Strategy finder

Hierarchical Process Modelling (HPM)

HPM Background: Theories and Concepts

by Prof Dr Mike Yearworth, February 2025

Strategyfinder Software GmbH
FN 623983y, ATU80524309
Muenichreiterstrasse 25
A-1130 Vienna Austria

First Edition, February 2025

ISBN: 978-3-903556-91-1

v1.6 21/02/2025

Contents

Theory and concepts of the *Strategyfinder* HPM Module

This guide assumes familiarity with the *Strategyfinder* documentation set[1] as this explains how to use the original platform. The HPM Module provides an alternative approach to modelling when problem structuring based on Hierarchical Process Modelling. Using the additional functionality is described in the 'Getting started with the SF HPM Module' guide, which should be read in association with this introduction to the theory and methodology. Further information about the origins and use of HPM as a Problem Structuring Method (PSM) can be found in Section III of Yearworth (2025).

Origins

HPM was developed at the University of Bristol over a number of years since 1990 to address the problem of bringing hard and soft systems thinking together into a single integrated modelling approach. This was achieved through two innovations i) thinking in terms of modelling *everything* as a process i.e., conceptual ideas and physical things can *both* be modelled as processes and therefore mixed together in the same model, and ii) combining a process model with a measurement model into single hierarchical structure representing purpose, in which each process is combined with its own measure of evidence of performance (Dias & Blockley, 1994; Hall, Blockley, & Davis, 1998).

Basic Concepts

From these simple innovations there are four foundations to the use of hierarchical process modelling as a PSM; (i) process epistemology, (ii) modelling oriented towards achieving purpose, (iii) how/why modelling dialectic, and (iv) measuring or judging process performance.

Process Epistemology

The Hierarchical Process Modelling (HPM) approach is rooted in a process epistemology, viewing everything as a network of linked processes, similar to methodologies like SSM, SODA, and SCA that use such arrangements to represent structured problems. Nodes represent purposeful processes, while links indicate composition (part-of) relationships. Processes are labelled using gerunds[2] to convey continuous action. HPM models even physical entities, e.g., a bus is realising the process *Transporting passengers*. This approach emphasizes purpose over enactment, reducing over-specification and saving time during

[1] 'Getting started with using SF', 'Background: Theories and Concepts', and 'Strategyfinder Getting started - User access manual'.
[2] In English the gerund form of the verb is constructed, give or take a few irregularities, by the addition of the suffix '*-ing*' to the infinitive. The full implications of the processual interpretation of modelling using gerunds, non-finite verbal nouns, in other languages is yet to be fully explored.

workshops by focusing on outcomes (i.e., achieving purposes) rather than specific methods of enactment.

Modelling Purpose

HPM represents purpose through a hierarchy of processes, each expressed using gerunds like projecting, changing, contracting, developing[3]… . These processes are enacted by entities, for example such as a project team for Project*ing* intent into the future. The top-level process typically defines the model's core purpose, similar to Planning in SCA, Strategising in SODA, or Transforming in SSM. HPM, like SSM, focuses on conceptual purposes rather than specific entities, allowing flexible, creative exploration of how goals might be achieved. HPM enables models to be constructed of various organisational purposes without constraining process enactment to predefined entities. This can be thought of as enabling creativity in enactment or simply as delayed reification. For example, a bus can be thought of as the process transporting passengers. However, if I model using the process <Transporting passengers> I can defer any consideration about how that process is enacted when modelling and may at some future point when enactment is required (i.e., reification) decide that I do not need a bus, whereas a taxi (or maybe even a horse and cart) would be all that is necessary.

How/Why Modelling Dialectic

HPM begins with a top process representing the model's primary, or anchoring, purpose. The model is developed through a how/why questioning dialectic: asking 'how' a process succeeds reveals necessary sub-processes, while asking 'why' uncovers higher-level purposes. This isn't a reductive exercise but focuses on processes essential to the overarching goal. The why questions can expose broader purposes, leading to parallel hierarchies and new stakeholder groups. These hierarchies might share processes, fostering synergies and creative solutions. This aligns quite well with ideas of boundary critique from critical systems approaches, by challenging initial problem definitions and considering alternative enactments. Again, delayed reification—postponing the conversion of processes into concrete entities—maintains conceptual flexibility, allowing exploration of different processes fulfilling the same purpose.

Measuring Process Performance with Explicit Representation of Uncertainty

HPM originally integrated process performance measurement, emphasizing uncertainty to support risk modelling. Performance was represented as an interval, $P(A) = [Sn(A), Sp(A)]$,

[3] There is an endless number of gerunds that would be relevant here – dealing with, improving, increasing, integrating, enhancing, broadening, proving, enabling, building… etc.

indicating belief in a process's performance: with $[1,1]$ indicating a process performing well, $[0,0]$ for a process performing badly, and $[0,1]$ to indicate complete uncertainty. Visualizing performance with green (performing well), white (uncertainty), and red (performing badly) created the "Italian Flag" representation and is summarised in Figure 1 (Hall, Blockley, & Davis, 1998, p. 248).

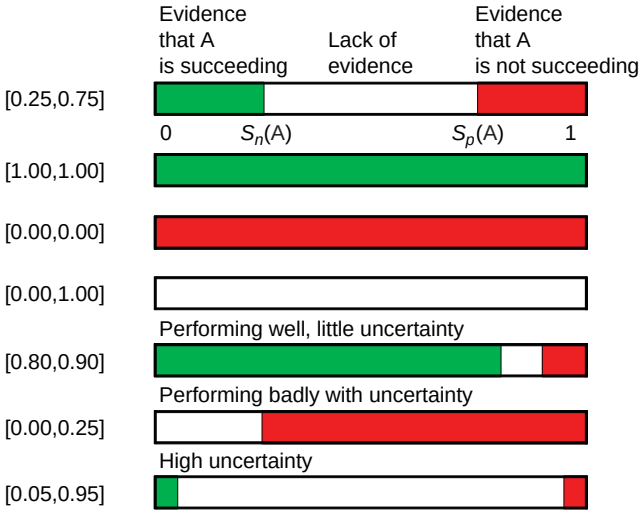

*Figure 1. Italian Flag representation of process performance (*Yearworth, 2025, Fig 9.4*)*

Performance calculations depended on necessity and sufficiency relationships between sub-processes and superior processes, using a variety of algorithms (Marashi, Davis, & Hall, 2008). Empirical methods worked well for physical processes but were less effective for organisational processes like strategising or planning, which are difficult to quantify.

As HPM evolved into a problem-structuring modelling approach, performance measures were often elicited via workshop participants' judgments rather than precise calculations. Flags that are predominately red indicate processes needing intervention to improve performance, flags that are mainly white highlight uncertainties requiring investigation or processes that are yet to exist, and flags that are mostly green signal processes that do not currently require investigation. This qualitative, participatory approach helps teams prioritize actions without becoming bogged down in numerical precision.

Argumentation

The final element of HPM involves argumentation, inspired by ideas from Issue Based Information Systems (IBIS) (Conklin, 2006; Marashi & Davis, 2007), with three components: Issues, Options, and Arguments. As processes are decomposed through 'how' questioning, Issues of enactment arise. These are addressed by exploring Options and Arguments. Groups then preference and vote on Options, considering Arguments, to guide action planning.

Combining into a Methodology

The overall methodology can be summarised into four phases: (1) Problematising to define initial 'anchoring' purpose, (2) Group model building, (3) Evaluating conceptual performance, and (4) Identifying actionable options. These phases form a cyclical process based as shown in Figure 2.

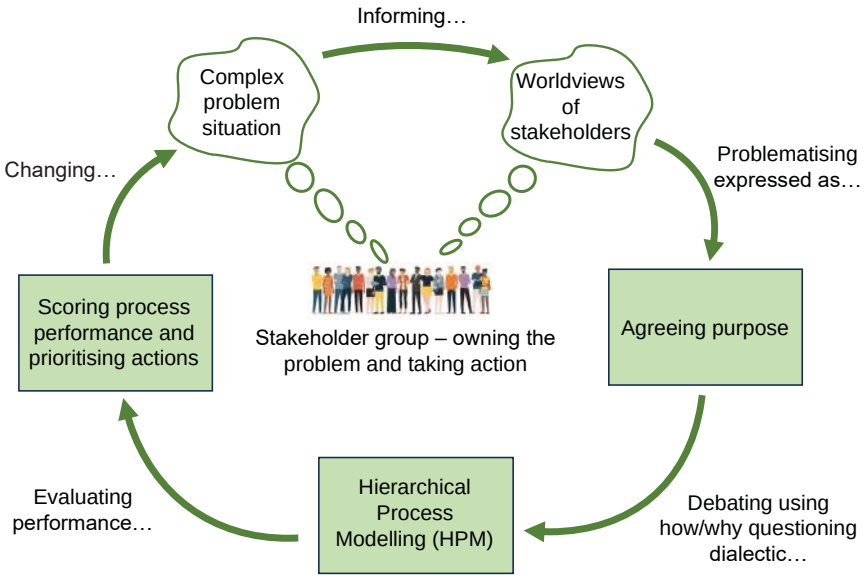

Figure 2. HPM as a PSM (Yearworth, 2025, p. 154) based on an original PSM teaching idea adapted from (Hindle, 2011)

Implications

Modelling everything as a process is a challenging new approach (a 'processual turn') to problem structuring. Perhaps the most perplexing idea is the notion of processes that are described using a gerund and convey a sense of 'ongoingness'. This blurs the distinction between process that need to exist to achieve a purpose, and processes that already exist as part of current ways of doing things. While there are similarities with the ideas of strategising (future oriented) and detecting emerging strategy (now oriented) in modelling with Strategyfinder, it is better to think of HPM as originating from a completely different conceptualisation, one that is grounded in a simple epistemology – everything we can know about the world can be expressed as a process – rather than management theories. However, this does not preclude HPM being used for strategising and detecting emerging strategy (i.e., it can be used in a SODA-like way), just as much as it can for general transforming (SSM-like) or planning (SCA-like) (Yearworth, 2025, pp. 140-141).

From a practical perspective, starting with an anchoring purpose expressed as a process in the HPM way, i.e., as a gerund, and then trusting to the how/why modelling dialectic is enough to progress to useful models. Processes that already exist will reveal evidence of

process performance that is not completely unknown; unlike processes that have yet to be enacted, whose performance will be completely unknown.

Another challenge arising from the ongoingness of processes in HPM is the absence of time in the sense of moving action along or accounting for observed behaviour over time

> *"Experience has shown that many professionals are used to process flow mapping, and that this familiarity can cause confusion when developing a model such as that which is produced using HPM. It is important to move people away from a temporal orientation (i.e. this happens then this happens etc.) towards a purpose-driven perspective. Questions such as "How can I do this" and "Why am I doing this" are useful tools in navigating up and down the hierarchy."* (Davis, MacDonald, & White, 2010, p. 902)

Again, trusting to the how/why modelling dialectic from the starting anchoring purpose is enough to move the modelling forward.

A description of the HPM methodology using HPM

Yearworth (2025) discusses the merits of a processual turn in Operational Research and observes that…

> "*In modelling the world processually we can also model our interventions within the same model … Or put more simply, problematic situations are processes as are the means of intervention.*" (p. 270).

Modelling our interventions processually requires the specific capability of representing our use of a Problem Structuring Method as a model. This idea can be traced to original work by Checkland and Scholes, who modelled the ongoing reflective practice of using SSM in client engagements using the modelling language of SSM itself (Checkland & Scholes, 1990, p. 294), i.e., the system to use SSM is just another purposeful activity system (Checkland & Poulter, 2006, p. 194; Yearworth, 2025, p. 78).

The same approach has been used here for describing the use of Hierarchical Process Models for problem structuring. This was first used in the EU-funded STEEP Project as means of self-evaluation of how well the methodology was performing, making use of the Italian Flag as a means of capturing judgement of process performance (Yearworth et al., 2015, p. 9).

The Healthy Resilient Cities project (Yearworth, 2015) modelled the process of using the PSM within the model of the problematic situation itself (Yearworth, 2025, pp. 168-181) i.e., the process <Improving the resilience of healthcare provisioning…> contained within it the

process <Using problem structuring>. Further work on exploiting the Italian Flag for capturing judgements of process performance in the use of a PSM was explored in depth by Lowe, Espinosa and Yearworth (2020).

Figure 3 provides a model for using HPM as a PSM expressed as an HPM in Strategyfinder. Note that methodological learning, an essential element of using a PSM, is reflected in the model at Process #26 <Evaluating the engagement and improving our understanding …> and the processes it contains. The model also references other models that could be incorporated as enhancements; for example using the framework for improving facilitation developed by Ackermann (1996, p. 95), which has been interpreted in Yearworth (2025, p. 108) as another process model. This in passing also illustrates another useful property – that all HPM are composable, according to their necessity and sufficiency for the success of the process that acts as the anchor for incorporation.

This model is available for download at

https://problemstructuring.com/models/model_using-hpm-as-a-psm-for-manual.json

The downloaded JSON file (model_using-hpm-as-a-psm-for-manual.json) can then be imported into Strategyfinder and used immediately as a guide to using HPM as a PSM. The model goes further and provides a complete description of structuring an engagement with a customer.

The model can also be used to self-evaluate a team's use of the methodology by evidencing process performance.

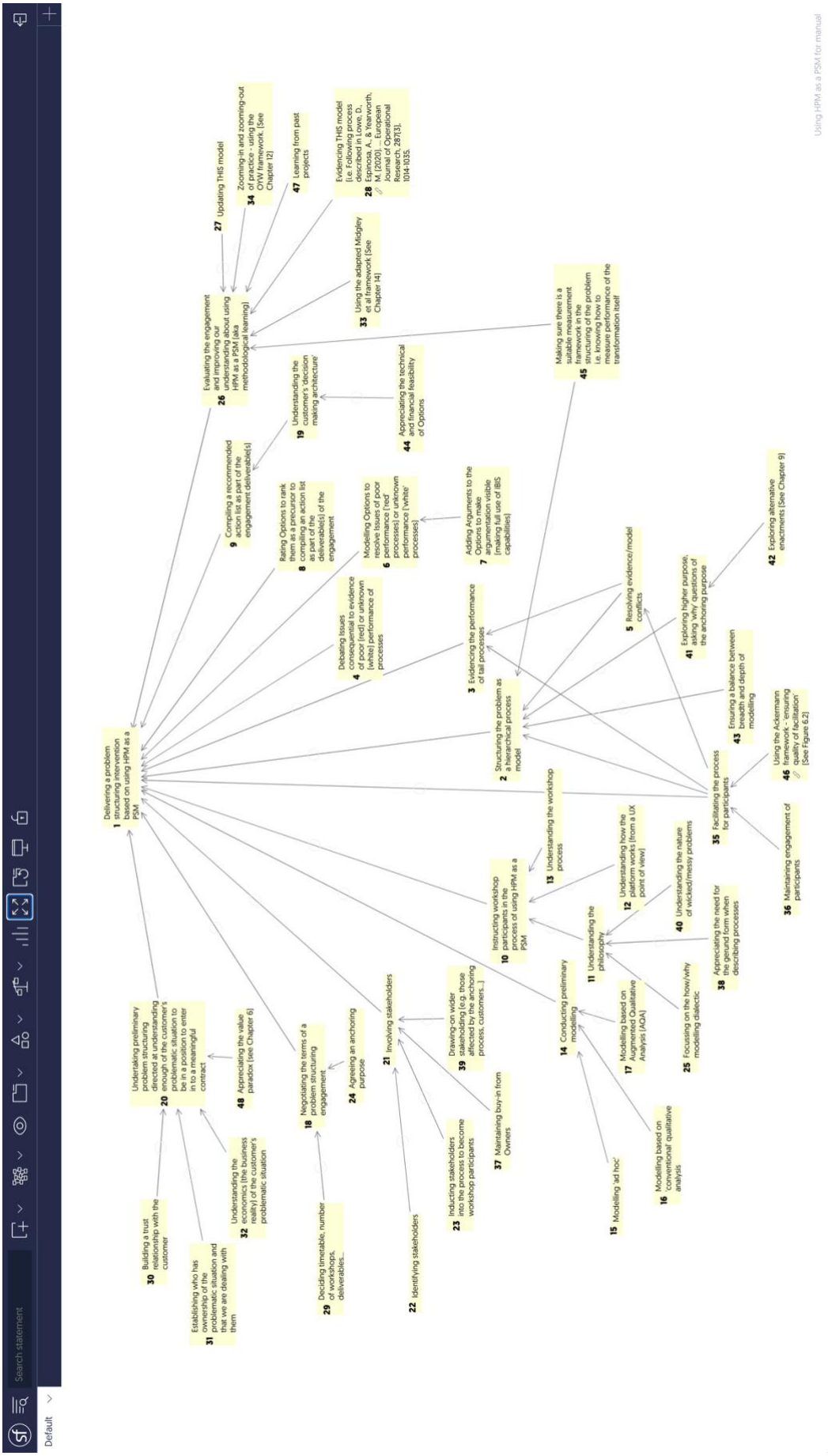

Figure 3. HPM of using HPM as a PSM

References

Ackermann, F. (1996). Participants' perceptions on the role of facilitators using group decision support systems. *Group Decision and Negotiation*, *5*(1), 93-112. https://doi.org/10.1007/BF02404178

Checkland, P., & Poulter, J. (2006). *Learning for action : a short definitive account of soft systems methodology, and its use for practitioner, teachers and students*. John Wiley & Sons: Chichester.

Checkland, P., & Scholes, J. (1990). *Soft systems methodology in action*. John Wiley & Sons: Chichester.

Conklin, J. (2006). *Dialogue mapping : building shared understanding of wicked problems*. John Wiley & Sons: Chichester.

Davis, J., MacDonald, A., & White, L. (2010). Problem-structuring methods and project management: an example of stakeholder involvement using Hierarchical Process Modelling methodology. *Journal of the Operational Research Society*, *61*(6), 893-904. https://doi.org/10.1057/jors.2010.12

Dias, W. P. S., & Blockley, D. I. (1994). The integration of product and process models for design. *Design Studies*, *15*(4), 417-432. https://doi.org/10.1016/0142-694X(94)90005-1

Hall, J. W., Blockley, D. I., & Davis, J. P. (1998). Uncertain inference using interval probability theory. *International Journal of Approximate Reasoning*, *19*(3-4), 247-264. https://doi.org/10.1016/S0888-613X(98)10010-5

Hindle, G. A. (2011). Case Article—Teaching soft systems methodology and a blueprint for a module. *INFORMS Transactions on Education*, *12*(1), 31-42. https://doi.org/10.1287/ited.1110.0068ca

Lowe, D., Espinosa, A., & Yearworth, M. (2020). Constitutive rules for guiding the use of the viable system model: Reflections on practice. *European Journal of Operational Research*, *287*(3), 1014-1035. https://doi.org/10.1016/j.ejor.2020.05.030

Marashi, S. E., & Davis, J. (2007). A Systems-Based Approach for Supporting Discourse in Decision Making. *Computer-Aided Civil and Infrastructure Engineering*, *22*, 511-526. https://doi.org/10.1111/j.1467-8667.2007.00507.x

Marashi, S. E., Davis, J., & Hall, J. (2008). Combination methods and conflict handling in evidential theories. *International Journal of Uncertainty Fuzziness and Knowledge-Based Systems*, *16*(3), 337-369. https://doi.org/10.1142/s0218488508005315

Yearworth, M. (2015). *Healthy Resilient Cities: Building a Business Case for Adaption (NERC NE/N007638/1)* [Grant]. Bristol. http://gotw.nerc.ac.uk/list_full.asp?pcode=NE%2FN007638%2F1

Yearworth, M. (2025). *Problem Structuring: Methodology in Practice* (1st ed.). John Wiley & Sons, Inc.: Hoboken. https://doi.org/10.1002/9781119744856

Yearworth, M., Schien, D., Burger, K., Shabajee, P., & Freeman, R. (2015). STEEP Project Deliverable D2.1(R2) - Energy Master Plan Process Modelling. *STEEP PROJECT (314277) - Systems Thinking for Comprehensive City Efficient Energy Planning*, pp78. Retrieved 26th January 2023, from https://problemstructuring.com/documents/01_STEEP_D2.1_Energy_Master_Plan_process_model_update_M24_DEF_sent.pdf

Strategyfinder
Consulting Software GmbH
FN 623983y, ATU80524309

Dr Anita Reinbacher
Muenichreiterstrasse 25
A-1130 Vienna Austria
Mail@Strategyfinder.com

ISBN: 978-3-903556-91-1