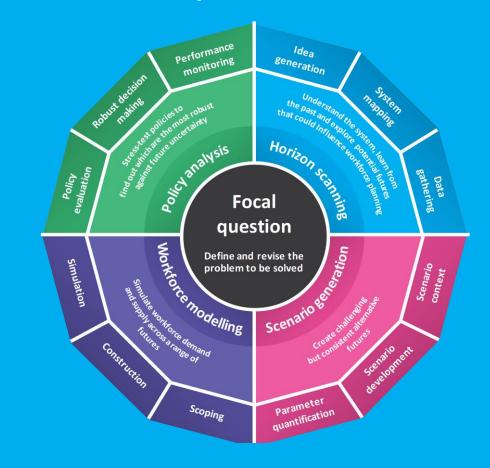


CfWI technical paper series no. 0010

Robust workforce planning framework: Update from practice



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Abstract

The Centre for Workforce Intelligence (CfWI) robust workforce planning framework (RWP) has existed largely unchanged for more than two years. This is perhaps a testament to its simplicity and ease of understanding. Over 20 reviews of health and social care professions have used the framework. Recent technical papers have reviewed and recommended improvements to the core stages – horizon scanning, scenario generation, workforce modelling and policy analysis – in some depth.

This paper reviews the latest development and provides a revision to the framework. The structure is unchanged but each stage now reflects practical experiences from projects, and key findings from our research and technical papers.

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1. Introduction

The Centre for Workforce Intelligence (CfWI) robust workforce planning framework (RWP) has existed substantially unchanged for more than two years. This is perhaps a testament to its simplicity and ease of understanding. Over 20 CfWI reviews of health and social care professions have used the framework. Recent technical papers have reviewed and recommended further refinements of the core stages – horizon scanning, scenario generation, workforce modelling and policy analysis – in some depth (CfWI a, b, c, d, e).

This paper reviews the latest development and provides a revision to the framework. The structure is unchanged but each stage now reflects practical experiences from projects as well as key findings from our research and technical papers. The purpose is to make the framework more relevant and accessible to workforce planners.

Chapter 2 of this paper provides an overview of the improvements made to the individual RWP framework stages. A distinction is made between the concept of a framework as source of guidance, and the detailed methods and practices underlying the framework.

Chapter 3 presents the revised framework together with details on the activities of each stage, and CfWI deliverables that provide more information and examples of the framework in action. These include workforce reports as well as the technical paper series.

2. Framework enhancements

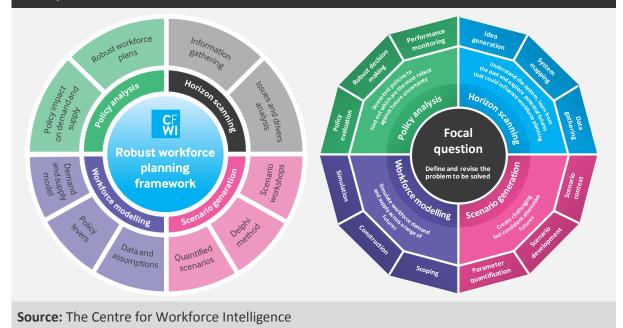
2.1 Introduction

This chapter presents the improvements we have been making to the robust workforce planning framework, building on our research activities and practical experience.

The original (CfWI, a) and revised robust workforce planning frameworks are illustrated in Figure 1. The original framework has been in use by the CfWI in a variety of graphical forms for over two years. The framework is the picture that serves to guide and explain our approach. It explains the general sequence of activities, but not what to do in any detail. The framework is supported by an underlying set of methods, tools and processes. Some of these are available in the technical paper series (CfWI a, b, c, d, e)



The robust workforce planning framework shows the core stages of: **horizon scanning** to elicit the uncertain driving forces, **scenario generation** to produce challenging futures, **workforce modelling** to project workforce demand and supply across these futures, and **policy analysis** to determine which polices are the most robust across these uncertain futures.



The framework is at present composed of the following stages.

1. **Horizon scanning**: Horizon scanning explores the potential challenges, opportunities and likely future developments that could influence workforce planning. These include technological, economic, environmental, political, social and ethical (TEEPSE) influences on an unfolding future.

- 2. Scenario generation: Scenario thinking focuses on how the future might evolve. Scenarios are essential for workforce planning, as it is not possible to predict the long-term future accurately. Scenarios are particularly useful since a range of plausible futures can be generated and demand and supply projections made. Workforce plans can then be assessed against the scenarios for robustness. A unique feature of the framework is the use of a Delphi process to quantify key workforce variables. Experts make quantitative judgments and share the reasoning behind them over several rounds to decrease uncertainty and refine the values.
- 3. Workforce modelling: The purpose of workforce modelling is to project demand and supply for a range of plausible futures, as described by the scenarios. Further modelling is then conducted to determine the robustness of policy options for achieving a sustainable balance of demand and supply.
- 4. **Policy analysis**: Workforce intelligence focuses on analysing future uncertainties and the impact of policy options, and presenting the findings. By considering multiple future scenarios, different options can be tested to see which one is the most robust. There will be some options that lead to favourable outcomes across all futures and others where the outcome is less clear.

Improvements to the framework directly impact the quality of advice that the CfWI provides to decision-makers. The following sections describe some of the enhancements we have been making.

2.2 Horizon scanning

The horizon scanning stage was originally a separate exercise largely conducted by interviews, and used to inform the scenario generation stage. We now view this stage as a way of understanding the past, present and future of the system under investigation. The stage uses systems thinking methods¹ to investigate the current system and the forces and factors driving the behaviour. To support this we have undertaken the following.

- 1. We have developed a consistent set of terms spanning horizon scanning, scenario generation and systems thinking. These terms are presented as a visual taxonomy, and may be published in a future technical paper. This ensures a consistent understanding of the terms being used.
- 2. Introduced the concept of 'ideas', defined by the CfWI in our taxonomy as stories or fragmented narratives about the future. Ideas can be collected by interview, or more effectively using a crowdsourcing approach based on the horizon scanning hub (the hub is located at www.horizonscanning.org.uk) Participants are asked to think about how the future might evolve, and the impact on a particular profession or aspect of workforce planning. They provide this as a brief story or narrative fragment. However, while they are not restricted in how they express an idea in the narrative, they are additionally asked to provide a quantitative interpretation of the significance of their idea. For example, this might be whether they consider the idea as having a low or high impact on the workforce, how likely it is, or which factors in the system are related to the idea. The hub provides an opportunity to increase greatly the number of ideas collected, and to provide a rich source of material for analysis.

¹ Systems thinking methods provide a way of analysing and better understanding a system by taking into account the fundamental causeand-effect relationships that drive system behaviour (Meadows, 2008).

- 3. Improving how we analyse the forces and factors in the system, we have developed an approach for mapping the system using casual loop diagrams to explore the cause-and-effect relationships. Analysis of the maps provides a simple way to categorise the factors, and help to decide which are potential policy levers or measures of performance. This has proved promising and areas for further research have been identified.
- 4. Supporting this analysis, a set of thematic categories has been developed, building on the TEEPSE framework. TEEPSE remains a useful check that the main areas have been covered in generating factors. The new themes provide a clear distinction between external and internal factors, and highlight specific areas of interest for health and social care scenario generation. The factor bank has been tested in several scenario workshops for the Horizon 2035 project, and has been found useful in focusing thinking and identifying potential gaps.
- 5. For further information see technical paper no.6 (CfWI, b).

2.3 Scenario generation

The scenario stage was previously focused on a single workshop to generate four narrative futures that were quantified for modelling. While the workshop is still an important component of this, the emphasis today is on producing a broad set of challenging but consistent futures for modelling and simulation. Several new approaches have been successfully trialled and tested on the Horizon 2035 project (CfWI, 2014).

- 1. Tighter integration has been achieved with the horizon scanning stage, following a systems thinking approach. Causal loop diagrams are analysed in the horizon scanning stage to provide thematic set of factors as input to the scenario workshops.
- 2. A formalised approach to workshops has been developed using a scripted technique derived from the group model building corpus (Hovmand et al, 2012). The original one-day workshop has been divided into a half-day cluster workshop and a full-day scenario workshop. Both are fully defined and scripted to capture the tacit knowledge of the presenters, and improve quality and repeatability.
- 3. A wider range of scenarios can now be produced. The 2 x 2 matrix method has been replaced and scenarios are now generated across four axes of uncertainty. Workshop participants qualitatively check potential factor combinations for consistency² before proceeding to create detailed narrative scenarios. This approach allows additional scenarios to be generated for situations where uncertainty is high, and it is important that the scenarios span the full range of this uncertainty.
- 4. Quantitative methods have also been introduced. The cross-impact balance method (Weimer-Jehle, 2006) is used to confirm the consistency of workshop scenarios, and to generate additional scenarios for modelling using a larger number of factors. This provides a greater depth and richness for subsequent quantification and modelling.

² Each factor in a scenario and its future outcome or projection needs to consistent with the projections of all other factors. To give an example, a future where the economy is not doing well but health research is very well funded may not be fully consistent if these are the main factors being considered.

- 5. We have recognised that scenario quantification needs further improvement. We are working with Professor Tony O'Hagan on the use of the Sheffield Elicitation Framework (SHELF) to elicit probability distributions for critical uncertain parameters (O'Hagan, 2013). Investigations are also ongoing in the use of this approach to refine the Delphi method, and into Delphi expert workshops where it is necessary to quantify a large number of parameters.
- 6. Scenarios are being developed at different levels of scale. Sector-wide scenarios for health, public health and social care were upscaled to produce six whole-system scenarios. Multiscale scenarios offer considerable potential to improve the current set of over 50 different scenarios from the previous workforce reviews, and to ensure that future scenarios are internally consistent as well as coherent. The higher-level scenarios frame the scope for the lower-level ones, increasing the overall coherence of the set.

For further information see technical paper no.6 (CfWI, c).

2.4 Workforce modelling

A core element of the framework is the use of system dynamics (SD) modelling to calculate workforce demand and supply. The models constructed by the CfWI vary greatly in size and complexity. The medical model developed for the medical and dental student intakes project (MDSI) (CfWI, 2012) contains 15 separate influence diagrams, has 997 distinct variables and is initialised with 903,525 items of data. Other models, for example dentistry, pharmacy, psychiatry and acute medicine, are of similar complexity. This places them firmly in the category of industrial-scale models, and thus there is a clear need to use a formalised, software engineering approach.

Since the development of the first SD workforce model, we have gained considerable practical experience. Decision Analysis Services Ltd³ (DAS) has worked with the CfWI to formalise and document our approach. The benefits of this include models that are better designed, easier to use, more focussed, and more efficient. Applying a rigorous formal approach also results in increased stakeholder confidence in model outputs.

The approach is composed of four steps: model scoping, model construction, model documentation and model testing. Each step is described in detail and is supported by best practice guidance (CfWI, d). The CfWI's approach collates best practices from the many excellent references addressing SD model development and is informed by practitioner experience at the CfWI. Our approach provides the following.

- 1. There is a clear description of how the SD modelling fits within the wider robust workforce modelling framework.
- 2. Detailed guidance on SD modelling best practices is provided, along with examples drawn from our tested workforce models and checklists covering model scoping and testing.
- 3. Workforce SD models are typically data-intensive, so particular attention is given to the critical activities of data gathering, loading, and testing.

³ Decision Analysis Services Ltd (DAS) provide technical consultancy to support the analysis of strategic challenges facing government and industry decision-makers using systems modelling and simulation methods.

For further information see technical paper no.6 (CfWI, d).

2.5 Policy analysis

Policy analysis is the process of determining which workforce planning decisions are the most robust in the face of an uncertain future. The scale of the health and social care workforce, and the costs of training and employment, mean that at national level these are typically senior government decisions. However, decision-making can be made at lower levels of scale, across small workforce groups, geographic regions or individual enterprises.

Policy analysis is the final and most challenging part of the framework. It is here where information has to be critically assessed, options prioritised, and then presented to the decision-makers. Decisions are not always clear-cut. The future is, as we know, uncertain. Data and model limitations mean the outputs will always have uncertainty.

The policy analysis stage has been the subject of much research and development activity at the CfWI. This is ongoing but progress has been made in the following areas:

- 1. We are understanding how policy analysis has been conducted across other disciplines as well as the NHS and workforce planning. This has been informed by a comprehensive literature review.
- 2. How policy analysis links to other stages of the framework is another area being looked at. In particular we are examining the specific activities to frame and scope the nature of the policy interventions, define prospective policy levers for modelling, and agree measures of policy effectiveness.
- 3. The nature of the decision-making process is another issue, along with how to present the impact of different policy options to decision-makers. This requires consideration of uncertainty, in addition to presenting the range of outputs across the examined scenarios.

For further information see technical paper no.6 (CfWI, e).

3. Revised framework

This chapter describes the revised robust workforce planning (RWP) framework. The framework is available in several versions to meet the needs of difference audiences:

- 1. high-level version for presentations and reports
- 2. standard version, including key activities in each stage, for general audiences
- 3. extended version, including stakeholder engagement activities, for workforce planners and managers.

A reference version featuring links to relevant technical papers and CfWI workforce reviews is planned for the future.

The following sections describe the five stages of the updated RWP framework (focal question, horizon scanning, scenario generation, workforce modelling, and policy analysis) the main steps in each stage, and the activities undertaken in each step.

3.1 Focal question

The framework revolves around a key focal question or issue of concern. This is a statement of the purpose of the project (for example, the requirements of the future workforce, their numbers and proportions). A focal question serves to anchor the investigation.

However, endeavours aimed at solving a problem in a complex system will often come up against the realisation that the problem that has been posed is not the right one. As better understanding is gained of the system and the forces and factors driving change, then the problem may need to be redefined. This can happen during horizon scanning when mapping the system might uncover new underlying causes of change. It can happen during scenario generation when challenging futures may be generated, or when the system does not behave as expected when modelled.

Greater understanding of the root cause of the problem may lead to the focal question being redefined during the course of the project, hence its centrality in the framework.

This stage starts to identify the stakeholders and expert groups, and puts an engagement plan and communications strategy in place. Balanced stakeholder representation is important, i.e. not just from within the workforce under investigation. Trainees, employers and the public should be included as well.

The main steps are as follows.

- Problem Define the key question or issue of concern. This is the problem to be solved, which
 may be revised as further understanding is gained of the system and the root cause of the issues.
- Scope and boundaries Define the system under investigation, the scope and the boundaries.
 Confirm and agree what areas are in or out of scope. Clarity of purpose is important.

• **Future** – Define how far into the future we need to look.

3.2 Horizon scanning stage

The main steps are as follows.

- 1. **Idea generation** Identify the stakeholders. Engage with stakeholders and subject-matter experts to collect narrative ideas or stories about the future, for example possible technological advances. Conduct one-to-one interviews or the use the horizon scanning hub to crowd source ideas. Ask respondents to quantify how significant they are with respect to the focal question.
- System mapping Synthesise relevant projects and research, and establish how today's situation
 has been reached. Identify the trends, driving forces and factors. Map the system using causalloop diagrams. Conduct systemic analysis to understand the system behaviour, and determine the
 critical uncertainties. Discuss the policy options and potential levers of change with decisionmakers.
- 3. Data gathering Start the process of collecting historical and current data. Engage with stakeholders and data providers to identify and access data sources. Investigate the available data and determine data quality. Identify any known gaps and quality issues, and where assumptions may need to be made. The availability of data will determine what can be modelled. Data collection continues up to and including model development during the workforce modelling stage.

3.3 Scenario generation stage

The main steps are as follows.

- Scenario context Select participants for subsequent workshops. Conduct one or more cluster workshops with stakeholders to identify, refine and simplify (or cluster) the factors in the system relevant to the focal question. Order factors by impact and uncertainty of outcome, and use to select the scenario dimensions.
- Scenario development Conduct one or more scenario workshops with stakeholders to create consistent scenarios based around four factors of high impact and high uncertainty. Reject inconsistent combinations of factors. Engage with stakeholders to review and refine the scenarios, and produce fully described narrative stories for each scenario outside of the workshop. Generate additional consistent scenarios using cross-impact analysis with a wider range of key factors.
- Parameter quantification Engage with experts to determine values for critical parameters that are intrinsically unknowable using a formal elicitation process. Repeat this for each scenario. Determine a probability distribution for those parameters that are particularly influential for the model outputs.

3.4 Workforce modelling stage

The main steps are as follows.

- 1. **Scoping** Develop a clearly defined model specification, to include the purpose of the model to be developed, key policy questions to be answered, outputs to be calculated, the model architecture and the minimum dataset.
- Construction Develop the model based on the specification, document and test. Construction completes when the documentation has been written and the model has passed the testing phase. Without documentation the model cannot be considered fit for purpose; without testing, no confidence can be placed in the results and the model should not be used for policy analysis.
- 3. **Simulation** Run the model with the data to simulate the future workforce. Repeat across the set of scenarios defining challenging futures. Simulation may also include sensitivity analysis to determine what data the model outputs are most sensitive to, and where data improvement may be needed.

3.5 Policy analysis stage

The main steps are as follows.

- 1. **Policy evaluation** Agree the prospective policies to be tested, including combinations. Decide on approaches for measuring the effectiveness of a policy, e.g. the 'goodness' or 'regret'. Test the policy options using the model to evaluate their effectiveness. Determine the uncertainty inherent in the data and multiple views of the future.
- 2. **Robust decision-making** Evaluate the robustness of the alternative policy options. Identify the vulnerabilities and trade-offs. Make recommendations on the desirability of the options, including consideration of uncertainty.
- 3. **Performance monitoring** Identify which futures are the most desirable or the most difficult. Determine the signals that a favourable or unfavourable future may be unfolding. Scan for signs of change so that mitigating actions can be taken if needed.

3.6 Revised framework

Figure 2 is the high-level version of the framework, designed for presentations and reports.

Figure 2: Robust workforce planning framework (high-level version)

The robust workforce planning (RWP) framework has four stages:

- horizon scanning to understand the system and what drives future behaviour
- scenario generation to explore the future and produce challenging scenarios
- workforce modelling to simulate these futures and quantify what they look like
- policy analysis to make robust decisions and understand which solutions are the least vulnerable to uncertainty.

The **focal question** is a clear statement of the project purpose and defines the scope of the study.



Source: The Centre for Workforce Intelligence

Figure 3 is the standard version, designed for general audiences. It includes the key activities in each stage.

Figure 3: Robust workforce planning framework (standard version)

The primary activities are given for each stage. Not all stages and activities need to be completed, depending on the nature of the project. For example, some projects may not require full horizon scanning. Furthermore, there is considerable overlap between stages.

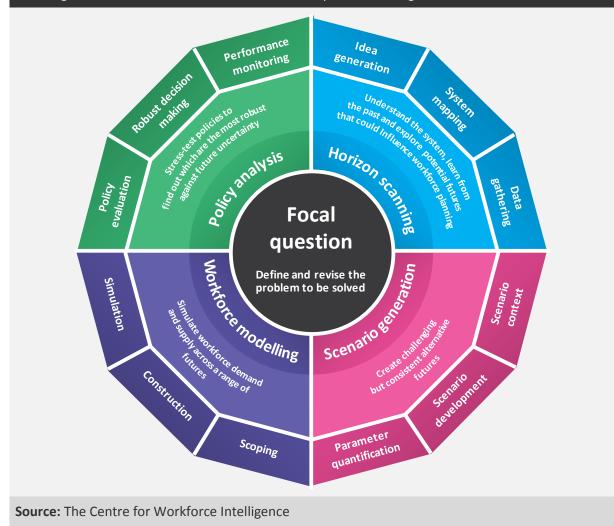
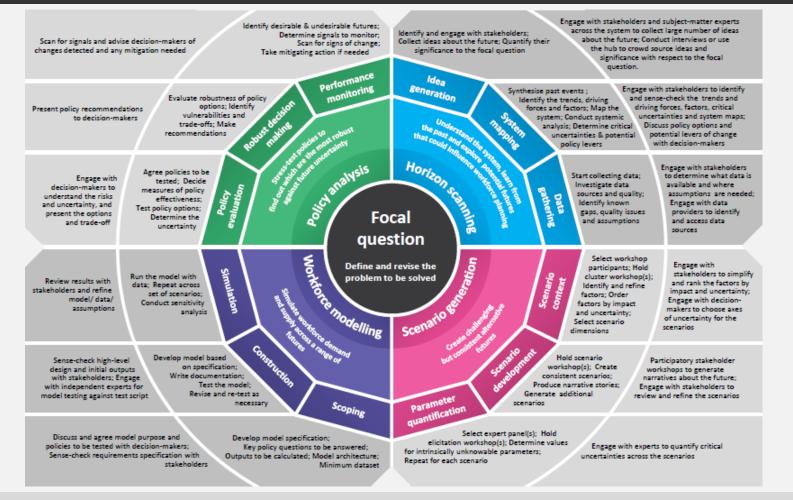


Figure 4 is the extended version, designed for workforce planners and managers. It includes stakeholder engagement activities.

Figure 4: Robust workforce planning framework (detailed version)

The detailed version includes the main stakeholder engagement activities.



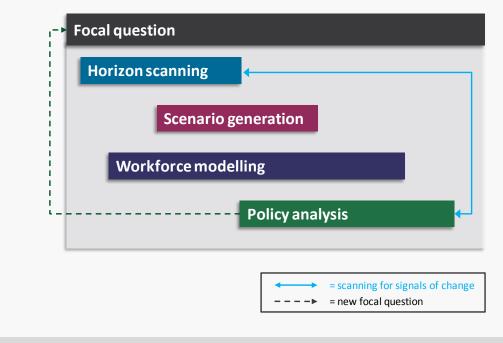
Source: The Centre for Workforce Intelligence

3.7 Framework process

It is important to note that the framework stages are not sequential and there is significant overlap and iteration. Iterations occur between all stages. All the stages sit within the focal question, which defines the purpose of the study. This may be refined during the project as greater information and understanding are gained. At the end of the policy analysis, horizon scanning may be started to look for signs of changes that would be unfavourable and throw the policy off track, or which would be favourable. It may also be that a new focal question has emerged to become the subject of a new study.

Figure 1: Robust workforce planning framework process

Note that there is significant overlap between the stages. Policy analysis (the final stage) may be followed by horizon scanning to look for signs of favourable or unfavourable changes. However, it may be that a new focal question has emerged and the process starts again.



Source: The Centre for Workforce Intelligence

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