A Tale of Two Managers: testing mental models of an intractable business problem

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Keywords

Mental models, system dynamics, management, profit, modelling

Problem

A local office of a multinational consultancy company[1] had been failing to meet its profit target over several years. Two senior managers were responsible for running the office, both of whom had very different personalities and often disagreed. Throughout a six-year period, these managers had been using their own separate policies to try to increase the office's profits to match its target. Despite their efforts, their policies did not prove successful and the problem persisted throughout the period. This paper[2] presents an exploratory study which sought to understand the managers' mental models as a first step towards developing a systemic explanation for this persistent problem.

Hypothesis

The profit target problem was characterised as a dynamic problem and the office business was considered as a dynamic system. Because decision makers have difficulty managing complex systems and often misperceive the causes of unexpected behaviour (Sterman, 1989; Moxnes, 2004), it has been proposed that decision makers' sub-optimal management of dynamic systems can be explained by inaccuracies in their mental models of the systems they are managing (Forrester, 1971). Gary and Wood (2011) provided empirical evidence for the proposed link between decision makers' mental models and their performance in managing dynamic systems, as well as identifying relationships between decision makers' mental models and their preferred management strategies. On this basis, the following hypothesis was developed to be tested in this study: *The two managers had different mental models of the causal structure underlying the office business system, and that the structures of neither of their mental models were sufficiently similar to that of the actual system to provide a causal explanation for the problematic behaviour. For these reasons, the two managers could not redeem the problematic behaviour.* Groesser and Schaffernict's (2012, p. 61) definition of a mental model of a dynamic system (MMODS) was adopted in this study.

Methods

This study sought to derive explicit representations of the two managers' mental models and to test them in a computer simulation. A mixed-methods research strategy was adopted (Denscombe, 2012)

[1] The company analysed in this study was not named to protect its commercial confidentiality interests.

[2] This document presents an extended abstract for a paper presented at the International System Dynamics Conference, Reykjavik, Iceland, 6-10 August 2018.

following the system dynamics modelling process (Luna-Reyes and Andersen (2003); Richardson and Pugh (1981)). The qualitative component involved collecting information about the managers' mental models and their explicit representation in Causal Loop Diagrams (CLDs). The quantitative component involved representing the managers' mental modes as stock and flow diagrams (SFDs) and testing their validity against office profit trends in a quantitative simulation model. This study departed from previous mental model research in that a formal elicitation process (e.g. Ford & Sterman, 1998) was not used. Resourcing constraints and a tight completion deadline precluded a participatory examination of the managers' mental models. Instead, information was used from one of the authors' prior experience of working for four years alongside the two managers. This study could therefore proceed in the context of limited resources and without the managers being aware they were being examined. The advantages and limitations of this approach for accurately representing the managers' "revealed" and "declared" conceptual structures (Groesser and Schaffernict, 2012) and for avoiding their potential distortion during elicitation (Richardson *et al.*, 1994) were discussed.

Results

Results indicated that the two managers had different mental models: Manager 1 believed that below-target profits were being generated because there weren't enough staff at the office generating revenues through the work they were doing for clients, so the office needed to recruit more people, whereas Manager 2 believed that there were not enough consultancy projects for the staff to work on, so the office needed to submit more bid proposals to get more work. Furthermore, sensitivity tests demonstrated that simulations of neither manager's mental model structures could reproduce the problematic office profit trend, except under extreme and highly unlikely circumstances. Sensitivity tests also revealed an additional important insight regarding Manager 2's assumption that "the office needs to make five bids to win one live project": Manager 2's mental model did not reproduce the reported profit trend with this win rate but could if eight or ten bids were needed to win one project.

Discussion

The findings of this study were insufficient to reject the hypothesis. Instead the results supported it: simulations of both managers' mental models were unable to reproduce the reported profit trend and the conceptual structures representing the two managers' mental models could not explain why the real problem persisted. It was therefore concluded that the two managers' mental models could be considered inaccurate representations of the actual causal structure underlying the office business system. The results were interpreted in the light of previous research (e.g. Gary and Wood, 2011) and with reference to the "Fixes that Fail" systems archetype (Braun, 2002), describing how the managers may have been unaware of structural components beyond their mental models that were contributing to the profit problem's persistence. Sensitivity analyses also highlighted the importance of Manager 2's assumption about the work win-rate in driving their model behaviour and therefore the need to ensure accurate data about this variable is available to managers at the company. An extension of this study was proposed whereby an explanatory model for the problem could be developed using Group Model Building to promote team learning and identify potential solutions (Vennix, 1996).

Conclusions

This paper makes three contributions. First, it provides insights that could contribute to the improvement of performance at the company. Second, the paper demonstrates the application and learning benefits of using system dynamics to test decision makers' mental models of intractable business problems. Third, from a methodological perspective, the study presents a bespoke method which contributes to the on-going discussion about best practice in mental model research.

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Supplementary Materials

A full version of the research paper, complete model documentation and models in Stella Architect files were submitted with this abstract. The full version is available from the authors on request.

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