact analysis and scenarios.

Is any software or other tools required?

Extrapolation can be performed using any software tool that is capable of processing a larger amount of structured data, applying mathematical functions and formulas, and ideally also creating a visual output in the form of a graph. There are a plethora of commercially available or free applications and calculators available (Visplore, PerfMatrix, MATLAB, Surfer, etc.). In principle, the widely used Microsoft Excel is sufficient for general use.

Best practices (recommendations and tips how to best employ the method)

Given that the accuracy of the mathematical function is affected by the quantity and the validity of the quantitative data ("hard data"), it should be collected periodically, on an ongoing basis, and using the same methodology. The availability and use of data series covering a sufficiently long historical period enables a more accurate extrapolation into the future.

Due to the widespread and long-term use of extrapolation, it is usually not necessary to invest time and effort in creating unique mathematical models and functions for extrapolating the available data. Where mathematical expression of causality between the monitored variables in time is needed, it is possible to use available models [3], still, as a rule, extrapolation is based on a simple linear mathematical function. Many commonly used software tools include functionalities that enable extrapolation of imported data. Perhaps the easiest way is to use Microsoft Office Excel, which contains the statistical function called Trend. This function enables automatic generation of future values based on existing data and automatic generation of extrapolated values based on linear trend or growth trend calculations. The function extends a linear trend line to calculate the additional y-values for a new set of x-values. At the same time, the application allows for a user-defined variable graphic representation of the extrapolation results.

Example of use in the security and defence field

In the field of security and defence, extrapolation can be used in several ways, e.g., for estimating economic development [4], determining defence planning trends, or forecasting economic expenditure related to ensuring security and defence [5]. It is also a suitable tool for forecasting the development of the staffing of the armed forces and its demographic characteristics [6], for subsequent planning of recruitment goals, education and training capacities, etc. It can be used in the field of logistics to determine the material and financial needs of the armed forces and to ensure the required military capabilities in the future. Extrapolation also has a significant use in the process of forecasting the development of strategic or security environments. It is used to clarify the development trends of some threats and challenges and to estimate their impact (e.g., population development [7] or international migration [8], infectious diseases [9], indicators of climate change [10], and other environmental threats [11]). The outputs of the extrapolation method can be used to clarify the future situation in the fields of environmental, food, energy, and other kinds of security. The outputs of extrapolation are often contained in strategic documents and future-oriented concepts and trend analyses produced by international organisations (UN, EU, OECD, etc.), states, business and commercial corporations, think tanks, and research institutions [12], [13], [14].

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B-8 FUTURES WHEEL

Futures Wheel is a structured brainstorming or organised thinking process that leads to a graphical visualisation (a map) of direct (primary) and indirect (secondary and tertiary) future implications of any issue (change, trend, event, decision, technological innovation, new policy, etc.).

What is it used for?

Futures Wheel can be used for a variety of purposes: identifying possible impacts of a change; organising thoughts about the development of an event/trend; visualising interrelationships of the causes and consequences; identifying opportunities when assessing how a situation may develop; developing strategies (to promote positive implications and avoid undesirable ones); or creating forecasts within alternative scenarios.

How to use it?

The *central theme* (event/trend/decision/change) is placed in the circle in the middle of a board. Then the key question to answer is: If this occurs, what might happen next? *Direct consequences* (both positive and negative) of this change are brainstormed by participants and positioned around the central theme and linked to it. A first ring of consequences is thus created. Afterwards, participants discuss the *implications of these direct consequences*. A new ring of second order implications (consequences of direct consequences) is drawn and linked to the previous one. The process can be repeated to identify *third order consequences*. Different orders of consequences correspond to different concentric circles. The outcome is a map of possible both positive and negative multiple level consequences of the central issue.

Another approach includes *historic, current and future dimension* visualised in a cone. It can be undertaken by three different teams each focusing on one dimension: (1) historical trends or events leading to the central issue; (2) contemporary impacts of the issue; (3) future impacts. For better visualisation it is recommended to use computer software that allows rotation. [1]

Once all levels of consequences are identified, they can be rated in terms of importance and probability. Scoring and *prioritisation* help stakeholders in decision making and strategic planning. Three types of consequences are usually of particular interest: (1) Highly desirable, low-probability consequences (policies aimed at increasing their likelihood); (2) highly undesirable, high-probability consequences (policies aimed at decreasing their likelihood); (3) surprising consequences in terms of extreme positive or negative impact. [2]

Strengths

In terms of *resources*, it is quick and easy to carry out, no advanced training, specific equipment or software are required. Indeed, it is one of the least expensive methods. When it comes to *using the method*, it is flexible and adaptable to different situations. It identifies both opportunities and risks and enables visualisation of complex interrelationships. As a result, it shifts from linear thinking to a more complex and network-oriented (system thinking). In terms of *forecasting*, Futures Wheel encourages thinking beyond the imminent outcomes and towards a long-term vision. It facilitates the detection of unforeseen consequences. By providing multiple parallel futures, it helps decision makers prepare for the best as well as worst alternatives.

Weaknesses

The major challenge stems from the complexity of visualisation, which may become overwhelming. Given that a large number of direct consequences results in even more indirect consequences, it may lead into a product that is difficult to analyse. Moreover, identification of consequences may be influenced by bias. These are things that can be de-risked through consideration of how best to address them in the planning stages of the foresight project.

What other methods is it usually combined with?

Futures Wheel can be conducted by means of *brainstorming* or *Delphi*.

It is often combined with other methods to study consequences of identified issues. For instance, Futures Wheel is often used after *trend analysis* to identify multiple level consequences of trends (in this context it can be used as part of trend impact analysis). The same applies for *Wild Cards* and their consequences. Eventually, it can be used in *system analysis* to analyse key components of a system and explore the range of their possible implications. It can also contribute to *scenarios* when one scenario and a specific item in that scenario are selected to be further explored by Futures Wheel. Finally, *Causal Layered Analysis* can benefit from Futures Wheels to improve understanding of a variety of views about the future.

To enhance understanding of outcomes of Futures Wheel, *risk assessment* is useful to score the consequences generated by Futures Wheel. *Cross-impact analysis* then enables assessment of interactions among key consequences.

Is any software or other tools required?

There is a possibility to use software to create Future Wheels, [3] [4] however it is not a prerequisite. There are several free online templates such as Creately. [5]

Best practices (recommendations and tips how to best employ the method)

To counter in part the impact of bias, the selection of participants should seek to ensure diversity / a broad range of participants should be involved, covering a range of experiences and focusing on different aspects of the problem set.

It is recommended to define the central theme as narrow and specific as possible[10] and limit the number of direct consequences to avoid over-complexity (five should be sufficient for a narrowly defined central issue). Both positive and negative implications should be included. Different levels of implications should be visually differentiated by different color, eventually, single lines may be drawn between central theme and primary consequences, double lines between the primary and secondary consequences, and triple lines between the secondary and tertiary consequences. Implications can be also organised by sectors (STEEP or similar approach) in order to explore different dimensions of a change. It also helps to avoid over-complexity of visualisation given that each sector has its own wheel.

Example of use in the security and defence field

Futures Wheel was employed in the Canadian project Future Army [6] [7] aimed at exploring the security environment and identifying its implications for the Canadian Army in the 2040 timeframe. It was used in combination with other methods such as environmental scanning, trend impact analysis, hindsight and red teaming. First, environment scanning was conducted to identify drivers, trends and weak signals. Futures Wheel was then used to identify multiple-order impacts of these trends and to better understand their possible future outcomes and implications for the Army. Futures Wheel thus enabled the identification of the most important drivers of change for the Canadian Army in 2040. The key change drivers were then assessed in terms of uncertainty and impact (low-medium-high). This prioritisation further served to develop alternative futures. The intention of this process was to enable decisionmakers be more proactive.

10 For example, J. C. Glenn defined the central trend as "increasingly smaller and less expensive computer communications devices". [1]

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B-9 FUTURE WORKSHOP

Future Workshop (also known as a Scenario Workshop) is a participatory method specifically conceived to work with people without futures studies training. It takes participants through different steps to analyse, reflect or generate future related content.

What is it used for?

Future Workshop can serve several purposes: (1) To engage with a community that is affected or connected to the subject under future research. (2) To generate future data with knowledgeable people without futures studies backgrounds. (3) In projects with a strategic angle, it can be used to generate consensus and momentum. (4) To bring in different collectives in a futures research project. This, in turn, can have different, not excluding, functions: to enrich the perspective, to check some preliminary conclusions, to add contending views, and to comply with participatory requirements. (5) To generate visions for a community or an organisation. (6) To let participants understand the implications of different future options.

How to use it?

Step 1: Analysis: also known as the cathartic phase, in which you let participants list the main problems or their main complaints regarding the workshop topic. It is recommended to start with this part for two reasons: (1) It helps to identify potential problems or conflicts from the very beginning, (2) it allows the participants to blow off steam first and be ready for the following phases with a constructive mindset. In any case, by the end of this step the facilitating team must have a list of problem, hurdles, or questions to address. It is important to keep this list because, whatever is produced later on should be able to tackle this list.

Step 2: Projection: this is the part where the participants generate content for the workshop. Therefore, criticism is not allowed during this phase, the idea is to take the participants into a mood in which they can express freely but reflexively.

Step 3: Construction: as criticism was banned in the previous step, it is expected that the inputs at this stage will be of mixed quality. Thus, in this step the facilitating team will ask participants to review and assess the inputs of the previous steps. The focus will be to determine how many of the projection inputs are compatible, which ones need to be ordered (I.e. one may need to happen prior to another), which ones are excluded, which one can be attained by the group participants and which ones are beyond the group's capacity. The function of this step is to let participants realise that in order to achieve any future goal they will have to negotiate and plan, and to plan effectively they need to understand the implication of different options or decisions.

Strengths

Future workshops can be extremely useful to: (1) engage with a community involved, affected, or connected to any future research, (2) integrate inputs from all sorts of different people (they can boost diversity of perspectives), (3) generate consensus and/or momentum in an organisation.

Weaknesses

The main problem in a future workshop is that you are dependent on the quality of the participants' inputs which requires strong facilitation skills. Moreover, a disruptive participant can ruin the whole workshop, a negative comment at the wrong time can do a lot of damage.

What other methods is it usually combined with?

It may be advisable to include some creativity-based methods at the beginning that could enrich the perspective of the participants and, even more important, help the facilitators to detect dishonest inputs. Brainstorming can serve this purpose. Also, once the workshop is finished, it can be useful to apply some evidence-based methods to corroborate inputs or to strengthen the conclusions (for specific examples of methods in these categories, see Table 4-4).

Is any software or other tools required?

No specific software is required, however you may need a tool for virtual meetings if you wish to organise a Future Workshop remotely.

Best practices (recommendations and tips how to best employ the method)

- The facilitation team is critical. It is paramount to have an experienced team (coordinator/facilitator) to lead the workshop with the capacity to steer and to modulate the participatory dynamic. This needs to be an expert in unstructured or semi-structured participatory methods, who has great leadership, authority and the ability to create an environment conducive to fostering creativity with respect and a common goal.
- The selection of the participants is also very important. And while it is necessary to select people according to their knowledge and/or affiliation, it is also convenient to avoid participants who are for instance too confrontational or too shy.

- The venue is another key aspect. If possible, avoid sub-basement rooms without any natural light. Ideally a place should allow for different combinations and, if necessary, could accommodate smaller groups.
- A concise pre-workshop information package will allow participants to come prepared and with a positive impression of the session. Always be clear about the purpose and development of the workshop.
- Try to include inputs from all participants.
- Do not let participants to engage in vis-a-vis discussions. Always keep a respectful atmosphere.

Example of use in the security and defence field

Example 1: The UK used future workshops to prepare the *Global Strategic Trends* report. A workshop was organised first to discuss and test the ideas collected during the scoping phase by means of literature review and online survey. Its ultimate objective was to identify the topics for research. Participants represented a large range of institutions including "academia, government, industry and the non-profit sector, both domestic and international". Another workshop was then held also during the subsequent phase when each identified topic was researched in depth. Finally, the results were validated again during workshops with "academia, partners across government with international partners in over 40 countries on five different continents". [1]

Example 2: ACT is using workshops as one of the tools to inform the Strategic Foresight Analysis Report. The Workshops identify and discuss future trends in different sectors and their drivers (as pre-identified by a literature review) and derive implications from trend analysis. This is completed with a wide international audience (from nations, academia and industry). The outcomes are from the future workshop are used as inputs for the SFA Report. (for more information see Annex A)

Example 3: Shell is using future workshops as part of scenarios development. The objective of the workshops is to involve the key decision makers in the foresight work and discuss different perspectives, including those that decision makers would not normally hear. Shell sees Future Workshops as a tool to maintain stakeholders engaged in the process.

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B-10 HORIZON SCANNING

Horizon scanning is about systematically exploring the environment for signals of change as part of the very first phase of the foresight project (sometimes referred to as the scanning phase) [1]. It helps to better understand changes in the environment and thus identify potential challenges or opportunities [2]. It can either take the form of a one-time project focused on a specific domain and/or period, or – and ideally - it can be a continuous, year-round process [3].

What is it used for?

The method enables the early tracking of changes in the environment, which helps to better anticipate and prepare for future developments, identify opportunities that could be exploited and avoid potential harmful surprises. Scanning for weak signals of change is also a form of gathering intelligence as part of early warning [4]. Importantly, horizon scanning helps to expand the organisation's strategic thinking by looking beyond the current trends toward potential change in the future by addressing the question "How will the future be different?" [2].

How to use it?

Horizon scanning consists of a simple sequence of steps that is very easy to follow, while the process can be adjusted according to your organisation's needs and resources.

1. Identify focus

Specify the domain/s that will be scanned and define the goal of the effort – ideally one that is clearly linked to a current need of the organisation to ensure the process is useful and relevant. These decisions provide an initial direction and help to prevent information overload especially if the resources are limited. Nevertheless, the scanning itself should be open to any possible direction. Finally, decide on the timeframe of horizon scanning, which can be conducted ad hoc as a one-time activity, in regular intervals or continuously according to resources available.

2. Set scanning criteria

Create a taxonomy / knowledge classification system to organise the data collection and recording, such as PESTLE or STEEP or any other system depending on your focus. Select sources of the data collection. Decide whether you will organise and record the hits manually or with help of a specialised software. Select the labels and categories that will help you organise the scanning results (such as the title, source, tags, and description of change).[11]

3. Scan for signals

Search for weak signals - early signs of change using the scanning criteria. An insight or a hit designates a single observation of change. These are "raw, diary entries of new, possible, and probable change noticed by researchers" [2]. Bishop and Hines define them as "something new or different, something out of the ordinary, a discrepancy in the pattern" that could have "important consequences for a domain or an organisation" in the future [1]. Bishop differentiates three types of scanning hits, while emphasizing that the real value lines in the latter two [5]:

- *confirming* as a change indicating that the baseline forecast of the future is more likely
- *creating* as a change pointing toward an alternative future as more plausible
- disconfirming as change making an alternative future less plausible

4. Scan for trends

In time, with greater number of hits recorded, you will be able to discover themes and patterns. A trend is a "cluster of similar events moving in the same direction". Be mindful of the fact that as soon as you identify a trend, it has already impacted on your organisation. You can use a visualisation of hits to help you discover possible patterns and trends.

Strengths

Horizon scanning has a universal use and can be easily combined with most of the foresight methods. It follows a set of simple steps and does not require any special methodological training. The method offers a systematic way of exploring the environment. Importantly, it encourages "out of the box" thinking on part of the analysts and decision makers. It sensitises them to the fact that the change is inevitable and that the future is rarely a smooth continuation of the present. By continuous tracking of early changes, the horizon scanning helps to avoid potential surprises and track potential opportunities that could be exploited.

Weaknesses

Although the method is relatively easy-to-use in terms of collecting data – the interpretation of the meaning can be less 'easy'. For instance, it is challenging to track weak signals amidst the noise since these are weak and early. Knowledge of the scanned domain is required to distinguish signals from the noise. This makes horizon scanning an inherently subjective process that relies heavily

11 You can refer to Jackson [2] for further advice.

on the analysts who bring their knowledge, experience and cognitive bias to the table. This underlines the importance of increasing diversity of the participants. The rare presence of signals amidst the noise makes the process also prone to be underestimated or even ignored by the stakeholders. To be truly effective, it needs to be done on a continuous basis, which makes it time-consuming. The analyst is required to collect data from many different sources, including fringe sources, to be able to identify the signals of future change before they penetrate the mainstream as they develop into discernible trends. However, the data collection can be also outsourced or automated.

What other methods is it usually combined with?

As a method used at the very beginning of the foresight project horizon scanning can be combined with most of the foresight methods. It is frequently used together with literature review and trends analysis. The implications of the potential futures derived from the signals of change can be elaborated with the help of brainstorming, Futures Wheel, trend-impact analysis or scenarios. Expert panels and Delphi can be also useful to identify emerging signals of change as can be interviews or surveys. Indicators/monitoring might help to track emerging issues that could in time develop into "current issues".

Is any software or other tools required?

Different tools can be used for scanning such as Shaping Tomorrow – which is an AI-driven horizon scanning and strategic foresight service, or the newly developed horizon scanning platform Might. For recording and organising scanning hits, you can also use programs such Evernote, Zotero or Pearltrees.

Best practices (recommendations and tips how to best employ the method)

A successful employment of horizon scanning depends on the fulfilment of several conditions. First, you need to clearly delimit the focus so that the scanning is manageable and cost-effective. On the other hand, as an initial phase of foresight, horizon scanning requires looking at the big picture and you should always account for global trends even if the foresight project is focused on one domain only. Use of the STEEP or PESTLE approach helps to keep this big picture in mind.

During the scanning, be open-minded and look for the unknown and unfamiliar that can lead you in any possible direction. Use a variety of sources in search for weak signals including fringe sources or social media. Be aware of the fact that once information gets public attention, it is usually too late to capture the change in time for early intervention or exploitation. Depending on the area of focus, exploit the knowledge both of experts and non-experts. If possible, design horizon scanning as an interactive and collaborative effort (see the chapter on diversity in foresight). This also helps to reduce the effect of the analysts' worldview and cognitive bias on the scanning. Those should be clearly acknowledged and addressed since they contradict the key purpose of scanning to search for the *new* and *unexpected*. During the scanning, make sure you look for good weak signals. Good signals are significant in terms of their potential impact, plausible, novel and timely with consequences potentially occurring in 10-15 years [6].

Horizon scanning can be tailored to your foresight project's purpose as well as resources, but the best results will always be achieved if done on a continuous basis. Only this allows revealing the early and subtle changes in the scanned environment. It also helps to align scanning with existing planning processes in the organisation. Finally, do not underestimate the delivery phase of horizon scanning. This requires drawing implications ("so what") of the effort and communicating the results with stakeholders in different formats tailored to different audiences – such as blog posts, short digests, or in-depth articles (for more advice see Hines [7], Conway [8] or Voros [9]). In this phase too, the diversity of the participants discussing the implications is of key importance.

E*xample of use in the security and defence field*

European Union Institute for Security Studies (2019) conducted a foresight project with the aim to "alert decision-makers to potential developments with significant strategic impact while they can still prepare for, or even avoid them". It combined horizon scanning with scenario-building to produce a set of plausible events in 2021 with strategic ramifications in longer time horizon. Importantly, the organisation conducts horizon scanning on a continuous basis. Based on the development identified during the scanning, the analysts were asked to create a scenario in their respective areas of expertise in which the potential consequences of these factors would be elaborated on. The scenarios reflected the logic of Grey Swans as high impact events considered unlikely to happen but supported by more evidence that they could actually happen unlike Black Swans or Wild Cards.

The Canadian Army Land Warfare Centre [10], INRS [11] or the OBSERVE project [12] uses horizon scanning in support of goals related to defence and national security.

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B-11 INDICATORS/MONITORING

Indicators is a method reflecting the assumption that "uncertainties resolve themselves into a singular present as the future gets closer" [1]. It helps to assess which one of the alternative futures the present appears to be unfolding towards. In this sense, Hines and Bishop [2, p. 217] define indicators as "observable quantities or events that indicate whether the future is moving in one direction or another". They can be quantitative as well as qualitative. Monitoring is a term used for the process of tracking indicators.

Note: Grabo insists on differentiation between "indication" and indicator". In the military field, an indicator refers to "a known or theoretical step which the enemy should or may take in preparation for hostilities", while an indication is information that "any of these steps is actually being implemented". An indicator is about expectation, while an indication is the actual development. Indications can be positive, negative, or ambiguous (uncertain). [3]

What is it used for?

Indicators are mostly used to monitor signals of change to assess which of the alternative futures the events head towards. As such, they are the next logical step in a foresight project following scenarios. You can also use indicators to identify and prevent unexpected threats or events as part of warning/indications intelligence (see Grabo [3]). Hines and Bishop differentiate between scanning (see Horizon scanning) and indicators, with the former being a broad and open-minded process looking for any signals of change, while the latter are "very specific, targeted pieces of information with a clear link to one alternative future or another" [1].

How to use it?

Indicators link foresight with decision-making and as such are used only after the forecasting part of the foresight process has been completed. The use of indicators in foresight is usually part of the following sequence of steps:

1. Scanning for emerging issues and trends in the environment.
2. Development of scenarios of alternative futures.
3. Identification of indicators for each of the scenarios.
4. Monitoring for the occurrence of the indicators.

The continuous process of monitoring the indicators helps decision makers to assess which of the alternative futures seems more plausible and / or provides a warning that a known threat is changing or a new one might be emerging. In warning intelligence, a threshold can be established for each of the indicators. The indicator is flagged for further investigation once it exceeds the threshold.

Hines and Bishop included Leading indicators as the last step in their Foresight Framework which consists of the following sequence of steps and activities [1]:

Activity	Step
Framing	1. Describe the domain
Scanning	2. Assess the current state of the domain
Forecasting	3. Establish a baseline future 4. Develop alternative futures
Visioning	5. Create a vision of a preferred future 6. Derive implications and changes for the customer
Planning	7. Develop a strategy to achieve the vision
Acting	8. Identify leading indicators 9. Prepare a summary of the foresight project

They advise initiating the process of developing indicators by the following question: "How will the organisation know when one or another alternative is actually happening?" The analysts will then look for *events* – these can either occur or not – or *variables* understood as "continuous quantities that vary over time" and that can behave and change in different ways. Before the monitoring begins, you need to establish a monitoring program with clearly defined responsibilities, sources of information as well as procedures for storing and reporting them.

Hines et al. [4] have developed a process for using monitoring to track emerging issues (see Horizon scanning) guided by the following question: "Once an emerging issue has been identified, when does

it become important or urgent enough to require consideration or action?" or in other terms: "when does it move from an emerging issue to a current one?" The monitoring approach consists of five steps:

1. Clearly define emerging issue.
2. Identify indicators for emerging issues that will serve as the search terms.
3. Search for monitoring hits.
4. Keep non-indicator hits that are related to emerging issues but not specific to any of the indicators.
5. Collect and organise the hits through a tagging scheme.

Strengths

By developing indicators for each of the alternative futures, the method establishes a clear link between foresight and decision-making or intelligence. This way it increases the decision makers' receptivity to warnings. It is a good complement to scenarios as it helps to keep them "alive" and makes them actionable. The monitoring of indicators can be supported by various technological solutions, including data mining. The method also makes the data collection more targeted and thus better manageable in contrast to horizon scanning.

Weaknesses

Since the method requires continuous monitoring, it is resource intensive. Expertise is required in the field that is monitored. The selection of sources of data is crucial and often challenging since informal and fringe sources need to be included. Failure to do so may prevent capturing early signals of change.

What other methods is it usually combined with?

Indicators usually follow the development of scenarios (see Ogilvy, Gregory, and Harris [5]). Similarly, the method is compatible with backcasting which allows reconstructing backwards how a vision of an alternative future could develop and what indicators of change would be present in this case. Indicators are useful for tracking technology development and as such can go well with technology roadmapping [6]. Since indicators are most useful in the "Acting" phase of the foresight project, they can be combined with any other method that helps to develop alternative futures upon which the indicators will be subsequently built. Indicators/ monitoring can increase the usefulness of horizon scanning if used to track emerging issues and whether they are maturing into "current issues" or to assess the need to act [4]. Text mining can also help to track indicators (e.g., through patent analysis).

Is any software or other tools required?

Software systems such as BASIKS and ELMIB can be used to gather data about indicators that will be then processed by analysts [1].

Best practices (recommendations and tips how to best employ the method)

Before looking for indicators, you need to establish a simple and easy-to-maintain monitoring program with clear responsibilities and procedures (see Hines and Bishop [1]). You need indicators that are easy to understand and collect so that when you collect the data, you can actually recognise the change. Failure to do so could bring along the danger of discontinuing the activity resulting from the frustration of being unable to record any change despite the effort. When selecting sources of data for monitoring, include fringe sources to be able to look for early signals of change. It is recommended that these are kept for further monitoring as they often become "early indicators". It is advisable not to be too strict about the cause-and-effect relationships when linking particular events and certain changes - supporting influences are enough. It is important to consider potential bias in the process of monitoring and indicators' interpretation, including the influence the worldview of the analyst(s) may have. It is also important not to abandon the monitoring too early, to keep monitoring indicators and to look for signals of change continuously.

Example of use in the security and defence field

The UK Ministry of Defence [7] has incorporated indicators into its Global Strategic Trends program. It started with data collection for 27 thematic topics through a literature review, workshops or interviews. In the next phase, trends were identified and projected into the future to get a baseline direction. To acknowledge the inevitable discontinuity, four alternative worlds have been developed through which the most important trends have been analysed. For each of the five thematic chapters (environment and resources; human development; economy, industry and information; governance and law; conflict and security), the analysts produced a set of watch points as "indicators that an aspect of a future world is likely to emerge". For instance, in the area of environment and resources, factors such as "conflicts over resources" or "adoption of carbon capture technology" have been identified among

the indicators to watch for. On top of that, each chapter included discontinuities as "factors that will change the path of a trend". This is similar to signals of change that analysts should also look for. For environment and resources, these would be represented by factors such as "ecosystem tipping point reached", "uncontrolled spread of invasive species" or "breakthrough in energy technology (cold fusion)".

For other examples of indicators use, you can refer to Carleton.ca [8] [9] or The Government Office for Science [10].

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B-12 INTERVIEW AND SURVEY

Interview and survey are methods of collecting data by asking respondents questions for the purpose of analysis. They provide inputs to the foresight process.

What is it used for?

Survey is used to gather large amount of data, generally for subsequent statistical analysis. As a tool, surveys are mainly used to measure peoples´ opinions about a certain issue. The results can serve as an important input for discussions or research. Interviews, on the other hand, aim to gather detailed information about an area of interest (usually interviewing an expert in the given field), enabling a deeper understanding of the area under study.

How to use it?

First, some preliminary research should be conducted in order to increase understanding of the area to be explored and this will help with formulating the questions. A key aspect of this preparatory stage is to be clear on the purpose of the survey / interview and what the outputs will help inform. There are also practical design considerations, such as how to collect the data, who the respondents are likely to be and what questions will be asked. In designing the questionnaire, the form of questions strongly depends on what you want to achieve, but in general closed-ended questions (multiple-choice, rating scale, ranking in order, yes/no questions, etc.) are usually preferred in a survey, given that their analysis is faster and easier. Before you distribute your questionnaire, test it to make final corrections. Survey can be then conducted by various means, online or printed. The final step is data analysis itself.

All above mentioned largely applies to interviews as well, with the exception that an interview does not necessarily need to have a pre-determined set of questions. An unstructured interview is more spontaneous and flexible as the interviewer is not bound by any format and he/she can simply adapt the questions to the flow of interview. On the other hand, structured interviews with a pre-defined format (a set of questions asked in a strict order) are better for data comparison.

Strengths

Both survey and interview are quite easy to conduct and cost effective (especially if conducted online). The major advantage of a survey is that it enables a large volume of data to be collected (from hundreds of respondents), and still, the results can be obtained quite fast if you use software for analysis. Moreover, an online survey enables you to reach geographically distant respondents. At the same time, a survey can ensure anonymity of respondents which is especially useful when researching a sensitive topic[12]. Although closed-ended questions often prevail, the advantage of open-ended questions is the possibility of uncovering original ideas about the topic and new ways of looking at it.

On the other hand, interviews enable you to go more in depth, be more flexible and adapt some questions (in case of semi-structured or unstructured interviews), and observe reactions of your respondents.

W*eaknesses*

Some respondents (in both surveys and interviews) might be unwilling or unable to provide requested information, or the information provided might be inaccurate or false. They can also be influenced by so-called “social desirability bias”, the tendency of people to respond as they believe it is expected or acceptable (especially when it comes to sensitive topics). Moreover, there is a risk of misunderstanding some questions (this can be reduced by piloting questions). Answers might be influenced by wording, order of questions, or order of choices.[13] Finally, the results will only be relevant if you manage to maintain representativeness of your sample which in some cases might be hard to influence (especially in case of online surveys, not so much in case of interviews).

Moreover, in online surveys, there is a risk of so-called “self-selection bias” [1], which means that some individuals are more likely to respond than others (e.g., computer-savvy people). There is also a possibility of some respondents replying repeatedly to the same survey. Not to mention that researchers also risk “the possibility of irate responses” from those who find online surveys annoying or even offensive [1].

What other methods is it usually combined with?

Delphi often relies on a survey as part of its approach. Survey and interview are often preceded by literature review to get acquainted with the researched topic. Brainstorming can be then used to formulate questions.

12 For more on how to approach a sensitive topic in a survey, see Susan McNeeley [1].
13 For more tips see Pew Research Center: Writing Survey Questions. [2]

Is any software or other tools required?

Statistica, Survio, Qualtrics, Survey Monkey are some examples of useful tools. There are also softwares to help automatically analyse printed questionnaires (if special format is used) such as Remark Office OMR.

Best practices (recommendations and tips how to best employ the method)

Do not underestimate the preparation phase before conducting a survey or interview. Have a clearly defined purpose and aim of your research. Special attention needs to be paid to the formulation of questions (wording, order of questions, number and order of response options, etc.), they must be clear and neutral (avoid double negative, biased words, etc.). [3] [4] [5] Be sure you know what you want to achieve by each question, why you are asking it, and how it fits the ultimate aim and purpose of the survey or interview.

It is important to conduct a pilot testing of the questionnaire to identify and correct potential issues early on; helping to minimise a risk of misunderstanding. You may also conduct a pilot study with open-ended questions to identify prevailing answers and then use it to develop closed-ended questions. This approach may also point to some issues/opinions that researchers were not aware of before. Finally, make sure you have a representative sample of respondents.

As for interviews, semi-structured interviews can be an acceptable compromise between structured and unstructured ones. Although there are some predefined questions to be answered by all the interviewees (which makes the analysis easier as you can compare responses of different interviewees) but it also allows you to be spontaneous and ask any additional questions if needed.

Example of use in the security and defence field

Example 1: Global Risk Perception Survey

The World Economic Forum conducts the Global Risk Perception Survey annually and it is a key data source for its Global Risk Report. The data is collected for about a month from WEF's multistakeholder communities, the professional networks and members of the Institute of Risk Management. [6]

Respondents are asked every year a similar set of questions which makes the data comparable over the years. In 2021, respondents were asked the following questions related to the future and the outputs were presented in the 2022 report:

- How they feel about the outlook for the world: worried, concerned, positive, or optimistic.
- How they imagine the world over the next 3 years by choosing one of the options: accelerating global recovery; fracture trajectories, separating winners and losers; consistently volatile with multiple surprises; progressive tipping points with increasing catastrophic outcomes.
- Respondents were provided with a list of 37 global risks (the list is updated every year with some risks being added, some slightly rephrased) and were asked to:
  - choose a time horizon (0–2 year, 2–5 years, 5-10 years) when they think a risk will become a critical threat to the world
  - choose the 9 most severe risks out of 37 and rank them according to their perceived potential to cause damage on a global scale within the next 10 years
  - finally, they were asked about global risks effect: which two risks will be aggravated by the three most damaging risks?

The responses were then analysed and the findings are presented in the Global Risk Report. This provides insight into how the perception of future risks and threats has been changing over the years. It provides an outlook for the world as perceived by respondents and can serve as an important data source for further discussion and research.

Example 2: Threat Perceptions and Drivers of Change in Nuclear Security Around the World: Results of a Survey

A survey was conducted by researchers at Harvard University to study "threat perceptions and drivers of change in nuclear security around the world". To avoid dealing with classified information which would make experts unwilling to participate, the survey was focused on the past changes in the nuclear security policy over the last 15 years. Twenty-six states in possession of either nuclear weapons or enough weapons-usable nuclear material were addressed, out of which 16 replied with one expert in nuclear security representing each (with the exception of USA and Russia which were represented by more experts given the scale of their nuclear arsenal). The authors admit that countries that participate in international nuclear security cooperation were over-represented due to personal contacts between the authors of the survey and experts from these countries, hence it

was more likely to get responses from them. At the same time, experts from countries that had achieved progress in their nuclear security policies were keener to respond, which may have made the results biased to a certain extent. [7]

The survey contained six thematic sections linked to the ultimate objective of the survey "to examine whether countries have made significant changes in their nuclear security and accounting practices in the past 15 years, and what the major drivers of change and the major constraints on change have been" [7, p. 1] All the sections contained closed-ended questions where respondents were asked to choose from a variety of options, yes/no or assess different issues (e.g., credibility of adversaries, causes of changes in nuclear security policy, constraints on nuclear security changes, etc.). Respondents could respond to the survey either in writing or orally (in person, by phone or video chat). For more information about methodology, questions, and results, see the full report.

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B-13 KEY TECHNOLOGIES

Key technologies, referred to also as "critical technologies", is a method seeking to identify the most important technologies and research developments which may have a significant impact on a certain issue (quality of life, national competitiveness, defence, etc.). It can be also understood as a meta-method using several other methods.

What is it used for?

It aims to identify research and development priorities, and accordingly formulate recommendations / advice to policy makers. It allows informed decisions about research and technological developments to be made that support agreed priorities, for instance, competitiveness, economic growth, security, and improved quality of life. It can be also helpful in long-term strategic planning which also needs to consider potential supply chain issues and vulnerabilities.

How to use it?

There is no single way to apply the method of key technologies. However, some general steps can be identified. First *a list of technologies* needs to be generated by means of various methods (interviews, Delphi, brainstorming, expert panels, scientometrics, literature review – the list can be derived from already existing lists, etc.).

Then a specific set of criteria is applied to assess how crucial these technologies are (*prioritisation*). Different criteria can be applied, yet often two parameters in particular are assessed: consequences (impact, benefits) and feasibility (likelihood of occurrence). *Consequences* can include economic, societal, environmental or other benefits (e.g., importance for human health, contribution to economic growth, quality of life, energy effectiveness, new job opportunities, etc.) or scientific opportunities (potential for breakthrough discovery, etc.). *Feasibility* reflects, for instance, human or financial resources for the given area, the level of education, requirements for research and development infrastructure, etc. A set of assessment criteria needs to be agreed in advance and then selected experts assign each technology a score (e.g. from 1 for low consequences/feasibility to 5 for extremely high consequences/feasibility). A graphic representation with two axis is recommended to visualise the results with the upper right corner containing technologies generally considered as critical (with the highest score for both parameters). The results are then discussed among experts and a list of key technologies is agreed upon. The final list could include technologies with extremely high benefits but lower feasibility if recommendations are provided on how to increase the feasibility. [1]

The final step should involve formulating recommendations on implementing results. For instance, this could be done by a SWOT analysis (to identify strengths and weaknesses that we have in relation to the specific research area and opportunities and threats this area might entail), scenarios (to see how these research directions may evolve) or wild cards (to identify disruptive events that might affect feasibility of a specific technology/research area).

Strengths

By identifying research priorities and key research directions, this method helps to allocate resources in line with these. Prioritisation is crucial for allocation of funds as no country or actor can afford to invest in all research fields.

Weaknesses

Experts could have biased opinions and conflicts of interest. Integrating different and potentially divergent views and opinions helps mitigate "group thinking" effects. At the same time, external players may have interests in this area which increases the risk of external lobbying influencing the results.

When scientometrics is used to analyse scientific and technical outputs on key technologies (see below), the major weakness stems from the fact that peer-reviewed journals often have a 2-year timeline from paper acceptance to publication.

What other methods is it usually combined with?

Key technologies are typically identified through various methods, including Delphi surveys, interviews, literature review, and expert panels. Traditional foresight methods to analyse key technologies include trends analysis and drivers analysis. It usually also goes hand in hand with (technology) roadmapping.

Different types of sources are used to build supporting evidence and generate insights on key technologies including academic articles or patents. Scientometrics (used to assess what was recently published on key technologies) and patentometrics (assessing new patents) provide comprehensive assessments of global scientific and technical developments and patent landscape. They indicate the state of scientific and technical developments, level of research in key technologies around the world, and international leadership in key technologies.

The development of alternative futures scenarios that build on key drivers and trends is useful for exploring how key technologies might evolve over time in different plausible scenarios. Exploration of key technologies in alternative scenarios can be done through war-gaming.

Is any software or other tools required?

Qualitative data analysis software such as NVivo, MaxQDA, etc. are useful to sift through vast amounts of textual data. For scientometrics, software examples include VantagePoint1, clustering software such as Gephi2.

Best practices (recommendations and tips how to best employ the method)

Consider and mitigate biases in data source selection, panel compositions, workshop participations by maximising diversity and inclusion. This includes creating an environment that encourages and enables diverse perspectives to be shared. Results should be protected from external lobbying as much as possible.

With respect to increasing the likelihood that decision-makers will act upon the results, best practice suggests:

- Generate products that are evidence-based as much as possible (as opposed to opinion-based).
- Integrate foresight activities of key technologies as part of the business cycle with specific milestones, resources and deliverables.
- Involve decision-makers early in the process when possible (applicable to any foresight project). Validate assumptions.
- Identify key priorities you want to influence.
- Develop multiple options and courses of actions for the decision space based on risk levels.

Example of use in the security and defence field

The method of key technologies has a particular benefit for the security and defence area given that national armies and the defence sector need to follow the newest technological developments to maintain competitiveness. This method is thus particularly important for identifying directions for defence research and development.

In 2022 European Commission published a report: Roadmap on technologies critical for security and defence. The idea behind is "to outline a path for boosting research, technology development and innovation (RTD&I) and reducing the EU's strategic dependencies in critical technologies and value chains for security and defence". [2] It calls upon member states to cooperate with the EU in mapping technologies critical for EU security and defence, that subsequently could be enhanced through European RTD&I programs and initiatives. For that purpose, the EU decided to establish an Observatory of critical technologies which will "identify, monitor and assess critical technologies for the space, defence and related civil sectors, their potential application and related value and supply chains. It will also identify, monitor and analyse existing and predictable technology gaps, root causes of strategic dependencies and vulnerabilities". [3] The ultimate objective is to boost innovation, enhance competitiveness, technological sovereignty as well as resilience of EU security and defence.

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B-14 LITERATURE REVIEW

Literature review is a survey of published sources on a specific topic. It provides an overview of current state of knowledge or recent trends related to a given topic.

What is it used for?

It is typically used as the first step of a research to obtain a better understanding of the topic under study, acquire a picture of where the current state of knowledge stands and gather inputs for subsequent analysis. The objective is to collect and review existing state of knowledge (already published data and information), and identify different approaches to the issue in question, different perspectives, major topics, problems, eventually gaps in the existing knowledge. It provides inputs for further research, but it also helps to decide the direction of the research, situate the research within existing knowledge, and see how it addresses a gap or contributes to a debate.

How to use it?

First, you need to search for relevant literature (related to your topic and published in relevant sources). Then you need to study the sources, identify issues relevant to your project, compare different perspectives and critically approach them. This stage can be time consuming but should not be underestimated. It includes identifying major themes, perspectives, debates, and gaps. It should not be regarded as a simple synthesis of information, but usually it also requires a critical approach and analysis. At the final stage you should have a clear picture of your topic as presented in the literature.

Strengths

Relatively cheap (although you need to invest in getting access to various databases). You do not need any specific technical skills besides critical and analytical thinking. It can be combined with most other research methods as their predecessor.

Weaknesses

The major weakness of collecting data from published literature is the time gap between conducting a research and publication of the results (especially when it comes to peer-reviewed publications). It usually takes time to get published in academic journals (months or even years), therefore, newly published articles, if they are not strictly theoretic, may not reflect the newest developments. This is especially problematic in the areas facing dynamic changes (e.g., international security). So-called grey literature might be an option to avoid this problem given that it does not undergo formal publishing procedures, yet as a result, it comes with its own challenges (quality might vary).

The quality of literature review also depends on what databases and resources you have access to. Limited access to resources can cause important sources to be missed. Another weakness is the fact that literature reviews can be time consuming.

What other methods is it usually combined with?

A literature review can precede any other research method as it provides inputs that can be further developed by various means. But to have a better understanding of data and information gathered by literature review, it is possible to use some statistical methods to analyse trends in the literature, frequency of occurrence of some topics, etc.

Is any software or other tools required?

Bookmark software such as Evernote or Zotero can be used.

Best practices (recommendations and tips how to best employ the method)

It is recommended to use a literature review at the very beginning of the foresight process. Diversity of sources is important: use multiple search databases and as many different and relevant resources as possible (think about different geographic perspectives, release time, etc.). Try to approach the sources and data critically (compare them, look for patterns, trends, gaps, etc.).

Example of use in the security and defence field

A literature review is used as the first step in most research work. For instance, ***ESPAS*** used a literature review when preparing Global Trends to 2030: Challenges and Choices for Europe (2019). [1] In their case, the literature review was focused on studies and reports published by the European institutions as well as third parties. The objective was to analyse what is already known (measurable trends that can be observed) and what is unknown (dynamics we are missing) and allow a discussion about different futures based on these two areas of known / unknown.

A literature review was also used by the UK Ministry of Defence to prepare *Global Strategic Trends*. [2] During the scoping phase at the beginning of their research process, they researched online sources to identify which topics related to future were covered the most since the

publication of the previous fifth edition of the report. This helped them to identify the topics that should be researched and included in the new edition. These topics were then discussed and decided during a workshop.

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B-15 MEGATREND ANALYSIS

Megatrends are large, transformative global forces that define the future by having far reaching impacts on global society. Megatrends are typically slow to form; persist for a long time (circa. 10-15 years); occur at a global or large scale; and are visible and well known to everyone. They are the underlying forces that drive trends. Examples include climate change and aging populations.

A trend, in contrast, is "an emerging pattern of change likely to impact large social groups or even state government and require a response". [1] They span individual organisations, possibly nations but are on a smaller scale and duration (circa. 2- 5 years) than a mega trend.

What is it used for?

The method is used to identify megatrends to be explored further with respect to their impact. Megatrend analysis allows a long-term strategy to be created that is proactive, rather than reactive. Given the scale of impact and duration of megatrends, a strategy will be fit for the future by taking megatrends into consideration.

How to use it?

There does not appear to be one universal method referred to as 'megatrend analysis'. In the open literature the most comprehensive guide on megatrend analysis is provided by Oxfam and this section is based on their approach. Oxfam identified megatrends by doing a 'scan of scans' – "a meta-analysis comparing recent scans of megatrends conducted by established consultancies, civil society organisations, think tanks and academics" [2, p. 9]. Their approach consisted of several steps:

1. Identify appropriate megatrend input material. It may be useful to consider if the material is: megatrend-focused; recent; universal in what it impacts; multi-trend; and future-looking[14].
2. Identify the megatrends outlined in the input material by:
   - Creating labels for megatrends: labels are identified from key words in the input material, they are the descriptors of similar phenomena found in different sources.
   - Coding the text (relative weighting of the labels): Oxfam allowed each piece of text to have 5 labels and used the following 'scoring' system:

     3 = label is explicitly referenced in the text as a megatrend.

     2 = the label appears in more than 2.5% of the total labels assigned to that particular input material / source.

     1 = all other remaining labels.
   - Identifying Megatrends across the sources: an average is taken that takes into account the frequency of occurrence of the label across sources and the strength of the claim that it is a megatrend.
   - Creating Megatrend and sub-trends: the previous steps help identify the strongest themes emerging from the input material (the megatrends) and the other areas that link into these as sub-trends.

Strengths

The approach outlined above has the advantage of building on the work of others and being highly systematic. It is also likely to be more cost effective to implement than identifying megatrends from a blank sheet of paper. Given that megatrends persist over a longer period of time, including them in the analysis might help to some extent mitigate uncertainties that are usually associated with foresight.

Weaknesses

There are a number of potential limitations to the approach, which can be addressed. First, the approach to collecting and identifying the megatrends by the samples used may inadvertently introduce additional bias. Second, the approach focuses on looking for consensus but often areas of non-consensus are important to explore also.

What other methods is it usually combined with?

Megatrends are often identified by means of literature review, Delphi or workshops. Given that understanding the implications of megatrends is important, it naturally needs to combine with other methods such as Futures Wheel or risk assessment (evaluating impact and probability).

14 This may lead to some sample biases, which should be acknowledge and, if feasible, addressed.

Is any software or other tools required?

No specialist software is required to use this approach and a spreadsheet analysis tool, such as Microsoft Office, should be sufficient.

Best practices (recommendations and tips how to best employ the method)

The nature of the sample is important and potential biases should be acknowledged and, if possible, addressed. If megatrends are identified based on already published work, it may be useful to consider supplementing this approach with subject matter expert input or other means to overcome potential bias. After megatrends have been identified, it is recommended that they are analysed in terms of their geographic relevance, implications, as well as opportunities and challenges they might entail.

Example of use in the security and defence field

In security and defence it is common to identify megatrends and then look for implications these megatrends might have in the field of security and defence. A similar approach was adopted by Roman Muzalevsky who identified megatrends (demographic, environmental, socio-economic, technological and military) that will create opportunities or threats for the U.S. in the battlefield. Megatrend analysis then consists of several steps. First, the author describes a prognosis for the future state in 2050 influenced by a particular megatrend. Second, the implications for the global operational threat environment and for the U.S. military were addressed. Third, recommendations were provided to the stakeholders for the work (U.S. Department of Defence, Department of State, and the military). Finally, each megatrend concluded by suggesting a respective Wild Card that could challenge not only the U.S. military but also both world and regional economic and security orders. [3] This approach to megatrends analysis enabled author to deliver a comprehensive vision of the strategic landscape for the U.S. military in 2050.

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B-16 MORPHOLOGICAL ANALYSIS

Morphological Analysis (also known as General Morphological Analysis – GMA) is a method for structuring and investigating the total set of relationships contained in multi-dimensional problems. [1] [2]. It provides a structured way to consider wicked problems by breaking them into a number of smaller units. Combinations of different units then lead to different scenarios.

What is it used for?

GMA is used to "explore possible futures systematically, based on a study of all the combinations of the various elements found in breaking down a system". [3] It is often used in problem solving to map possible solutions and future possibilities. In foresight, it provides a means of generating scenarios.

How to use it?

First, you need to define the problem you want to study and break it down into smaller units: variables and their different parameters (sometimes referred to as hypothesis)[15]. Next, create a morphological chart called a 'Zwicky Box' with variables in rows and their parameters in columns (usually two to five parameters are identified per variable).

15 The use of the term parameter tends not to be very consistent with the accurate meaning of the term (sometimes parameters are used instead of variables, and values instead of parameters).

The next step is to create different combinations of parameters (understood also as scenarios). The principle of creating combinations is to choose always one parameter per line / variable.16 [3] However, the Zwicky box can contain vast numbers of all possible combinations (depending on the number of variables and parameters). There are a variety of ways to reduce their number, for example by eliminating logically impossible or incoherent combinations.17 It is usually recommended to select the most contrasting scenarios that differ in several parameters (if scenarios are too similar, they might be perceived as just a variant of the same future). Or you can select the combinations that create new opportunities. The outcome of this process is a reduced subset of possible scenarios. - usually, three to seven are selected. To highlight them, it is suggested that a different color code or typographical style for each scenario is used (see Table B-3).

16 You can even construct a 3-dimensional matrix visualising all possible combinations of parameters (see [4]).

17 The process of reducing combinations also tends to use a framework called a Cross Consistency Matrix (see Ritchey [5])

Table B-1: A general example of a morphological chart

Variables	Parameters		
Variable 1	Parameter 1.1	Parameter 1.2	Parameter 1.3
Variable 2	Parameter 2.1	Parameter 2.2	Parameter 2.3
Variable 3	Parameter 3.1	Parameter 3.2	Parameter 3.3

Table B-2: A more specific example of a morphological chart as provided by Lamblin [3]:

Variable	Parameter 1 (Hypothesis 1)	Parameter 2 (Hypothesis 2)	Parameter 3 (Hypothesis 3)
Demographics	Continuous growth (French population at 68.5 million)	Weak demographic growth (French population at 67 million or below)	Strong growth and migration (French population above 70 million)
Population location	Economic hubs + south and west + fertile crescent	Medium-size cities and scattered rural areas	Metropolitisation (large and medium-size cities)
Employment, incomes and redistribution	Continuation of current trends; rising inequality	Improvement in employment, decreased inequality	Overall reduction in incomes, increased inequality

Recreated on the basis of Lamblin [3, p. 5]

Table B-3: Example of combining parameters in a morphological chart

Variable	Parameter 1 (Hypothesis 1)	Parameter 2 (Hypothesis 2)	Parameter 3 (Hypothesis 3)
Demographics	Continuous growth (French population at 68.5 million)	Weak demographic growth (French population at 67 million or below)	Strong growth and migration (French population above 70 million)
Population location	Economic hubs + south and west + fertile crescent	Medium-size cities and scattered rural areas	Metropolitisation (large andmedium-size cities)
Employment, incomes and redistribution	Continuation of current trends; rising inequality	*Improvement in employment, decreased inequality*	Overall reduction in incomes, increased inequality

Created on the basis of on Lamblin [3, p. 6]

If the number of variables is too high (more than 10), it is recommended to group them into components (by theme or interrelations) consisting of a similar number of variables. A morphological chart ('Zwicky Box') is then created for each component, hence combinations are created also for each component separately (so-called microscenarios). Then a new chart is drawn with components placed in rows (instead of variables) and microscenarios in columns (instead of parameters). Different combinations of microscenarios then create overall scenarios. This approach is called "nested morphological analysis". [3]

Strengths

GMA is strong in exploring possibilities. It provides a structured way to consider unstructured problems. It is focused on possibility rather than probability and stimulates new ways of thinking - opening new alternatives that are often beyond traditional reasoning. [6] In foresight, it provides a useful means to facilitate discussions around alternative futures that might not otherwise be considered and, as such, is especially useful when dealing with uncertainty. It boosts creativity and encourages innovation. Its strength also lies in transparency of work.

Weaknesses

The GMA method is quite complex and can be time consuming. Moreover, its use usually depends on computer support tools.

What other methods is it usually combined with?

GMA is especially useful to build scenarios[18]. Relevance trees are used to break the system into elements (variables and parameters). To select key variables having the greatest influence over the system, structural analysis is a useful method.

Is any software or other tools required?

There are several computer support tools for GMA:

- MA/CarmaTM (Computer-Aided Resource for Morphological Analysis): http://www.swemorph.com/macarma.html
- Parmenides EIDOS: https://www.parmenides-eidos.com/eidos9/us/offer/eidos-blog2/262-scenario-based-strategizing-using-eidos
- Scenaring Tools: https://scenaringtools.com
- GitHub: https://github.com/sgrubsmyon/morphr or https://johannesbuchner.github.io/zwicky-morphological-analysis/)

In general, the computer support has made it possible to create interactive, non-quantified inference models, further extending GMA's breadth of applications

Best practices (recommendations and tips how to best employ the method)

For morphological analysis it is useful to work in a diverse group to generate as many different ideas as possible. If the number of identified variables exceeds ten, it is recommended to use nested morphological analysis (see description of process above). To make the process easier, it is recommended that software is used to support the work. When selecting scenarios, you should not limit yourselves to the best case, worst case and one in between, but try to provide more alternatives while all of them being unique in a certain way.

18 See Johansen [7] who applied scenarios modelling with morphological analysis in Norwegian defence planning.

Example of use in the security and defence field

Dstl in the UK MOD commissioned work to look at future IED make up. They first used an ontology to describe the IED make-up to provide the variables and their parameters. Afterwards, logically impossible combinations were removed and the combinations that had been seen in the historical record were separated out. The remainder provided a list of possible future combinations that might form IEDs (IED v1.0). In addition to this, additional permutations were added for a number of parameters from the Horizon Scanning database. Of the additional combinations generated (above those that had already been identified) the logically impossible ones were again removed. The remainder provided an additional set of possible future combinations that might form IEDs (IED v2.0).

GMA was also used by Tzezana [8] to develop scenarios for the potential use of the internet of things by criminals and terrorists in the future. Factors were first identified in three categories (methods, motives, and targets). Afterwards they were ranked in terms of likelihood and impact and cross-matched to produce scenarios. Finally, a plausibility score was calculated for each scenario according to a formula. The process benefitted from diversity of participants as all together 50 experts with different backgrounds participated by interacting via the online platform Wikistrat. Other examples of GMA in security and defence relate for instance to civil aviation security [9], sabotage in nuclear facilities [10] or transport of radioactive materials [11].

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B-17 RELEVANCE TREES

Relevance trees is an analytical method that disassembles a complex issue into increasingly smaller units (sub-topics). The output is a graphic representation (hierarchical or tree structure) of a larger subject enabling a better understanding of different layers of complexity. [1] It is similar to a structured brainstorming or Futures Wheel, yet compared to the later, it has a broader applicability given that it shows any kind of connections not only cause-effect.

What is it used for?

Relevance trees is a useful analytical and planning tool used often but not exclusively in technology foresight[19]. Relevance trees are used to graphically represent a complex issue or a system by decomposing it into individual parts connected by cause-effect or any other relationships. It is often used to analyse and better understand larger problems / challenges or implications of a decision. It helps to identify possible solutions and options and thus can be useful in problem-solving. It is also used to study a goal or objective by decomposing it into partial objectives and tasks, thus helping to create strategies of achieving specific goals.

How to use it?

First, you need to identify the issue/topic to be studied. Then, list out the components of the topic and see how they are connected to the issue under study. Next, do the same for the components (decompose them into sub-components).[20] The result is a tree (or trees) arranged in a hierarchical order. When looking for solutions, usually several trees can be identified and the final step involves analysing the trees (prioritise them by assessing for instance impact and probability or incorporate relevance numbers to each tree) and choosing those with the highest relevance.

Strengths

The method is very systematic and enhances structured thinking, while the outcome is easy to interpret. It helps to understand complex issues (challenges or goals) by breaking them down into smaller more comprehensive entities. It is easy to use, it does not require much preparation, skills or time; it can be used spontaneously when needed. It provokes creativity and can reveal previously undetected issues, relationships or solutions / options (in fact, the process usually leads to a large number of creative solutions). It is very flexible and can be used in different kinds of situations.

Weaknesses

The method is sometimes criticised for the lack of sound reasoning and lack of critical judgement.

What other methods is it usually combined with?

It can be used during brainstorming to map initial ideas about a topic. It is useful in combination with trend analysis (to break down the trends into driving forces), horizon scanning, scenarios. Given that the method is easy and fast and does not require deep knowledge, it can be used in combination with any method when the situation requires it (to decompose complexity).

Is any software or other tools required?

You can use tools provided by MS Office to visualise hierarchical relationships.

Best practices (recommendations and tips how to best employ the method)

When creating relevance trees, individual layers in the tree should not overlap, keep it simple and easy to read. To mitigate the impact of subjective judgements and cognitive bias, it is recommended to involve a diverse group of participants.

Example of use in the security and defence field

Example 1: Relevance trees are often used in technological forecasting. It was used by C. Fleisher and B. Bensoussan in combination with other methods (Delphi, extrapolation, scenarios) to study the direction of technological changes. This particular case was in the area of business and competitiveness in general, technology forecasting is important in the security and defence industry. In this case, the authors used a relevance tree model to outline solutions to air pollution. Five different levels of the tree were defined. Level 1 consists of the general objective: “air pollution control”. The second level provides two alternatives how to approach this objective: “develop alternatives to internal combustion engines” and “develop petroleum tech. to eliminate pollution causing constituents”. Each of them is then provided with specific processes and methods required to achieve them (level 3). Level 4 consists of performance and cost of these processes and finally, the level 5 outlines applied research alternatives. [4]

Example 2: Relevance trees were also used by Mishra, Deshrnukh and Vrat as one of the methods to study futuristic combat vehicles. The tree structure was used to identify needs required to develop a suitable engine for future combat

19 See for example Jack R. Meredith and Samuel J. Mantel [2].

20 Two examples of impact-based relevance trees are provided on the Horizon website [3].

vehicles [5, p. 378] as well as to identify the type of a suitable engine [5, p. 380]. The authors then used Analytic Hierarchy Process to validate the results obtained by relevance trees method. [5]

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B-18 RISK ASSESSMENT

Risk assessment is a method that serves to determine the level of risk by analysing probability and consequences. *Consequence* (or impact) refers to the extent to which a risk event may affect a community/enterprise/environment etc. *Likelihood* represents the possibility that a given event will occur. Risk is then the function of consequence and likelihood.

What is it used for?

Risk assessment helps answer the questions: "What can go wrong? What is the likelihood that it would go wrong? What are the consequences?" [1] As a result, it is used to prioritise risks faced by a society, organisations or a state; evaluate risks before deciding whether any treatment is necessary; or to prioritise investments (for acquisition).

How to use it?

Risk assessment is the key element of risk management which has been standardised by International Organisation for Standardisation and consists of three components:

1. *establishing the context* (defining the scope, setting the boundaries of what we are going to look at);
2. *risk assessment* (risk identification, risk analysis, risk evaluation);
3. *risk treatment* (decide on control measures, monitor and review). [2]

Risk assessment begins with *risk identification and* its objective is to recognise risk events (or threats/ hazards) that need to be addressed. The outcome of risk identification is a comprehensive list of risk events which may be organised by categories (financial, operational etc.). The list requires prioritisation which is achieved by risk analysis and evaluation. Given that risk is a function of consequence and likelihood, *risk analysis* is a process by which the potential consequence and likelihood of a risk event are determined. First, a set of assessment criteria for both consequence and likelihood needs to be developed. The criteria can be assigned values either in qualitative or quantitative terms (e.g., consequence: insignificant / minor / moderate / major / extreme; likelihood: very unlikely / unlikely / possible / likely / almost certain; likelihood may be expressed also using terms of frequency or as a probability in percentage). Ratings for consequence and likelihood are then combined in a risk matrix to determine the level of risk (e.g., low – medium – high – extreme).

During the *risk evaluation* process, the level of risk determined in the risk analysis is compared with acceptability criteria to define if the risk is acceptable or not. (e.g., low risk is tolerated, medium risk should be managed to make it low, high risk must be treated, extreme risk must be treated as a priority). *Risk treatment* is then focused on either reducing the severity of the consequence, or the event's likelihood. A residual risk is the degree of risk that remains after the measures to reduce it have been implemented. It should not be too high (yet note that zero risk is impossible). It is calculated in the same way as the initial risk (by determining likelihood and consequence and combining them in the risk matrix).

Strengths

The method is capable of prioritising (and not merely identifing) the risks. Moreover, by making analysts focus on the risks it helps overcome so-called optimism bias (a tendency to underestimate losses and overestimate gains). It is relatively easy to perform, as there is no need of a software or computer expertise. In general, the method is not too demanding in terms of resources, and it can be done relatively quickly.

Table B-4: An example of a risk matrix

		CONSEQUENCE				
		Insignificant (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
LIKELIHOOD	Almost certain (5)	Medium (5)	High (10)	High (15)	Extreme (20)	Extreme (25)
	Likely (4)	Medium (4)	Medium (8)	High (12)	High (16)	Extreme (20)
	Possible (3)	Low (3)	Medium (6)	Medium (9)	High (12)	High (15)
	Unlikely (2)	Low (2)	Low (4)	Medium (6)	Medium (8)	High (10)
	Very unlikely (1)	Low (1)	Low (2)	Low (3)	Medium (4)	Medium (5)

Weaknesses

A situation may be encountered when impact and probability run in counter-directions (events with high probability of occurrence have negligible impact while those with low probability may trigger catastrophic consequences). Practitioners then face a challenge, how to assess such events and how to reflect them in strategy development. Risk assessment tend to be affected by subjective judgements and diversity of inputs is important.

What other methods is it usually combined with?

Risk assessment is often preceded by SWOT analysis, in fact, threats identified in SWOT may be used as inputs to the risk matrix. Futures Wheel can then serve to identify consequences of risk events / threats. Outcomes of risk assessment can be then used to inform scenarios (e.g., events assigned extreme level of risk may serve as inputs to developing the worst-case scenario).

Is any software or other tool required?

There are many risk management tools that can be easily found online (for specific tips see references [3] and [4]), however it can be conducted even without the use of any sophisticated software.

Best practices (recommendations and tips how to best employ the method)

If you want to distinguish between four grades of risk, it is recommended to use 5x5 matrix. The more grades for likelihood and consequence there are, the more risk grades can be identified. When assigning the impact score to an event, the rating for the most important consequence should be considered (note that one event may have several diverse consequences). A risk matrix can be easily adjusted also for other similar purposes such as uncertainty – impact analysis.

To mitigate the risk of subjective judgements and bias, it is recommended to involve a group of diverse people. However, ensure that different categories of probability and impact are understood in the same way (between analysts as well as those who use the assessment).

Example of use in the security and defence field

Example 1: Karmperis et al. discuss in their publication the use of risk assessment techniques as a tool to support decision-making in military operations. [1] First, they identified events that could impede the transportation of the military between two places. These risk events include for instance lack of food and water, lack of communication with supervisors, lack of tents, road damage in the main route, lack of fuel for vehicles, etc. All of them were then assessed in terms of likelihood (rare-unlikely-possible-likely-almost certain) and consequence (insignificant-minor-moderate-major-severe) and they were scored by using the risk matrix. The final risk was expressed as low, medium, high, or extreme. Finally, each event was suggested specific actions to mitigate the risk (e.g., supply of canned food and bottles of water, check communication equipment, supply of tents from supply network, etc.).

Example 2: The United States Army Techniques Publication No. 5-19 provides guidance on risk management and apply its principles for troop leading procedures as well as to the military decision-making process. [5]

Example 3: For more examples see also the study by Svetoslav Gaidow and Seng Boey. [6] It contains examples of how risk management is approached by the defence sector in Australia, USA, UK, Canada, and New Zealand. They indicate that risk management can be used as analytical support for decision-making, it can identify gaps in current capabilities and anticipate future capability requirements.

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B-19 ROADMAPPING

Roadmapping allows an entity to identify how to get where it wants to go to achieve its objectives. In more scientific terms, it is based on "the application of a temporal-spatial structured strategic lens" [1] and it usually, but not necessarily, produces a roadmap. The *roadmap* is defined as "a structured visual chronology of strategic intent" [1]. It visually portrays relationships between capabilities and requirements. As a visual representation of the roadmapping process, it serves as an important communication tool for the strategic intent and plans. *Technology roadmapping* (abbreviated as TRM) is a popular subtype of this method, which has, however, broader applicability as embodied in other terms such as "product" or "strategic" roadmapping.

What is it used for?

The method has universal use in supporting organisational strategy development, strategic planning and innovation. It is popular in industry, where it helps organisations to forecast science and technology developments as well as to align technology with organisational goals and thus survive and thrive in today's competitive environment. The defence sector usually employs the method to support the technological development of the defence industry.

How to use it?

Technology roadmapping offers two basic approaches known as "push" and "pull" (see Gordon [2], Kostoff and Schaller [3]). A "push" roadmap is based on pushing forward from a present state. It starts with an already existing research project or a technology and then identifies capabilities/products thatit could help inform in the future. On the other hand, a "pull" roadmap is based on pulling toward the desired end-state. It starts with a goal or a product that the organisation wants to achieve and then identifies science and technology solutions that would need to be developed to support such a product. A possible sequence of steps is described below in the example of a roadmapping exercise conducted by the Spanish MoD.

Production of a roadmap is not a necessary output of the process, but it is highly recommended since it offers an important tool for communicating the findings with stakeholders. A roadmap is comprised of a horizontal axis – the "know-when" dimension spanning from the present toward some vision in the future, and several vertical layers (see the figure below). The top one of them depicts the "know-why" dimension as the project's purpose, the middle is the "know-what" dimension referring to the delivery and the bottom is the "know-how" dimension to be populated with resources needed to achieve the desired product or service [4].

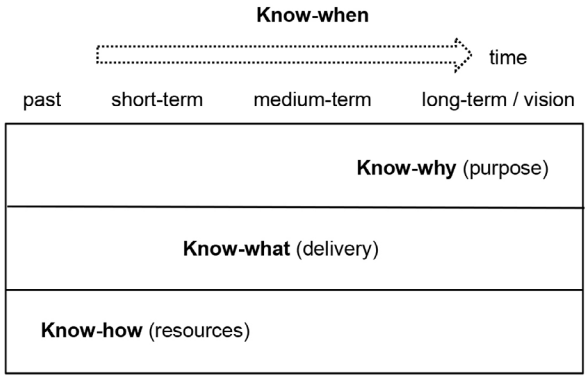

Figure B-1: A roadmap architecture
Source: adapted from Kerr, Phaal and Probert (2014)

The construction of a roadmap usually consists of the following steps [3]:

1. Identify the nodes as the milestones on the road.
2. Specify the node attributes.
3. Connect the nodes with links ("roads").
4. Specify attributes of the links (such as time, uncertainties or costs).

Strengths

The method allows flexibility in terms of the aim, time horizon or the process itself. It is easily customisable to the organisation's needs and strategic context. Kerr and Phaal highlight its ability "to clearly and coherently portray and present the dynamic linkages (including highlighting discontinuities) between resources and capabilities, product/service solutions, organisational objectives and business drivers, market characteristics, and the changing environment". [1, p. 6] This visual representation in the form of a roadmap also makes it appealing to the stakeholders and by itself serves as an important communication sense-making tool. The use of roadmapping can promote dialogue, collaboration and mutual understanding between the contributors as well as the stakeholders' engagement. In the defence sector, it can help to obtain the support of the private sector for the national defence goals by directly engaging them in the process and highlighting the linkages between the market and the end-user long-term objectives.

Weaknesses

Roadmapping requires a high level of expertise. If the entity cannot rely on sufficient in-house

expertise, it can be costly. The method is also dependent on subjective judgment, which, in absence of a certain level of diversity of the expert inputs, can considerably affect the findings. The linear nature of the roadmap carries the danger of taking progress for granted and disregarding discontinuities or alternative options.

What other methods is it usually combined with?

Roadmapping works well with most other methods. Delphi and expert panels are frequently used to provide the needed expertise to fill in the roadmap with content. Literature review or trend analysis might be useful as inputs to the roadmapping process, together with other analytical techniques such as bibliometrics, patent analysis or text mining. You can use trend extrapolation or morphology analysis to help with the roadmap development. The method key technologies complements well with technology roadmapping as a specific subtype of roadmapping.

Since the method works with a vision of the future, it can follow development of a preferred future scenario ("pull" roadmapping) to see what development could fulfil this vision. Or, it can support a scenario development by "pushing" forward from the present state to achieve some future state. Either way, the roadmapping enhances the quality of scenarios and clearly links them with decision-making.

Is any software or other tools required?

Various software can facilitate the application of roadmapping. You can find several examples below and refer to the links for further information:

- Strategic Planning & Roadmapping (https://roadmappingtechnology.com/innovation_software/strategic_planning_roadmapping.aspx)
- Product Roadmap Toolkit™ (https://280group.com/products/toolkits/product-management-office-professional/)
- Roadmunk (https://roadmunk.com/)
- Aha! (https://www.aha.io/)

Best practices (recommendations and tips how to best employ the method)

Since the expertise is greatest at the point of the roadmap completion, you should make the process iterative instead of conducting it as a one-time exercise. To limit the inherent subjectivity of the effort, secure the engagement of the greatest number of experts available while seeking enough diversity among them. Expertise from related research and technology areas can further enhance the quality of the process. The interaction among experts is desirable and can be supported by the use of workshops. The visual representation of the process in a form of roadmaps should be exploited to depict the findings and gain the stakeholders' attention. Kostoff and Schaller offer more guidance on how to get high quality roadmaps. (see [3, pp. 140-141]' However, you should also consider discontinuities and incorporate them into the roadmaps to account for uncertainty. Since, for the technology roadmapping specifically, the sensitivity and confidentiality of the information gathered is often an issue, high ethical standards should be established and upheld.

Example of use in the security and defence field

In Spain, the General Directorate of Armament and Material used technology roadmapping to increase the country's military capabilities in the long term (15+ years) and more generally to facilitate actions in the defence sector. Experts, mostly from the Ministry of Defence, designed the exercise based on the principles of a future-oriented technology analysis (FTA). The project analysed how a set of desired objectives could be reached through technology development. It also helped to determine the priorities of technological capabilities of different entities (firms, universities etc.). The findings were incorporated into the Defence Technology and Innovation Strategy (ETID), which "provides the base for defining technology roadmaps that will help make available those technologies necessary for developing systems that the Armed Forces will require in the future". [5]

In the first step, six functional areas of technological goals (Armaments, ISTA, Platforms, Personal Protection, Platforms and Critical Assets, Information and Communication Technologies) were defined. Each of them was covered by a technical group and researched through other sources. The functional areas were divided into functional sub-areas and these were further divided into technological goals – the latter being the objectives to achieve in the technological domain for attaining the needed military capability (see Table A-5). Finally, for each of the technological goals, the experts elaborated a specific roadmap, which included the key enabling technologies as well as appropriate actions to be taken. They were further classified according to the technological readiness and target level pursued.

Table B-5: Example of a functional area

Functional area	Armaments
Functional sub-area	Munition
Technological goal	Enhancing technological capabilities to increase the range/velocity of munitions.

Source: General Directorate of Armament and Materiel [4]

Note: In the defence sector, the roadmap can be populated by other resources beyond technology, such as human resources, logistics or information [4]. For other examples of roadmapping or roadmaps use in the defence sector refer to Ayodghu et al. [6] or Kerr, Phaal and Probert [4].

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B-20 SCENARIOS

Scenarios help guard against predictions that are too tame or too wild – they provide an informed view of what may happen in the future and in doing so allow us to plan against eventualities. They can capture a wide range of possibilities, identify trends and allow for better informed decision making. Scenarios can provide descriptions of alternative futures. Finally, they are not a predictive tool, but rather one that can describe possible futures and identify emerging challenges.

What is it used for?

Scenarios are used to identify such things as emerging trends and technologies as well as the security challenges they pose. They can help decision-makers understand and plan for future possibilities. Scenarios can also test current assumptions about the security environment as well as current capabilities or strategies against future threats and identify gaps. By presenting new possible futures, scenarios can also be used to encourage adoption of new ways of thinking about the challenges and the opportunities they may offer.

How to use it?

There is no one "right" way to develop a scenario but there are steps that are widely applicable to the process. The steps offered below are not exhaustive but illustrative of ones that may be used.

- Define the parameters of planning (or other decision-making need), such as the issue, timeframe, and level of analysis needed.
- Identify change driver(s) (e.g., shift in geopolitical power) that will guide the scenario development. These change drivers would be identified during the scanning phase of the scenario development. You may wish to separate identified drives into likelihoods (e.g., likely, not at all likely, etc.) of occurring for analysis and planning purposes.
- Gather data and identify any key factors and trends that will inform your scenario. Next begin to develop the narrative (e.g., rapid decline of a state actor, a region, the environment, etc.) around the subject and within it identify new challenges / opportunities the scenario presents.
- Once constructed, test the assumptions derived from the scenario by asking questions such as how likely is the assumption to occur, how will it influence current strategy, does addressing it fall within current capabilities, etc. Assumptions that are determined extremely unlikely may be discarded or perhaps parked for follow-on investigation.

Strengths

For participants in the scenario design, development and testing process they encourage people to think broadly and critically about how a particular future may unfold and in doing so help them challenge any preconceived notions and views. Engaging in scenario work also can facilitate team building through the exchange of ideas, experiences and best practices. Scenarios can be constructed in a number of ways and with few or many resources thereby making them easily scalable to available resources. Obviously, the more time spent on scenario development and testing and the greater the number of participants the more robust the final product will be. Another strength of scenarios is that they can be done quickly with limited resources, or more meticulously and with vast resources.

Weaknesses

Scenarios can take a great deal of time to develop, and depending on how ambitious the investigation into trends and drivers is they may require access to many experts or barring that access, more time to conduct research. Participants may either become too accepting that their scenarios will happen or conversely too dismissive of their probability of occurring. Some participants may be unable to overcome preconceived notions and thereby constrain the development of the scenario. Convincing decision makers to incorporate scenario outcomes into planning processes may be difficult if they are unfamiliar with the method or if the results do not align with current plans or institutional thinking.

What other methods is it usually combined with?

Scenarios can be easily complemented by other futures methods. They are often used in combination with the Delphi method, road mapping, expert panels, SWOT analysis, scanning, drivers and trend analysis, etc. Arguably, the more methods that are used in combination with scenarios the more robust and defensible the scenario will be.

Is any software or other tools required?

There are a number of software tools that can aid in scenario development. ITONICS Foresight (https://www.itonics-innovation.com/itonics-strategic-foresight) is one such tool that features a free trial but has a cost for full feature access. Another tool is Futures Platform (https://www.futuresplatform.com/) that includes a number of tools including one that aids in scenario development. It has a free trial but a cost for full access.

Best practices (recommendations and tips how to best employ the method)

At the beginning of any scenario work select the number of scenarios you wish to develop and plan the time needed to achieve this accordingly. In developing scenarios try to assemble a diverse group of experts to avoid group think and to ensure that all relevant aspects of scenario development (e.g., political, military, technology, economic aspects) can be addressed. If your leadership is unfamiliar with scenarios consider explaining to them the benefits of their use. Finally, storytelling can be used as a tool to communicate the scenarios to the audience (see Annex D).

Example of use in the security and defence field

Numerous nations, organisations and think tanks (such as the IMF and the U.S. National Intelligence Council) or large multi-national corporations (Shell) utilise scenarios for (defence) planning purposes.

The scenario development process by *Shell* includes a multitude of short-, medium-, and long-term portraits of global energy developments; individual country analyses; and consideration of major trends in areas like public health and urbanisation. Scenarios can take a global view or focus on specific issues in specific countries, such as the future for some emerging democracies.

Scenario building by Shell includes the following common features: first, a range of drivers is looked at, such as exploring how the world is changing – politically, economically, technologically and socially. Then scenario sketches are created that outline a range of potential futures. At this stage Shell involves the key decision makers in the foresight work by means of scenario workshops. Finally, the scenario building is complemented with complex econometric modelling and 'sophisticated methodologies'. (Quantitative modelling is used by Shell to inform and shape the development of scenarios and to 'test' the scenario stories. An example is Shell's World Energy Model that provides scenario-based simulation of the world energy system.). [1]

Shell scenario methodology was used also by *SIPRI* when creating future scenarios for South Sudan. First, data were gathered by means of desktop research, workshops, and interviews. Scenarios were then created in three steps: (1) Setting the time horizon. (2) Identify probabilities and uncertainties. (3) Identify key uncertainties: three key uncertainties can be visualised as the axes – visualised also as the edges of a cube. Corners of the cube then represent scenarios. Scenarios are then assessed to select the most relevant and consistent ones (usually no more than five scenarios are selected), and they are described in more details. Finally, lessons and policy implications are identified: how to reach the most positive scenario and to be best prepared for the worst. [2]

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B-21 SCIENCE FICTION

Science fiction offers a way to write about realities that differ from our own and that result from such things as new scientific discoveries, new technologies, or different social systems. It then looks at the impact of this change on us. In foresight development science fiction offers a method to explore numerous aspects of the future whether they be scientific developments, societal changes, climate change, etc. Science Fiction in foresight work takes the form of future oriented stories based on an evidence-based study of such things as future geopolitical trends, technologies, etc.

What is it used for?

In foresight work science fiction offers a way to incorporate change across the entire spectrum of our lives, including those in defence and security. Through incorporating technological, climate, defence, social, etc. changes into a narrative that posits how those changes will impact our future, defence planners are able to both see what future challenges may emerge and with this knowledge plan against them. Change and its impacts woven into a narrative form may help planners better visualise what the future may look like.

How to use it?

The process of developing a science fiction narrative is similar to that for developing a scenario. One difference is that the science fiction product may take a longer written form, for example a novella, than some other methods that may be only a few pages in length. Graphics are often employed to help readers better visualise the changes being discussed. A timeframe for the narrative is selected as well as a theme, for example responding to a particular crisis, and within this theme change drivers (technology, societal breakdown, etc.) are included to demonstrate the types of challenges this future could present. All these elements incorporated into a narrative enable defence planners to understand what future challenges military and security forces may face, test current capabilities against them and also against predicted future capabilities. From this analysis capability gaps could be identified.

Strengths

Costs can be low, especially if one is able to use available resources to develop the science fiction narrative(s). This method offers an opportunity for team brainstorming and team building when developing the science fiction narrative. There are numerous and easily available examples of science fiction narratives that can be used both for inspiration and for how to develop a narrative. Science fiction narratives are flexible in that they do not have to just describe fantastic futures that look nothing like our current reality. Instead, they are able to weave together elements of our current reality, predicted future trends and shocks or wildcards and in doing so produce a narrative that has both the familiar and the new and thereby increases its relatability to readers. Because it takes on a story telling format, this method is accessible to an audience far beyond the specialist and therefore can be easily used by foresight practitioners with various levels of expertise.

Weaknesses

Writing an engaging science fiction narrative is not an easy task. If one does not have access to a writer of appropriate skill, then an outside resource will need to be contracted and this may be expensive. Regardless of cost, it may take weeks or months for the narrative to be written, so this method may not be best for organisations with tight forecasting deadlines. The final product will be informed by the experiences, interests, and biases of those who developed it. This means that depending on the background of the author or authors the future posited may not be as broad as it could be. To mitigate against this, it would be beneficial to bring together a group from varied backgrounds to ensure the widest possible range of ideas be considered.

What other methods is it usually combined with?

Science fiction can be used with a variety of other methods such as brainstorming, Delphi, expert panels. It can also help to identify Wild Card.

Is any software or other tools required?

These are suggested software tools that could help in writing a science fiction story to use as part of a foresight exercise. Bibisco (https://bibisco.com/) is a free story planning and word processor, Evernote (https://evernote.com/) is a free word processor and organisational tool, Scrivener (https://www.literatureandlatte.com/scrivener/overview) is a story planning and word processor software that has a monthly fee, and Ulysses (https://ulysses.app/) is also a story planning and word processor software that has a monthly fee.

Best practices (recommendations and tips how to best employ the method)

As this method may take considerable time from start to finish, planning for it early in your process is advisable. This includes investigating potential cost, which should be factored into your overall plan early on. In preparing to develop

the science fiction narrative it is best to bring together a diverse group of experts to enable the widest possible array of ideas to be generated and debated.

Example of use in the security and defence field

Using science fiction in forecasting for defence has a long history. Numerous militaries, such as the U.S. [1], Canada [2] [3], and France [4] have used science fiction as a forecasting method. Future Army, a foresight project run by Canadian Army Land Warfare Center (CALWC), was designed to help military leadership envision what the future security environments might look like. A report published in 2005 was accompanied by a science fiction novel to present the findings in a more attractive and digestible way and thus attract more readers than the actual report probably would. CALWC hired a science fiction author Karl Schroeder to accomplish the task and it resulted in a science fiction novella Crisis in Zefra (a story of Canadian peacekeepers who get caught in a street battle in a failing state in Africa). It is focused on future peacekeeping and potential future military technologies and their use on the battlefield (such as drones, next-generation body armor, threat detection systems, but it also anticipates some problems linked to the use of cellphones on the battlefield). [5] [2] The second novel by Karl Schroeder was produced for CALWC in 2012 and is called Crisis in Urlia. It is focused more on command processes and procedures involved in meeting armed conflict given changes in organisational culture and government cooperation. [3] Both novellas illustrate potential military implications of empirically grounded findings based on use of alternative futures.

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B-22 STRUCTURAL ANALYSIS

Structural analysis is a way of analysing mutually interacting factors (variables) typically by means of cross-impact analysis. The name of the method stems from the fact that it reveals the structure of a system consisting of impact and dependency between variables. The objective is to represent interrelations between the variables and to identify variables that are crucial for the development of the system.

What is it used for?

It is used to identify factors essential for the system´s evolution. It is especially helpful in dealing with complex issues when a large number of variables need to be taken into account (internal, external, major actors). Moreover, it can help to create a common understanding of a complex problem / issue among a heterogenous group of experts.

How to use it?

First, all the variables that may influence the issue in question should be identified. These can be clustered into several thematic groups, helping to check that the spectrum of possible variables has been covered. The relationships between variables should then be analysed and a cross-impact matrix (where all the variables will be placed in both columns and rows (see Table B-6)) can be used for this. Next, progress systematically by assessing relationships for each pair of variables. This is indicated by numbers: 0 for no direct influence between the two variables, 1 for low direct influence, 2 for medium direct influence, and 3 for high direct influence. You can use 4 (or "P") if there is a potential direct influence (e.g., for an emerging variable whose influence cannot be assessed yet). [1] Another option is to distinguish between direct, indirect (A influences C via B), potential, and no influence. [2] Filling the matrix requires a consensus among participants. Data is then processed by a computer software (e.g. MICMAC) to calculate two different indexes for each variable: influence index express to what extent the variable affects the system (other variables) while dependency index express to what extent the variable is affected by the system (by other variables). For a better visualisation it is then recommended to place variables in a graph with two axes corresponding to influence and dependency. Based on different levels of influence and dependency, it is possible to distinguish between different groups of variables from crucial (those with strong influence and high degree of dependency) to autonomic (having the lowest values for both indexes). [3]

Strengths

It helps stimulate (systemic) thinking and contributes to a shared understanding of an issue among participants. The advantage is the ability of the method to identify correlations that may not be obvious at first. The outcome is a prioritisation of variables and a representation of a complex system in an organised way.

Weaknesses

Structural analysis can be a time-consuming process (depending on the size of matrix as well as working group and the level of knowledge). Moreover, the outcome can be more difficult to explain given the amount of calculations along the process.

What other methods is it usually combined with?

Structural analysis can be combined with expert panels or workshops to validate the list of variables or the cross-impact matrix. Structural analysis often precedes scenario building as it provides important inputs to scenarios as for the key drivers. In fact, the variables identified by a structural analysis as crucial can be translated into the axes in a scenario. Structural analysis can be also used to analyse trends and their key drivers.

Table B-6: Matrix for structural analysis (cross-impact matrix)

	Variable 1	Variable 2	Variable 3	Variable N
Variable 1				
Variable 2				
Variable 3				
Variable N				

Is any software or other tools required?

For data processing programs 'MICMAC' and 'MACTOR' can be used.

Best practices (recommendations and tips how to best employ the method)

In the case of a large number of variables, it can be helpful to categorise them according to sectors (e.g., STEEP, PESTLE, etc.). To overcome the pitfalls of subjectivity, it is recommended that the list of variables is compiled by a diverse group of people with a multidisciplinary background. It can then be validated by interviews and consultations with even more experts. The same applies when filling in the cross-impact matrix.

Example of use in the security and defence field

Joanna Ejdys et al. used structural analysis to identify and classify factors influencing the development of nanotechnologies in Podlaskie Province. [4] The example has useful insights related to the technological sector, which is relevant for defence and security. First, the authors listed all factors influencing the development of nanotechnologies in the given province organised by sectors (they opted for STEEPVL approach: social, technical, economic, ecological, political, values, legal). Each sector was identified with three factors (enumerated S1, S2, S3, T1, etc.). In the next step, a cross-impact matrix was created to assess how factors influence each other. The impact ranged from "0" (no impact) to "3" (crucial impact), while "P" stood for potential impact. The dependence and influence index was then calculated for each factor enabling the factors to be organised into seven groups:

A chart was provided with crucial factors placed in the top right corner (high values allocated at both axes). Two of these crucial factors where then recommended as the axes for the development of scenarios further analysing the researched topic (i.e., development of nanotechnologies in the Podlaskie Province).

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Table B-7: Factors in Terms of Dependence and Influence According to Joanna Ejdys et al

Factors	Characteristic in terms of dependence an influence
crucial factors	high degree of influence and dependence
aim factors	high dependence and relatively strong influence
result factors	high dependence but weak influence
regulatory and supplementary factors	medium dependence and medium influence
determinant factors	strong influence, but low dependence
external factors	medium influence, low dependence
autonomic factors	both influence and dependence are the smallest

B-23 SWOT ANALYSIS

SWOT is an analytical method used to identify and classify important internal and external factors that are either favorable (strength, opportunities) or harmful (weaknesses, threats) to an organisation (or state or another subject). *Strengths* are understood as qualities inherent to the organisation that create a competitive advantage or areas where it performs particularly well. *Weaknesses*, on the contrary, are those features inherent to the organisation that could improve. *Opportunities* refer to chances for improvement arising from external environment, while *threats* are anything from external environment that can negatively affect the organisation.

What is it used for?

The objective of SWOT analysis is to raise full awareness of the situation and provide a list of major issues that should be considered when drawing a strategy for an organisation (profit from what the organisation does well, address the shortcomings, minimise risks, and exploit opportunities). It is used to help match the resources and capabilities of an organisation to the environment in which it operates. It enables the question 'where are we and where can we go?' to be addressed. It thus helps to choose the most effective course of action. In the security and defence field it is usually used to assess the current environment, formulate strategies, but it can be also used for evaluation in the battlefield.

How to use it?

In general, there are three steps when using SWOT for development of strategy:

Step 1: SWOT matrix

Create a list of factors in each of the four categories: strengths and weaknesses relate to internal factors (they can be influenced by the organisation), while opportunities and threats arise from the external environment (external factors are usually out of an organisation's control or they can be influenced only to a limited extent). Internal factors reflect the current state (what strength and weaknesses does the organisation currently have) while external factors can be identified based on expected developments over a defined time horizon – what opportunities and threats can we expect to arise for the organisation?

Once you have a matrix, you can assess the data and interpret the matrix in order to develop strategies.

Table B-8: SWOT matrix

	Favorable	Harmful
Internal	STRENGTH	WEAKNESSES
External	OPPORTUNITIES	THREATS

Step 2: Assessment/prioritisation of SWOT factors

Both external and internal factors can be prioritised based on their importance (e.g., high-medium-low). For instance: what benefits would the opportunity entail? How serious is the threat (this can be assessed based on likelihood and impact)?

Another option for assessing the factors in a SWOT analysis is to use more sophisticated methods for *multicriteria evaluation of variants* including Saaty's AHP (Analytical Hierarchy Process) or ANP (Analytic Network Process) methods. Both are advanced mathematical approaches for quantifying the weights of factors. [1]

Step 3: Development of strategies based on SWOT

For *strategy development*, it is recommended to *pair* prioritised *items* within a SWOT matrix in the following way: (1) exploit strengths to grasp opportunities; (2) overcome weaknesses by seizing opportunities; (3) avoid threats by using strengths; (4) avoid threats by minimising weaknesses. It is possible to use *a confrontational matrix* to see how the elements affect each other. [21]

Strengths

Basic SWOT is simple, flexible, can be used universally and there is no request for technical knowledge and skills (if the SWOT is not combined with some of mathematically more demanding techniques). It is good at identifying priorities, barriers to success, and emerging opportunities.

Weaknesses

SWOT may generate a long list of factors with usually no prioritisation, therefore, there is a need to combine it with other methods. Moreover, the lists are subject to compiler bias and subjective judgements (indeed SWOT is sometimes criticised that it lists opinions rather than facts). Not to mention that the compilers

21 For a more advanced techniques of strategy development see Ahmet Kandakoglu, Ilker Akgun, Y. Ilker Topcu [2] (they provided a formula to measure relative importance of factors and build/evaluate strategies accordingly).

often tend to emphasise strengths while ignoring some weaknesses. At the same time, a good SWOT analysis requires deep knowledge of the organisation/state/region in question. Although SWOT can be used also for a longer time horizon, there are some limitations because uncertainty increasingly comes into play.

What other methods is it usually combined with?

Input data for SWOT analysis can be obtained by means of horizon scanning, brainstorming, interviews, or PESTLE (to identify external factors). To assess the factors and their mutual relations, SWOT analysis can be combined with the more mathematically demanding AHP method, ANP method or Porter's 5 forces analysis. Eventually, threats can be prioritised by means of risk assessment. Finally, SWOT often provides inputs to scenarios and it can be used also prior to Delphi (in this case, the information provided by SWOT may help to create the questionnaire).

Is any software or other tools required?

Basic SWOT does not require any sophisticated software. However, if you want to analyse SWOT through AHP method, AHP Software is necessary.

Best practices (recommendations and tips how to best employ the method)

The best results are obtained if SWOT is used for the short-term time horizon (the longer-term the time horizon the more limitations there are because of increasing uncertainty). To overcome compiler bias, it is recommended to create teams of more people from different units, levels of management and functional areas that bring to the table different perspectives, experience, and expertise (diversity of personnel is crucial). When creating the list of entries, minimise vague and broad formulations, and be as specific and clear as possible. Distinguish between internal and external factors (avoid the common mistake of mixing factors internal to the organisation with external factors, e.g., weaknesses with threats) and try to avoid unsupported claims (list facts not opinions). To avoid overcomplication, try to limit the number of entries for each category to five. Once you have the matrix, prioritise the factors. To achieve more accurate results, it is recommended to combine SWOT with quantitative techniques, however, the method then becomes more demanding in terms of skills.

Example of use in the security and defence field

Ahmet Kandakoglu, Ilker Akgun, Y. Ilker Topcu used quantified SWOT as a strategy development and evaluation method in military operations (their case study involves a fictitious brigade commander). [2] First, inputs to the SWOT matrix were identified by means of brainstorming. A hierarchical structure was then built from the list and, subsequently, the use of the AHP method enabled the relative importance of individual SWOT factors (express their value in quantitative terms) to be measured. Strategies can be then developed while particular attention is paid to the factors having the highest weight. Four main strategies were formulated: attack, defend, delay and withdraw, while each of them influencing a SWOT factor in a certain way (building on strengths, overcoming weaknesses, exploiting opportunities and countering threats). Finally, the authors evaluated the weight of strategies with respect to SWOT factors (they calculated the degree of the relationship between the strategy and SWOT factors) and ranked the strategies in descending order. This approach of quantified SWOT sought to identify the most successful strategy in the battlefield.

Jeffrey M. Post used SWOT to assess the external and internal working environment at Naval Air Station Joint Reserve Base Fort Worth. [3] The ultimate objective of his study was to assess the consolidation of support services at the base against a backdrop of defence budget restraints. The author used literature review and semi-structured interviews with both military and civilian personnel to gather data. SWOT then provided a framework to analyse the interviews and identify strengths, weaknesses, opportunities and threats suggested by interviewees (data categorisation). Finally, the author formulated recommendations on how to take advantage of strengths and opportunities while minimising weaknesses and threats.

Other examples include Heriyadi, Z. Fanani, Setyo Widagdo and Alfi Hariswanto who used SWOT to analyse the contemporary national defence system of Indonesia in the face of information warfare in the digital era. [4] Finally, Kulcsár Gábor used SWOT to assess relatively newly established company within the Hungarian Ministry of Defence and suggested solutions to revealed problems. [5]

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B-24 TREND IMPACT ANALYSIS

Trend impact analysis (abbreviated as TIA) is a method invented by futurist Ted Gordon. He defined it as "a forecasting method that permits extrapolations of historical trends to be modified in view of expectations about future events" [1]. The method follows the assumption that trends change over time and as such challenges the validity of mere extrapolation of trends into the future without considering how unexpected events can alter them.

What is it used for?

The method allows us to account for unanticipated events and to evaluate their impact on current trends. By outlining possible future trajectories of the present trends, it provides a foundation for scenario development. It can also help to evaluate how a new technology could affect a certain field, business or company, which makes it particularly useful in the field of armed forces' development.

How to use it?

Trend impact analysis consists of four basic steps. In the next step, scenarios can be developed based on the adjusted trend values.

1. "Surprise-free" extrapolation of historical data

In the first step, data reflecting the past development of the phenomenon are gathered and extrapolated into the future by fitting an appropriate curve to the data. For the extrapolation, you can either use a curve-fitting algorithm or in the absence of quantitative data, you can opt for an expert judgment.

2. Identification of future events that could deviate from the historical data extrapolation

In the second step, you need to assemble a list of events that could alter the trajectory of the extrapolated data in the future. Only important, unprecedented events should be considered. Other methods, such as literature review or Delphi, can help you to identify these events. You can also explore emerging or potential changes in the different domains to identify possible surprises (see Horizon scanning) with the help of STEEP, PESTLE or another analytical approach.

3. Experts judge the probability of occurrence for each event on the list

Next, the probability and impact of each of the events are evaluated by experts. Generally, it is assumed that a high-impact event will change the trend direction more substantially. You can express the impact estimate in the following ways:

- *as areas* which the event will affect;
- *as the time from the occurrence of the event until:*
  - the trend is affected (*time to first impact*)
  - the largest impact on the trend (*time to maximum impact*)
  - the impact reaching a final or steady-state level (*time to steady state impact*);
- *as the magnitude (size)* in terms of:
  - the *largest* impact
  - the *steady-state* impact.

4. Extrapolation of the curve by an algorithm

In the fourth step, the "surprise-free" extrapolation is combined with the judgments on probability and impact to obtain the adjusted trend values (see figure below). Again, you can use either expert judgment or specialised software.

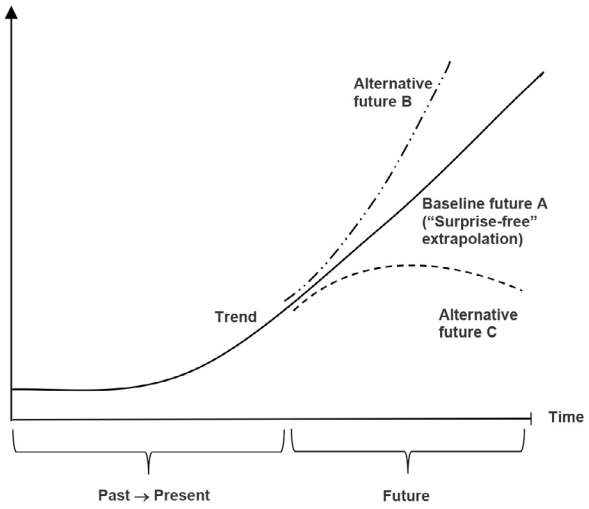

Figure B-2: Trend impact analysis

5. Scenarios development

TIA can be used more generally to stretch thinking or to develop scenarios based on the identified events. In a single scenario, you can account for more than one event. It is possible to evaluate the scenarios according to their probability to identify the most probable ones for further description and policy recommendations.

Strengths

Trend impact analysis helps to account for discontinuity and uncertainty by working with a range of alternative futures rather than a single-point forecast. This way the method sensitises the stakeholders to potential surprises and prevents

Table B-9: Examples of events and their impact on the national security of Romania based on the trend impact analysis

Event No.	Event Title	Advent Probability in 2018 (%)	Years Until First Impact	Years Until Maximum Impact	Maximum Impact
3.	The post petrol society	20	3	20	6
13.	The collapse of the European Union	10	5	30	3
19.	The union of Romania with the Republic of Moldova	20	3	10	5
20.	Two Ukrainian states	50	3	8	3

Source: Grigoras [2]

bias and conventional thinking that relies too much on the present trends' continuation. TIA offers a solid baseline for scenarios' development into which it also brings a certain level of quantification. It might also enhance the usefulness and accuracy of quantitative forecasting methods such as extrapolation. Finally, by analysing potential impacts of (un)intended changes, it supports strategic planning and policy evaluation.

Weaknesses

Although the method follows a simple set of steps, it requires some level of proficiency in quantitative methodology. It relies on (subjective) expert judgment in identifying trends and estimating their impact and probability. For the initial extrapolation, TIA requires a solid base of data. The analysts may also encounter difficulties when looking for a proper curve shape to extrapolate the historical data as more than one can fit the data. The method does not allow to consider the relationship between the impact of an event and the time of its occurrence.

What other methods is it usually combined with?

Trend analysis or literature review typically precedes trend impact analysis by identifying the current trends to be extrapolated into the future. Horizon scanning or Delphi can be used for identifying events or signals of future change that could alter the trends' trajectory. Risk assessment then provides procedures to estimate the impact and probability of such events. While the basic version of TIA considers events as independent from one another, a cross-impact analysis can account for their interdependence and thus further enhance the validity of trend impact analysis. By identifying a range of alternative futures, the method is easily complemented with scenarios. Futures wheel can enhance the accuracy of trend impact analysis' outputs by accounting for secondary and tertiary consequences of the events as well as their interdependence. Brainstorming might be conducted at any point of the TIA process where a certain level of creativity is needed (e.g., identification of events, their impact and interrelations).

Is any software or other tools required?

TIA typically uses specific algorithms or a Monte Carlo simulation that can be supported by numerous statistical software.

Best practices (recommendations and tips how to best employ the method)

Since important parts of TIA – such as identification of trends, estimate of their impact and probability – depend on the subjective judgment of experts, you should always seek involvement of a greater number and diversity of experts. The accuracy of a trend impact analysis can be enhanced by using an advanced TIA algorithm that also accounts for different degrees of severity of the event (e.g., number of victims in an attack) (see Agami [2]).

Example of use in the security and defence field

Example 1: Short-term impact of unpredictable events on the national security in Romania

Grigoras used trend impact analysis to analyse the potential impact of unpredictable events on national security in Romania in the short term. The exercise followed the basic steps of TIA: (1) it identified a set of unpredictable events that could affect the security environment and (2) for each of the events, it identified consequences for Romanian national security. For the latter part, it estimated a) the event probability in 2018, b) the number of years until its first impact and c)

until maximum impact, d) as well as the maximum impact expressed in a simple numerical evaluation (see the table below). Finally, Grigoras described how the different events could affect each of the security sectors by using the Copenhagen school's taxonomy (economic, social, political, military and ecological sectors) in the 2018-2020 period. A negative as well as positive impact on the sectors were taken into account. The finding should serve to develop an adequate policy response to unpredictable but impactful events. [3]

Example 2: Impact of different events on cybersecurity spending in 2030

You can also refer to Aalto, Kuosa and Stucki to see an example from the cybersecurity field, in which the authors evaluated the impact of different events on cybersecurity spending in 2030 and compared it against the baseline growth trend. [4]

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B-25 TRENDS ANALYSIS

Trends analysis is an analytical approach to studying trends – a continuous, incremental change of a variable over time, a general tendency or trajectory of a development over time. Trends can be increasing, decreasing or stable. Their form can be expressed in mathematical functions (linear, exponential, logistic, cyclic, etc.). They can even encounter random changes if the mean or median value remains constant. Functions can also be combined, such as an increasing trend with cyclic oscillations around the trend value. Due to this characteristic, it is possible to forecast the probable development of observed phenomenon by extrapolating trends into the future although there is no guarantee that past trends will continue.

What is it used for?

Trends analysis is used to observe and understand main trajectories of development in economic, social, technological or another sector. It then helps to identify probable future developments if no surprises were to occur (by means of extrapolating trends). In security and defence, trends analysis can be used to identify and understand developments that shape or will shape the (future) strategic or operational environment and demands on the armed forces of a state.

How to use it?

Trends can be first identified by collecting data related to studied phenomenon. Then the data is analysed to identify patterns (increasing, decreasing, constant). This will indicate the existence of a certain trend. The graphic visualisation of a trend then uses time as the horizontal axis and the given variable (e.g., defence spending) as vertical axis. The pattern observed could eventually be expressed in mathematical functions with one of the variables being the time (t). This enables the trend to be extrapolated into the future (setting the time variable to some future time provides a forecast of the value of that variable at that time). Finally, the signals of change should be identified and closely monitored so that any changes in the trend's direction are spotted soon enough.

Strengths

The outcome of trend analysis are clear and legible charts that well outline the development of a given phenomenon. Mathematical expression of a trend enables its extrapolation in the future and thus prospection. The method is one of the most effective for short-term forecasting given that uncertainties (and thus risk of discontinuities in trends) raise with extending time horizon.

Weaknesses

If we try to extrapolate the trends into the future, results may be uncertain (especially in long-term time horizon) given that there is no guarantee as for how long the trends will continue and surprises can occur that will change the direction of the trend.

What other methods is it usually combined with?

Trends can be identified by means of historical analysis, horizon scanning, literature review, or surveys. Identified trends can then serve to forecast future by means of extrapolation (extrapolating the current trends into the future) and scenarios (identifying probable futures). Trends can be further analysed by trends impact analysis to identify implications of trends, by impact and uncertainty analysis to prioritise them, or by structural analysis to identify their key drivers. Indicators and weak signals are used to monitor how trends evolve over time.

Is any software or other tools required?

Recommended software: Statistica, Google Analytics, ISPAG, MetaStocks, AmiBroker,

Best practices (recommendations and tips how to best employ the method)

If the number of identified trends is too high, it is recommended to cluster them into thematic groups. To address the uncertainty of past trends continuing in the future, it is recommended to identify and monitor signals of change and discontinuities. Extrapolate trends over a short or mid-term time horizon, eventually combining trends analysis with, for instance, wild cards to explore how some surprises could affect the development of a given trend.

Example of use in the security and defence field

Example 1: Global Strategic Trends: The Future Starts Today (6th edition)

Global Strategic Trends (GST) published by the UK Ministry of Defence looks to improve foresight and encourage better strategic choices to shape the desired future, enhance preparedness for alternative futures and support resilience and adaption to change. It generally considers what the future might look like in 30-years' time

frame. There are a number of stages involved in producing the GST [1]:

1. *Scoping* to identify topics for research. This involves sense-checking how the landscape has evolved since the previous edition of GST, literature reviews, online surveys and a workshop.
2. *Research* of each identified topic through literature reviews followed by workshops, interviews, and research papers. This enables the identification of trends and in some cases their projection forward. A single paper is produced for each topic of interest and outputs are tested and validated at workshops and seminars in a large number of countries (I.e 40 for the 6th edition). Another means of validation used is red teaming.
3. The topics were *merged* into 13 geographic regions and five thematic areas (environment and resources; human development; economy, industry and information; governance and law; conflict and security). This was achieved by undertaking a cross-impact analysis of ideas and highlighting interactions between major drivers and trends.
4. Four different *Future worlds*, which offer 'plausible alternatives' to described outcomes were created to overcome some of the challenges of only taking a trends-based approach. Each thematic chapter concluded by analysing the key trends through the prism of these four worlds. In addition, there is a list of watch points and discontinuities (that might change the direction of trends) as well as implications for defence and security at the end of each thematic chapter.
5. This all led to the identification of 16 focus areas (where 'potential change to humanity is high') and 40 strategic implications ('issues that need to be addressed'). Some strategic implications were taken forward into projects and papers. GST refers to this as *'exploitation'*.

Example 2: The Future Security Environment 2013-2040

Trend analysis was used in Canada in the Future Security Environment 2013-2040 (FSE). [2] This document is intended to offer a near as possible comprehensive understanding of the future security environment so that the Canadian Armed Forces (CAF) are able to maintain a relevant and adaptive force to effectively meet challenges in the years ahead. The FSE forecasts the future out to approximately 30 years. First, it uses historical research and analysis to identify trends in the following areas:

1. geopolitical trends;
2. economic, environmental and social trends;
3. science and technology trends;
4. military trends.

Then, the implications of trends for security environment and CAF are provided throughout the document (at the end of the document, there is a summary of all 72 military implications). This assists the CAF with Capability Based Planning by helping answer three key questions: what do we think we will need to do in the future, how well do we believe we could do it with our present force, and what changes would make us perform better against future challenges?

Example 3: Global Trends Report: Paradox of Progress

The Global Trends report has been published by the U.S. National Intelligence Council, lately in 2017. [3] The document is developed through a process of wide-ranging research and consultations (more than 2,500 individuals) with stakeholders both internal to the U.S. government and external to it, as well as academics, and senior officials in other governments. The document first identifies regional trends and then aggregates them to identify larger global trends (seven trends are defined as "transforming the global landscape"). Then using two timeframes, a 5 year and a 20 year one, it offers its primary customer (US Government) near term regional issues that require attention and also longer-term thematic trends (in the areas such as demographics, economics, governance, security) that can be folded into strategic considerations. In addition, trends analysis is complemented by scenarios to better project possible futures and describe "how critical trends and choices might intersect to create different paths to the future."

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B-26 WARGAMING

Wargaming is a simulation of a given scenario where opposing sides engage in a series of moves with the overall goal of improving planning. RAND describes wargames as "analytical games that simulate aspects of warfare at the tactical, operational and strategic level. They are used to examine warfighting concepts, train and educate commanders and analysts explore scenarios and assess how force planning and posture choices affect campaign outcomes." [1] Peter Perla writes that wargaming is "a warfare model for simulation that does not involve the operation of actual forces, and in which the flow of events is shaped by decisions made by a human player or players." [2]

What is it used for?

Wargaming is used primarily to improving planning. It allows for testing ideas and "what if" analyses as well as to gain insights into how an opposing force could react to actions one may take. It is also used to identify options available to planners and to help them identify risk.

How to use it?

In developing a wargame the first step is planning – determine what the wargame's aim is as well as the timeline and resources available. The next step is to determine the participants needed and to reach out to them. This step is followed by the development of the wargame by conducting research, preparing materials including such items as background pre-reading packages for the participants and game play instructions. Next is sharing with participants all relevant information on the game, such as location, timings, specifics on individual roles, game rules, number of rounds for the game and desired outcomes. The execution of the game is next and it includes incorporating a review of each round once it is complete to capture any lessons, make necessary adjustments and so on to position the game play and participant experience towards the best outcomes. At the close of the game document the conclusions arrived as well as any questions and comments that arose during game play.

A more thorough guide to the process of wargaming is found in the UK's Ministry of Defence "Wargaming Handbook." It summarises the steps to a wargame as being design, develop, execute, validate and refine. The authors of this handbook also note that a wargame should be guided by an educational or analytical purpose, and that typically they are two types of wargames, training and analytical ones with the former being defined by "the effects to be enacted on the players (training)", and the latter by the "subjects of analysis and metrics (analysis)." [3]

Strengths

Wargaming allows planners to better understand changes in the strategic environment (e.g., political, technological, etc.). It is a means of determining how an adversary may react to a set of actions and in doing so allow planners to develop countermeasures to blunt those actions. Wargames can provide training opportunities, the analysis of such things as force structure changes and capabilities and all in a low-risk environment. Wargames also have the benefit of allowing planners to explore future concepts, and to identify risks as well as gaps. They may allow for the identification of the need for augmented or new capabilities and thereby enable better strategic planning choices.

Weaknesses

Wargames do have some drawbacks. For example, they are not predictive but rather offer possible outcomes (which in fact applies to most foresight methods). They can be limited by the players' knowledge, experience and willingness to approach the game in an open-minded and collaborative manner. There is a risk when designing a wargame that it may be used to validate a specific item or items for acquisition. To do this undermines the value of a wargame's ability to enable participants to explore a problem to both better understand it and to design innovative solutions to address it.

What other methods is it usually combined with?

Wargaming can be used with numerous other foresight methods, it is often combined with expert panels, Wild cards, Delphi method, scenarios and brainstorming.

Is any software or other tools required?

There are numerous software applications used to assist in wargaming such as the US Standard Wargame Integration Facilitation Toolkit (SWIFT), which is used to assist Department of Defence wargaming.

Best practices (recommendations and tips how to best employ the method)

To achieve the best results from utilising wargaming one must first clearly define the goal of the wargame. What is the purpose of the game and what are the desired outcomes? To achieve this first step and to refine the game as it is built to ensure best outcomes, frequently interact with

the game's customer as it is developed. Next, ensure a scenario is designed that will test the game's ultimate purpose. Work to ensure the correct subject matter experts are identified in both the wargame's design, development and execution. Ensure that the game is tested to allow for resolving any identified problems before the full event takes place. Finally, conduct a thorough analysis post game play and document conclusions and lessons identified.

Example of use in the security and defence field

Wargames are used by many western militaries as part of their defence planning and include such nations as Canada, the United States, the United Kingdom, and Australia. The RAND corporation also employs the use of wargaming to aid military planners in their work. An example of this was the series of 2014-15 wargames it ran on the outcomes of a Russian invasion of the Baltic states. [4] The US Naval War College, for example, has used wargaming since 1887 to assist developing analytical skills.

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B-27 WILD CARDS

Wild Cards refer to low-likelihood (or high uncertainty, hard-to-predict) and high-impact events, events that occur fast and unexpectedly (no time for warning to allow the system to adjust) and provoke fundamental implications. Wild Cards are often categorised according to their plausibility. For instance, Mendonça with colleagues distinguish between: (1) certain surprises: known events, it is certain they will occur, but we do not know when (e.g., earthquakes); (2) imaginable surprises that are probable (e.g., an oil price shock); (3) imaginable surprises that are improbable (a global nuclear war). [1] A separate category consists of unimaginable surprises (unknown unknowns, there is no precedent for them, they are beyond our imagination), yet they are referred to as *black swans* instead of Wild Cards. In this context Wild Cards are closer to the concept of so-called gray swans: rare but scientifically tractable events. [2]

What is it used for?

Wild cards help to better understand uncertainty and to cope with it. They extend the space of possible futures and consequently the option space. They might reduce strategic surprises. Wild cards challenge us to consider very unlikely events and by doing so, complement established scenarios and assessments.

How to use it?

John L. Petersen and Karlheinz Steinmüller suggested four steps to study Wild Cards [3]:

1. Identification: What Wild Cards can happen?

Prepare a list of Wild Cards by means of brainstorming, expert interviews, surveys, historical analogies, or science fiction. It is recommended not to select only the "usual suspects".

2. Assessment: Which are the most important Wild Cards?

Select the Wild Cards with major impact on the subject under consideration. There are several options of how to assess the importance of Wild Cards:

- *Futures Wheel* can be used to assess the secondary or tertiary implications of the Wild Cards on the subject under consideration.
- *Risk assessment* can be used to assess the importance of Wild Cards in terms of their impact and probability.
- Another option of quantifying the relative effect of Wild Cards is a so-called Arlington Impact Index suggested by Petersen and Steinmüller. It consists of seven impact factors: [3]

1. *Vulnerability* (V): A vulnerable system has difficulty to adapt to change. more vulnerable = less adaptable. Change scale: 1 (less vulnerable) to 3 (more vulnerable)
2. *Timing* (T): As time goes by, the humanity improves ability to deal with shocks. Hence, the later the event occurs, the better prepared we will be for it. Later events = better outcome. 1 = t+15 up to t+20; 2 = t+10 up to t+15; 3 = t+5 up to t+10; 4 = present year (t) up to t+5
3. *Opposition* (Op): If there is much opposition against the changes, the chaos and length of the transition period may increase. Change scale: minus 2 (much support) to 2 (much opposition)
4. *Power Factor* (P): How does the event affect human beings? More individual effect=stronger impact. Change scale: 1 (less effect) to 4 (more effect)
5. *Reach* (R): Is the effect of the event local, national, or global? Wider reach=more impact. Change scale: 1 (local) to 5 (global)
6. *Outcome* (O): With increasing unpredictability, it is more likely that our response will be ineffective and chaotic. More uncertainty=more impact. Change scale: 1 (less uncertainty) to 3 (more uncertainty)
7. *Rate of change* (ΔC): If the event happened without any early indicators or it might be so large, that it was impossible to address it quickly enough, the impact would be more serious. Faster change = more impact. Change scale: 1=years, 2=months, 3=days

The Arlington Impact Index (IAI) is a sum of impact factors (the ratings for vulnerability, timing, opposition, power factor, reach, outcome, and rate of change). In symbolic terms:

$$IAI = V + T + Op + P + R + P + \Delta C$$

It's value can go up to 24. Higher number corresponds to bigger impact.

3. Monitoring: Can we anticipate their arrival?

Wild Cards can be anticipated by monitoring the weak signals (indicators of raising probability of Wild Cards). They can be understood as symptoms of change in the environment / of a system, the first signs of a potential Wild Card event. Weak

signals should be monitored as part of an early warning framework, which is a component of Wild Cards management system.

4. Options for Action: Is there anything we can do about them?

Dealing with Wild Cards requires innovative methods, out-of-the-box thinking. According to John L. Petersen and Karlheinz Steinmüller it should be focused on the following areas: (1) Prevent Wild Card from happening if its consequences would be negative. (2) Mitigate negative consequences of a Wild Card. (3) Adjust for the changes that a Wild Card may entail.

Strengths

Wild Cards enable blind spots to be reduced by focusing on events that are usually underestimated or neglected due to their low level of likelihood. They promote out-of-the-box thinking about the future, thus, helping to determine potential futures beyond what is probable. They extend the space of possible futures and consequently the option space. As a result, they might reduce strategic surprises.

Weaknesses

Most Wild Cards may seem implausible; therefore a significant effort is required to persuade the public, superiors or decision makers to consider them. Moreover, you never have sufficient resources to prepare for all, possible / imaginable Wild Cards.

What other methods is it usually combined with?

Wild cards can be used to complement most other foresight methods. For Wild Cards *identification* the following methods are suggested: Delphi (it enables the inclusion of expert opinion), interviews, workshops, brainstorming, science fiction, trends analysis or megatrend analysis (Wild Cards as possible discontinuities), horizon scanning (used for weak signals identification). Wild Cards can be then *analysed* by means of Futures Wheel (for identification of primary, secondary, or tertiary implications), risk assessment (with probability sometimes being exchanged for (un) predictability), scenarios, or by Arlington Impact Index (see above).

Is any software or other tools required?

Software and programs can be eventually used to monitor foresight-relevant online sources and identify Wild Cards by means of web-crawling and text-mining. A bank of Wild Cards and weak signals is provided e.g., by iKnow platform. [4]

Best practices (recommendations and tips how to best employ the method)

Identification and assessment of Wild Cards need creativity and broad and deep general knowledge. Workshops should be performed in an atmosphere of openness and confidentiality where "crazy ideas" are welcome. In terms of identification, it is recommended to not only think about the most often selected Wild Cards but to encourage out-of-the-box thinking. For analysis, it is recommended to use risk assessment, Futures Wheel or Arlington Impact index.

Example of use in the security and defence field

Roman Muzalevsky used Wild Cards as part of strategic and operational threat environment assessment for 2050. [5] First, he identified six megatrends that would create opportunities or threats for the U.S. in the battlefield. To further analyse each megatrend, the author suggested for each megatrend a Wild Card that could challenge not only the U.S. military but also both world and regional economic and security orders (he provided one page for each Wild Card). A combination of megatrends analysis with Wild Cards helped the author to envision the strategic landscape for the U.S. military in 2050. For illustration, the list of megatrends and respective Wild Cards as identified by Muzalevsky are summarised below:

B10: Megatrends and Respective Wild Cards according to Muzalevsky

Megatrend	Wildcard
Demographic dividends and liabilities	Raging youth bulges of the Greater Middle East
Environmental risks and breakthroughs	Flooded coastlines, submerged cities
Uneven socio-economic and political transitions	The death of China's experiment
Technological disruptions and Solutions	From cyber Monday to mega blackout
Military revolution and counter-revolution	Self-aware armed robotics – wither the human control
Regional economic, technological, and military races	The coming war over the Arctic

Another example can be found in the publication by Nathan Freier where he deals with the role of strategic shocks (known unknowns, the game changing events) in defence strategy development in the U.S. Department of Defence. [6]

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ANNEX C – CATEGORISATION OF METHODS (DATASETS)

Table C-1: Methods in relation to the stages of foresight process

	Stages of foresight process			
	Input	Analysis	Interpretation	Prospection
Backcasting			•	••
Brainstorming	••	•	•	•
Causal layered analysis		•	••	••
Delphi	•	•	•	••
Driver analysis		••	•	
Expert panels	•	••	••	•
Extrapolation				••
Futures wheel		•	•	••
Future workshop	•	•	••	••
Horizon scanning	••	•		
Indicators/monitoring	••	•		
Interviews and surveys	••			
Key technologies		••	••	
Literature review	••	•		
Megatrend analysis		••	•	
Morphological analysis		••	••	•
Relevance trees		••	••	
Risk assessment		••	••	
Roadmapping			•	••
Scenarios				••
Science fiction				••
Structural analysis		••	••	
SWOT		••	•	
Trend impact analysis		•	•	••
Trends analysis		••	•	
Wargaming			•	••
Wild cards				••

Legend:

• can be used with reservations/some added value
•• recommended/essential use

Table C-2: Methods in relation to the time horizon

	Time horizon		
	<5	5-20	>20
Backcasting	•	•	••
Brainstorming	•	•	•
Causal layered analysis	•	•	••
Delphi	•	••	••
Driver analysis	•	•	•
Expert panels	•	••	•
Extrapolation	••	••	•
Futures wheel	•	•	••
Future workshop	•	••	••
Horizon scanning	•	•	••
Indicators/monitoring	••	•	•
Interviews and surveys	•	•	•
Key technologies	••	•	•
Literature review	•	•	•
Megatrend analysis	•	••	••
Morphological analysis	•	•	•
Relevance trees	•	•	•
Risk assessment	••	••	•
Roadmapping	•	••	•
Scenarios	•	••	••
Science fiction		•	••
Structural analysis	••	••	•
SWOT	••	•	•
Trend impact analysis	•	••	••
Trends analysis	••	•	•
Wargaming	••	••	•
Wild cards	•	••	••

Legend:

• some added value
•• recommended/essential use
3x •the value is more or less the same for all the categories / time horizon does not really matter

Table C-3: Usability of methods in relation to resources

	Level of proficiency to apply the method			Minimum number of personnel/ participants to get a good result			Minimum time required to get a good result			
	Low	Medium	High	Up to 5	6-20	>20	Hours	Days	Weeks	Continuous process
Backcasting	x	x		x				x		
Brainstorming	x				x		x			
Causal layered analysis			x	x				x		
Delphi	x				x				x	
Driver analysis		x		x				x		
Expert panels	x				x				x	
Extrapolation		x	x	x				x		
Futures wheel	x	x		x			x			
Future workshop		x				x			x	
Horizon scanning		x		x				x		x
Indicators/monitoring		x		x				x		x
Interviews	x				x			x		
Key technologies		x		x				x		
Literature review	x			x				x		
Megatrend analysis		x		x				x		
Morphological analysis			x	x				x		
Relevance trees	x			x			x			
Risk assessment		x		x			x			
Roadmapping			x		x			x		
Scenarios	x	x		x				x		
Science fiction		x		x					x	
Structural analysis		x		x				x		
Survey		x				x			x	
SWOT	x	x		x			x			
Trend impact analysis		x	x	x				x		
Trends analysis		x		x				x		
Wargaming		x			x				x	
Wild cards	x	x		x			x			

Table C-2: Methods in relation to the time horizon

	Evidence	Creativity	Expertise	Interaction
Backcasting		••	•	
Brainstorming		••	•	••
Causal layered analysis	•	•	••	
Delphi			••	•
Driver analysis	••		••	
Expert panels			••	•
Extrapolation	••		••	
Futures wheel		••	•	
Future workshop		•	•	••
Horizon scanning	••		••	
Indicators/monitoring	••		••	
Interviews and surveys			••	
Key technologies	••		••	
Literature review			••	
Megatrend analysis	••		••	
Morphological analysis	•	•	••	
Relevance trees		•	••	
Risk assessment	••		••	
Roadmapping		••	••	
Scenarios		••	•	
Science fiction		••	•	
Structural analysis	•		••	
SWOT		•	••	
Trend impact analysis	•	•	••	
Trends analysis	••		••	
Wargaming		••	•	••
Wild cards		••	•	

Legend

• primary source of knowledge
•• complementary source of knowledge

ANNEX D – STORYTELLING

> *"Telling stories about the future takes us from speculation to exploration to innovation." [1]*

Storytelling is used as means to communicate the outputs of futures work (it is most typically used as a means to share a scenario with people [2]). The use of stories has been around from the dawn of time and, as a result, there are many different ways and forms to do it (oral, digital, and written). What is rapidly changing with the growth in new technology is the growth in digital as a medium to tell stories (for instance, the use of virtual reality). [3]

Irrespective of the storytelling methods used or the medium to be used to communicate a story, there are common elements in the structure of a story and things to consider at the outset. Suggested **steps** to take are:

1. Decide what the purpose of the story is. For instance, is it to secure support to an idea, convey the complexity of a situation or some other reason.
2. Define the issue to be explored.
3. Key planning considerations:
   - What *type of story* will it be? It is suggested that there are four types of narrative writing: Linear Narrative; Non-linear Narrative; Quest Narrative; and Viewpoint Narrative.
   - What is the *mode of storytelling?* It is suggested there are five different modes of fiction stories: action, dialogue, thought, description and exposition.
   - What *form of storytelling* will be used? For instance, oral, digital or written.
4. Plan out the story using a framework, which covers the common elements of a story. Example frameworks are:
   - Four Ps: people, place, plot and purpose.
   - 5 Ws: why, what, when, who and how.
5. Extract inputs from the foresight work undertaken for the story.
6. Create the story using the chosen storytelling method.
7. Share and discuss what has been produced.
8. Refine as necessary.
9. Share the story using the chosen medium.

Depending on the medium used, it could be quite time consuming and even costly, therefore save the more costly mediums for situations of strategic importance. When used appropriately, storytelling is a powerful means to share the output of foresight.

Storytelling is often used in defence, most commonly in the oral and written sense. However, one recent example of the use of virtual reality in storytelling comes from the *Museum of the Future* in the UK. "The platform virtually 'transports' defence and security policymakers to the future, challenging their thinking and inspiring new approaches – in a way that written reports cannot. [...] Alongside the virtual reality exhibits that are futuristic versions of things that already exist – a space-going version of a naval ship, for example – the museum houses a set of fully immersive virtual reality 'worlds'." [5] These speculative settings are experimental and are intended to highlight the uncertainty of the future.

> *"You need the capability to recognise early signals, longer term patterns and harness diverse perspectives. You need data but you won't change the world with data. You change the world through discourse, language and emotion. You mobilize your organisation and those within your ecosystem through creating and sharing stories of a future that speaks to your collective values. Tell a great story, and others will help build that future." [4]*

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