

## Background and aims

- In broad terms, conceptual modelling is the process of developing a graphical representation (or model) simplifying the real world. A conceptual model is useful as a communication tool with other stakeholders, helps in the development of modelling objectives and is often used as an aid to decision making and problem solving.
- A conceptual modelling framework guides the modeller through structured steps, suggesting practical tips and methodology. Conceptual modelling frameworks are useful for systematic model development, transparency and reporting.
- Whilst there are established frameworks in disciplines other than health economics, there has been little research in the field of economic evaluation, and no generic standardised conceptual modelling frameworks exist. The objective of this research was to identify conceptual modelling frameworks in non-economic evaluation fields and apply the steps in these frameworks to a generic conceptual modelling framework for use in economic evaluation.

## Methods

- Critical interpretive synthesis was used to identify frameworks and synthesize results:
- The research question was used as a compass rather than an anchor.
  - An purposeful approach to searching was used; both Web of Science and the internet (using Godin methodology) were searched with references checked.
  - Broad inclusion criteria were used; frameworks with discrete steps, there was no restriction on the source or discipline of the framework.
  - Purposefully picking relevant evidence to inform the research; frameworks were chosen that add to the research topic.
  - Evidence was not restricted to certain types and was included from any source; this could include government and charity guidelines as well as peer reviewed publications.
  - Framework analysis using Nvivo software was used to identify common steps in the included frameworks, employing an iterative process.

## Results

- 534 items of potential evidence were identified from the literature search. After initial screening 43 remained, further screening resulted in 15 items of evidence identified as suitable for inclusion in the research. Figure 1 presents a word cloud from the included evidence depicting the most common words used.
- Six frameworks were from the discipline of ecology, 3 from engineering, 2 from operations research, 2 from healthcare, 1 from physics and 1 from manufacturing.
- Methodology used for developing the frameworks varied; Figure 2 summarises the methodology, splitting it between 'Based on a previous framework', 'Methodology included' and described in the evidence and 'Case study included' to illustrate the framework. In Figure 2 a traffic light system is used to indicate whether the methodology used to develop the frameworks included any of the 3 methods described; red for no methodology, amber for methodology mentioned but unspecific (ie author's experience) and green for method included.
- Similar steps were identified in all frameworks regardless of discipline, a total of 11 steps were included in the proposed framework; content, objectives, scope, documentation, detail, understanding the research problem, validation, outputs, review and refine, choosing the project team and looking at previous conceptual models. The frequency of these steps are presented in Figure 3 with 'Content' the most frequent (included in all 15 frameworks) and 'Looking at previous conceptual models' the least frequent (included in 1 framework).
- Based on these results a framework for developing conceptual models for use in economic evaluations is proposed and presented in Figure 4. The steps are split into three broad phases; Phase 1 is a scoping phase, Phase 2 is developing the content of the model, and Phase 3 is finalising the conceptual model.

Figure 1. Word cloud from included evidence

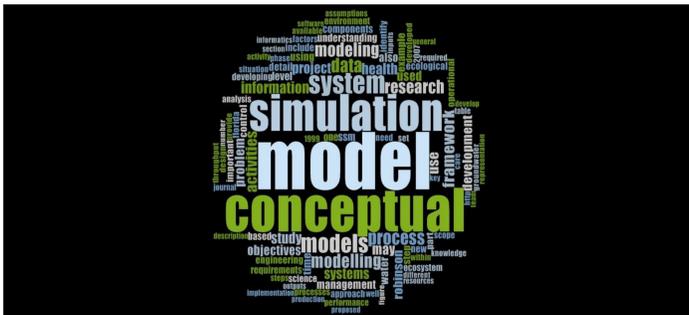


Figure 2. Methodology used for developing frameworks

Framework background	Based on previous framework	Methodology included	Case study included
Ecology - hydrogeology risk assessment	●	●	●
Operations research - discrete-event simulation model	●	●	●
Engineering - discrete-event simulation model	●	●	●
Ecology - ecosystem management	●	●	●
Healthcare - health informatics	●	●	●
Ecology - monitoring programs	●	●	●
Engineering - discrete-event simulation model	●	●	●
Ecology - government guidance for natural resource management	●	●	●
Physics - conceptual model leading to simulation	●	●	●
Manufacturing - discrete-event simulation	●	●	●
Operations research - conceptual model leading to simulation	●	●	●
Healthcare - involving stakeholders to improve success	●	●	●
Engineering - link conceptual modelling with engineering process	●	●	●
Ecology - water management	●	●	●
Ecology - implementing WWF standards	●	●	●

Legend: ● Not included (Red), ● Unspecific (Yellow), ● Included (Green)

Figure 3. Frequency of steps from the frameworks

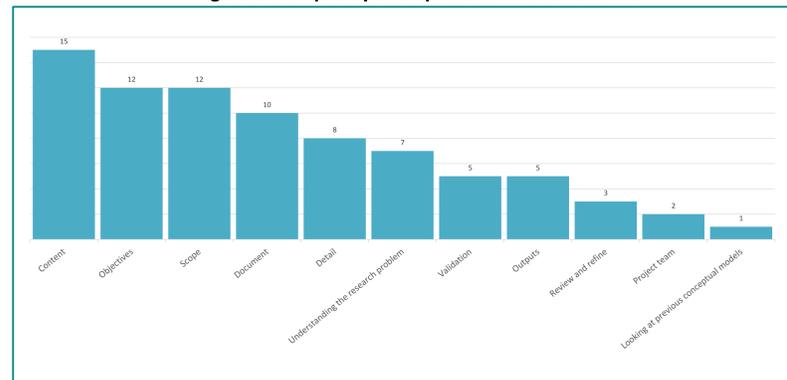
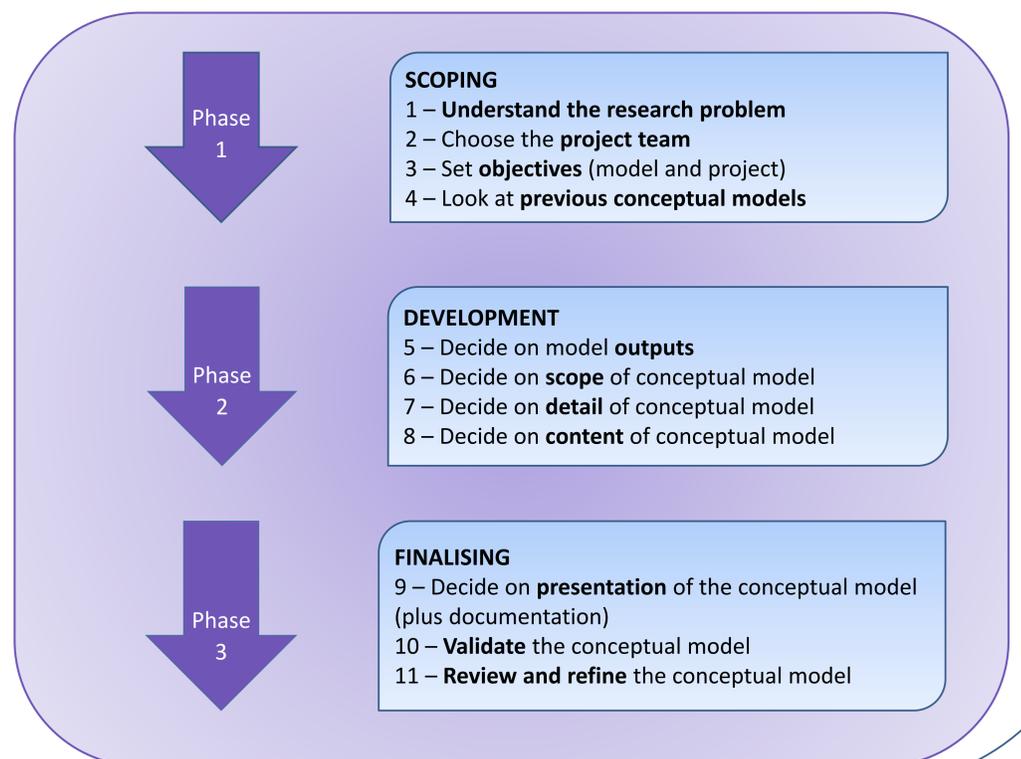


Figure 4. Proposed framework



## Conclusions

Fifteen non-economic evaluation frameworks were identified from the literature search, these were suitable to inform the proposed conceptual modelling framework for use in economic evaluation, similar steps were found in all disciplines. The next stage in this research is to validate the framework using expert opinion and case studies.