Introduction

**What is Foresight**

Our global food systems require fundamental transformation to tackle hunger, enable good health, protect the environment, and ensure long term food security. But setting our food systems on a more sustainable and resilient path is a complex challenge with many interacting factors from local to global scales. Change will require concerted and coordinated efforts from across government, research business and civil society. But what are the pathways forward? What are the future risks and opportunities? What different scenarios might evolve in the future given the complexity and uncertainty of food systems?

Tackling these questions is the domain of foresight. Not to try and predict the future, but rather to intelligently engage citizens and leaders in a better understanding of what is currently going on, what the future consequence would be and what might be alternative pathways with more desirable outcomes.

This document articulates a framework for understanding the different dimensions and approaches to foresight and how they relate to each other.

**Foresight4Food**

This framework has been produced as part of the foresight4Food Initiative.

Foresight4Food is supported by a group of international organisations, food systems researchers, business players and civil society organisations with the collective aim of enhancing foresight and scenario analysis for the global food system. Those involved recognise that while there is much food systems research, foresight, scenario analysis and modelling going on it is often fragmented. There is a need for better synthesis, and for improvements in how food system changes are explained and visualised. And, better connections are needed between science and processes of policy dialogue, business engagement and societal learning.
Transforming Food Systems – key to the SDGs

Food Systems are central to all of the Sustainable Development Goals.

Yet our current food system is leaving billions of people either underfed or overfed, has huge interconnections with climate change, is over stretching use of natural resources and many who produce food remain impoverished.

However, changes in food systems also offer many opportunities for contributing positively to the SDGs. Connecting multiple facets of the environment with society, interventions within the food system can help achieve all of the SDGs.
A Framework for Understanding Foresight

This diagram illustrates the foresight framework. It is explained on the next page.
Framework Overview

This framework has been developed to illustrate an integrated approach to foresight that connects stakeholder processes of foresight analysis with the science of foresight research and studies.

It represents a core “foresight process” of: clarifying actors; establishing the purpose of a foresight exercise based on actors needs and interests; understanding and mapping the boundaries and relationships of the systems to be analyzed; identifying key drivers, trends and uncertainties; which provide the basis for exploring possible future scenarios; understanding stakeholder visions for the future; and from this identifying what strategies for influencing or adapting to change may be desirable.

This core is then supported by stakeholder engagement, dialogue and scientific knowledge base (that itself is constantly evolving and influenced by foresight).

In practice, foresight processes exist on a continuum from highly stakeholder driven with limited scientific input to very scientific studies that have limited stakeholder engagement at the other extreme with full integration in the middle.

A few basic definitions and premises underlying the framework: foresight here is used in a general way to refer to developing insights about the future to improve responsiveness and decision-making to future risks and opportunities. Related terminology includes strategic foresight, future studies, and scenario analysis.

There is considerable overlap between the ideas of foresight and scenario analysis. Simply, scenario thinking means recognising that due to complexity and uncertainty, the future may unfold in different ways. Scenarios are a way of trying to understand the implications of these different futures. The term ‘scenario’ is also used in a narrower sense in the computer modelling world to refer to the future outcomes of a particular set of parameters and assumptions. Approaches to scenario thinking incorporate many aspects of what has been referred to as foresight, and many foresight approaches incorporate aspects of scenario analysis.

The framework takes three core premises:

Due to complexity and uncertainty the scope for accurately predicting exactly how the future will be is limited at best.

However, this does not mean that it is not possible to detect and respond to emerging trends that will significantly shape the future, for better or worse (the negative consequences of a trend of destroying much of the world's biodiversity is pretty clear, warranting some form of ‘anticipatory action’ to avoid the negative consequences).

Foresight is a social and political process, informed by scientific understanding and analysis that enables organisations and societies to better respond to emerging risks and opportunities.
Resources For Getting Started

Strategic Foresight Primer

The Futures Toolkit

ECOSYSTEMS: HUMAN WELL-BEING

A Manual for Assessment Practitioners

Strategic Reframing

The Delphi Scenario Planning Approach

A Framework for Assessing Effects of the Food System

FORESIGHT IN INTERNATIONAL DEVELOPMENT

Scenario Planning

Scenarios: An Explorer’s Guide

DRAFT
Exploring the Future of Real World Situations

Foresight helps us explore how the world around us might change what the implications might be and hence how we may want to try an influence the direction of change and/or adapt. However, we can only ever have a partial understanding of “real” world situations for two reasons:

1) What we ‘see’ is always framed by our partial perspectives, our assumptions, the limits of methodology and the consequences of where we place the boundaries of what we are exploring

2) Our social and ecological worlds are complex adaptive systems with multiple and complex relationships and feedback loops that the future is impossible to fully predict.

Consequently, foresight in complex situations with high levels of uncertainty can never be about ‘predicting’ the future. Rather, it is a cyclical process of constant learning and adaption to help to improve our judgements about the best ‘anticipatory’ actions to take given the best assessments we can make about possible future risks and opportunities.

Ramirez and Wilkinson (2016) in their book “Strategic Reframing” recognise that foresight is undertaken in what that call TUUNA conditions:

- Turbulence
- Unpredictable
- Uncertainty,
- Novelty and
- Ambiguity

Overall, a foresight process is about enabling actors to have better insight into this ‘real world’, how it might change, how it could affect collective and individual interests, and the implications for taking action. Actions taken (and many other factors) will influence the ‘real world situation’, creating a new situation that calls for a new assessment of the situation – an iterative and ongoing process of foresight (learning).
The starting point must be to recognize and understand the actors who will use, participate in or frame foresight and scenario processes and studies.

While some foresight work may be done largely as a scientific exercise in most cases foresight work has the objective of helping actors to learn about their situations in order to make better decisions for the future.

Considering actors from the start means giving attention to:

• Who are the potential users or beneficiaries of the exercise?

• How will who participates frame or shape the boundaries of what is considered and the questions asked?

• How will the legitimacy of the exercise be influenced by who participates and at what stage?

• How will the outcomes be influenced by who’s knowledge and perspectives are included or excluded?

• How might future scenarios be influenced by the way different groups of actors respond or not to changing circumstances and the actions of others? (game theory)

• How do foresight outcomes need to be presented, packaged and communicated to meet users/participants needs?
Considerations in Stakeholder analysis:

- Ensuring representation from actual stakeholders or realistic proxies
- Positions of the stakeholders on the situation or the exercise of concern
- Level of influence of the stakeholders in the system of concern and the exercise
- The values and interests of the stakeholders in relation with the exercise and situation
- Building in sufficient time and facilitation in the stakeholder engagement to ensure that all views are heard
- The analysis should produce an equitable balance of advantages and disadvantages from an action in the exercise

Ultimately, stakeholder analysis should remain an ongoing and iterative process in a foresight exercise. It is a critical tool in clarifying the social-economic, political, and cultural environment of a situation needing analysis or resolution.

Potential stakeholder groups to involve in the process include government institutions at different scales, planners, politicians, researchers and analysts, NGOs, the general public, schools and universities, industries and businesses, women’s groups, indigenous peoples’ groups, and the media.
Effective foresight must engage the right stakeholders in setting the foresight questions/demands and in considering implications of the outcomes. It needs to be a multi-stakeholder process that recognises the different values and diversity of interests of different groups, and that enables debate about trade-offs such as those between socio-economic and environmental aspects of different agricultural development pathways. Foresight must be a consultative process that goes beyond the academic world and combines technical, social, economic and ethical aspects. It needs to have engagement through key platforms such as the CFS, G20, WEF, etc. Developing capability for stakeholder engagement at local, national and regional scales, as well as at the global level, is critical. However, there is a need to balance the scientific generation of foresight information with stakeholder engagement in foresight processes.

**Facilitation Tools:**
Inquiry based approach, participatory modelling, participatory mapping, consultative workshops.
Clarifying the Purpose and Motivation for Foresight

There are different reasons why foresight exercises are undertaken, ranging from scientific curiosity and underpinning research through to supporting policy making and advocacy. Processes may have more of a technical analysis approach or be more oriented towards helping overcome conflicts and reaching agreements on contested issues, while other may be work in a very integrated way.

There no rights and wrongs in this diversity and different processes all have their place and their contribution.

The critical issue is for a group of actors who are embarking on a foresight exercise to be clear on its purpose and the motivations of those involved. This will shape who is involved, the way the work is undertaken, the methodologies used and how the boundaries are set for what will be assessed.

A decision on the time frames and scales of concern is useful as part of the purpose and motivation. This will be useful part of the boundary definition of the exercise and provide a clearer ‘objective’ for the stakeholders.

Anticipatory Governance:

An important motivation for foresight, anticipatory governance provides the opportunity to govern with a longer-term perspective for current and future generations. It requires a sharing of perspectives on what constitutes a desirable future, and identifying and responding to drivers and trends that threaten or support these futures. It requires the exploration of plausible futures and creating mechanisms of resilience and risk management for different scenarios, being aware of and mitigating ‘tipping points’, and looking for ‘weak signals’ that foreshadow ‘black swans’.
Understanding the System of Analysis

Understanding the system of analysis is a critical conceptual stage in the foresight process. This will involve the creation of a conceptual or analytical framework of analysis for the situation of concern, identifying the boundaries and relationships between the actors. A systems map developed for understanding global level drivers and system outcomes is presented below. This illustrates how using a systems approach allows for the consideration of the impact of driving forces on food system activities and outcomes.

Taking the food system approach then requires an understanding of the system ‘drivers’ (influences on food system activities and outcomes), identifying the activities of relevance (producing, processing, storing, distributing, consuming & disposing), the interests and relationships of the ‘actors’ doing the activities, and how the consequences of the activities impact on food availability, access, and utilization. The food system should ‘deliver’ ultimately on food and nutritional security, socio-economic welfare, and environmental sustainability.
Conceptual frameworks are developed to address specific situations, problems, or conceptual needs. The conceptual framework on the left was developed through an iterative stakeholder consultative process for the SUSFANS project for assessing the sustainability and food and nutrition security of the EU food system. This framework illustrates how the drivers impact specific food system actors, and includes the desired EU policy goals in the system.

The Millennium Ecosystem Assessment Conceptual Framework places human well-being as the central focus for assessment, while recognizing that biodiversity and ecosystems also have intrinsic value and that people take decisions concerning ecosystems based on considerations of well-being as well as intrinsic value.
The framework on the bottom right is from the Institute of Medicine and National Research Council (2015) and is focused on assessing the health, environmental and social costs of the food system. It also considers markets and the flow of money and demand information. The framework on the left from CIAT is applying a sustainable food systems approach to tackle food system problems holistically, prioritizing the need for nutritious and accessible diets, produced with a minimal environmental footprint.
A strong information and knowledge base is critical at the heart of the foresight process, and is produced by:

- Stakeholder analysis
- Systems analysis
- Empirical evidence
- Data sets
- Quantitative modelling
- Qualitative analysis and insights
- Game Theory

These methods produce a rich set of resources and information that will be used in the systems mapping and foresight process. However, the information must be presented in a way that is easily approachable by the various stakeholders involved.

The table on the right categorizes the types of information that form part of the analysis and dialogue process. ‘Tacit formal’ information includes things like unpublished models and databases and information in the private domain, while ‘Formal Explicit’ include things like the ecosystem assessments and peer-reviewed materials that are shared with the wider public and specialist communities. ‘Tacit Informal’ includes opinions and experiences that are shared through stakeholder engagement processes, and ‘Explicit Informal’ include indigenous knowledge and practices, communal beliefs, and untested databases. An inclusive knowledge base ensures that the dialogue and analysis can be well-informed and not exclude the views of marginal groups.

<table>
<thead>
<tr>
<th>Tacit</th>
<th>Explicit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private images or photos</td>
<td>Ecosystem assessments</td>
</tr>
<tr>
<td>Unpublished models and databases</td>
<td>Peer-reviewed papers, chapters, or books in the scientific literature</td>
</tr>
<tr>
<td>Diaries</td>
<td>Peer-reviewed databases</td>
</tr>
<tr>
<td>Opinions</td>
<td>Oral traditional knowledge</td>
</tr>
<tr>
<td>Experience</td>
<td>Indigenous knowledge, rules, and practices</td>
</tr>
<tr>
<td>Intuition</td>
<td>Communal beliefs and values</td>
</tr>
<tr>
<td>Private beliefs and values</td>
<td>Untested scientific databases</td>
</tr>
</tbody>
</table>

Tacit information is known only by individuals, whereas explicit information is shared, with some level of agreement.

Source: Fabriious et al. 2006.
Drivers, Trends and Uncertainties - Examples

Identifying the key drivers that influence the food system, their associated trends and patterns, and the main uncertainties are crucial before undertaking a scenario development process. This can be done through a consultative stakeholder process (see SUSFANS example above).

**Drivers** are influences on food system activities and outcomes. Global-level drivers of the food systems are enumerated below:

1. Demographics and Development
2. Consumption
3. Technology
4. Markets
5. Climate and Environment
6. Policy and Geopolitics

**Trends** are emerging patterns of change likely to impact the food system. Examples of global-level trends are enumerated below:

1. Increasing population
2. Increasing urbanization,
3. Worsening climate change
4. Increasing resource scarcity
5. Accelerating technological change
6. Increasing market connectivity

The global food system faces a number of **uncertainties** in the future decades, such as:

1. Pace of Market Growth
2. Effects of climate change
3. Shifting demand of food
4. Disruptive technologies
5. Migration
6. Social and economic change
Drivers, Trends and Uncertainties

‘Steam Trains’

Identifying the critical ‘steam trains’ and ‘black swans’ in the system of concern are crucial in a foresight process. However, it is equally important to consider the transformational opportunities that such systemic risks can offer. Stakeholders must be asked include the transformational opportunities that may exist alongside the systemic risks that can be a barrier (or inherent to) the desirable and plausible futures they are envisioning.

Considering easily perceived drivers and trends that will influence change (whether direct or indirect).

‘Black Swans’

The rate and/or unpredictable events that have big impacts.

An exploration of drivers, trends, and uncertainties also requires the identification and acknowledgement of underlying assumptions. Assumptions may differ between stakeholders, and are crucial to identify in the stakeholder analysis, the system of concern, and the mapping of drivers. This step actively contributes to the creation of scenarios in the foresight process and ensures that the stakeholders are aware of the underlying assumptions of the discussions and negotiations.
Scenarios allow for the consideration of possible future situations given key critical uncertainties influencing systems change. They have the potential to informing decision-making by exploring a variety of possible futures around a core issue. They explore the most uncertain and unexpected futures and can stretch thinking around risks and challenges in the future. Since they examine all possible futures, including desirable ones, they can help ensure that all vulnerabilities are explored and accounted for. Therefore, in situations and contexts involving a high degree of change, uncertainty, and complexity, scenarios can drive discussions, and provide a medium for informing choice in future decision making. See below for the different types of scenarios that can be created:

**Reference scenarios:** Sometimes also referred to as “predictive scenarios”, they set out to address the question “what is expected to happen?” and include forecasts as well as what-if analyses.

**Explorative scenarios:** Attempt to map “what can or might happen?” and explore what future developments may be triggered either by exogenous driving forces (developments that are external and cannot be influenced by the decision makers in question), by endogenous driving forces (developments that are internal and can be influenced by decision makers), or by both.

**Normative scenarios:** Sometimes referred to as “anticipatory scenarios.” Aim to illustrate “how can a specific target be reached?” or “how might a specific threat be avoided?” and thus include both backcasting studies and planning exercises.

**Problem-focused** scenario exercises centre on the factors shaping future developments and usually emphasize the product rather than the process.

**Actor-centric** exercises focus on the relationship of specific actors to their environment and primarily see scenarios as a basis for strategic conversations (particularly in an organizational learning context).

**Reflexive interventionist** scenario processes are developed around the interactions between various actors and their environment (and vice versa) with the aim to inform action learning (especially in a public policy context).
Uncertainty and complexity can be used to define ways of exploring how uncertain we are about future developments of key drivers; and how well we understand the complexity of the system and its causalities. While there are a wide range of methodologies that can be used for developing scenarios depending on context, three are presented on the left, and the figure on the right locates scenarios with respect to uncertainty and complexity:

**Two Axes:** These are illustrative rather than predictive and tend to be high-level (with the possibility of adding more detail). They are best suited for testing the robustness of medium to long-term policy direction. They tend to look out 10-20 years.

**Branch Analysis:** These are suited to developing scenarios around specific and known turning-points (e.g. elections) These look out 5 years.

**Cone of Plausibility:** These offer a more deterministic model of the way in which drivers lead to outcomes, by explicitly listing assumptions and how these might change. These suit contexts with limited drivers. They look out a few months to 2-3 years.

Scenarios lie somewhere in between forecasts and speculations, that is, when the degree of uncertainty and complexity is of an intermediate level. Scenarios therefore have an exploratory character.
Scenarios - Examples

The image on the left are the four scenarios developed by the WEF for the future of global food systems and the image on the right is the four scenarios generated branch analysis, based on the outcomes of the Comprehensive Peace Agreement (CPA) and the 2011 referendum in Sudan.
The final example is the three scenarios for India in 2020 developed using the cone of plausibility method based on four drivers and four assumptions:
A vision is an image of how an actor or group of actors would like things to be in the future. Visioning is a well established process in strategic planning. Most organisations have a vision of how they would like to see the future and a mission of how the organisation will contribute to this desired future.

Visioning can be coupled with scenario thinking to help actors understand how the future might unfold and to explore what they consider to be more or less desirable. Scenarios can also help explore the pathways for realising a vision.

From the MSP Guide:
Visioning is a tool that brings stakeholders together to develop a shared vision of the future. It helps to answer the question: “What do we want to see in place 5-10 years from now in this MSP?”

By engaging participants in the formulation of a common goal, visioning gives people a sense of control and motivation, and offers a possibility for fundamental change. It nurtures essential characteristics of powerful and effective groups, like cohesion and common direction.

With problem solving, a group can become mired in technical details and political problems and may even disagree on how to define the problem. Problem solving, although useful, rarely results in any real fundamental change.

While a problem is something negative to move away from, visioning provides a positive paradigm by offering something to move toward. It offers a bigger picture. It generates creative thinking and passion to solve the problems that might arise when moving toward a vision.

A good vision is both realistic and stretching. Visioning too far into the future has the drawback of not creating enough motivational pull. Visioning too close to today and has the drawback of appearing as just another plan.

Source: http://www.mspguide.org/tool/visioning
Influencing Change

The last component of the framework involves the creation of strategies, policies, and actions to respond to the scenarios and visions above. The end point of the approach is for stakeholders to identify strategies for systemic changes that would make desired futures more rather than less likely. Such strategic thinking is based on recognising the dynamics of complex systems where positives can be encouraged and negatives dampened but linear and predictable change is not feasible.

Theory of Change:

Theory of Change is a comprehensive description and illustration of how and why a desirable change is expected to happen in a specific context. It focuses on identifying the desired long-term goals and works back to identify the steps and processes needed to make that visualized future happen. In other words, a theory of change provides the narrative around an impact pathway and require a clear articulation of the inputs and outputs of a program or an intervention, and the assumptions underpinning these relationships. Theories of change approaches can help facilitate learning within and between organizations and have implications for monitoring and transparency of interventions. The example of the right is CARE’s Theory of Change for Food & Nutrition Security and Resilience to Climate Change.
Computational Models

Computational models contribute to the ‘explicit’ set of knowledge and information discussed on page 16. They use equations to characterize how key processes (e.g. atmospheric, economic, water) operate, and use quantitative methods to simulate the interactions of the important drivers of the systems of concern. Examples of models used in food systems foresight are presented below:

**IMPACT - The International Model for Policy Analysis of Agricultural Commodities and Trade (IFPRI)** is a network of linked economic, water, and crop models. At its core is a partial equilibrium multi-market economic model, which simulates national and international agricultural markets.

**GLOBIOM - Global Biosphere Management Model (IIASA)** is used to analyse the competition for land use between agriculture, forestry, and bioenergy, which are the main land-based production sectors. As such, the model can provide scientists and policymakers with the means to assess, on a global basis, the rational production of food, forest fibre, and bioenergy, all of which contribute to human welfare.

**MOSAICC - Modelling System for Agricultural Impacts of Climate Change (FAO)**, in partnership with European research institutes, has developed an integrated pack- age of models to assess the impacts of climate change on agriculture (including forestry), water resources and the national economy.

**PEM - Policy Evaluation Model (OECD)** partial equilibrium model based on the PSE database, developed to connect Producer Support Estimates (PSE) database and its economic outcome.

**CAPRI (Common Agricultural Policy Regionalized Impact Modelling System)** supports decision making related to the Common Agricultural Policy based on sound scientific quantitative analysis.

**MAGNET** is a multi-sector, multi-region computable general equilibrium model of the world economy which is widely used to simulate the effects of agricultural, trade, land and biofuel policies on the global economy, as well as for long-term projections (IPCC SSP scenarios and mitigation and adaptation options).

**IMAGE (Integrated Model to Assess the Global Environment)** is designed to capture interactions between economic activity, land use, greenhouse gas (GHG) emissions, climate, crop yields and other environmental variables. It includes a multi-region CGE model of global trade and production, a carbon-cycle module to calculate GHG emissions resulting from economic activity including energy and land use, a detailed land-use module and an atmosphere–ocean climate module that translates GHG emissions into climate outcomes.
Data Sets

Data sets and databases on food and foresight often provide methods and standards for food and agriculture statistics, and disseminates data for global monitoring, evaluation, and research. Data from these databases are used in computational models (discussed above). Example data sets that can be used in food systems foresight are presented below:

**FAOSTAT** provides free access to food and agriculture data for over 245 countries and territories and covers all FAO regional groupings.

**IFPRI Dataverse** is a collection of IFPRI’s primary data and the compilation and processing of secondary data. The resulting datasets provide information at the local (household and community), national, and global levels.

**OECD Datasets** provide statistics on agriculture, development, economy, education, energy, environment, finance, health, technology, etc. They publish an Agricultural Outlook every year for a ten-year period.

**African Growth and Development Policy modeling consortium (AGRODEP)** brings together dispersed and disparate statistical, economic, and geo-spatial data from Africa in one central Web data portal. It links existing key data sources, complements them as necessary, and develops shared standards, formats, and exchange protocols that facilitate access.

**Office for National Statistics** is the UK’s largest independent producer of official statistics and the recognised national statistical institute of the UK.

**World Bank Open Data** provides free access to global development data by indicator and country and facilitates access to data collected through sample surveys of households, business establishments or other facilities.

**UNdata** brings international statistical databases within easy reach of users through a single-entry point. Users can search and download a variety of statistical resources compiled by the UN statistical system and other international agencies.

**Global Health Observatory data repository** contains an extensive list of indicators, which can be selected by theme or through a multi-dimension query functionality. It is the WHO’s primary health statistics repository.

**Resourcetrade.earth**/ has been developed by Chatham House to enable users to explore the fast-evolving dynamics of international trade in natural resources, the sustainability implications of such trade, and the related interdependencies that emerge between importing and exporting countries and regions.