Making system dynamics accessible to SMEs through user-parameterised generic models

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Abstract

System dynamics is a powerful strategic analysis approach, but it can also be a costly one, if all models must be constructed largely from scratch. This appears to preclude their widespread use in small-medium enterprise (SME) applications. Field research has shown that generic parameterisable simulations can challenge mental models and enhance confidence as a firm faces major change. We discuss whether such simulators could be the only viable option for SMEs to benefit from system dynamics modelling and scenario planning.

Introduction

In Industrial Dynamics, Forrester (1961, p365) argued that dynamic modelling was applicable to smaller firms as much as to larger ones, and maybe even more so, particularly firms facing the challenges of major growth:

"....aggressive, rapidly growing, medium- and small-size organisations may be the places where the methods discussed in this book will have their first important impact ... the smaller organisations may be more fluid ... the costs of management systems research are low enough so that they present no great difficulty...."

Historically, this does not seem to have been the case and the impact of SD within the SME sector has not been high. With this statement in mind, a research project into how SMEs prepare for fundamental business change led to the development of a 'change visioning' tool built around a system dynamics flight simulator. One key feature of the simulator was a core generic model that could be parameterised to a specific firm by non-specialists through a self-managed interrogatory interface. Given the potential cost savings in this process, this short paper discusses the potential for such tools in providing low-budget entry into system dynamics modelling for SMEs

The Notion of User-parameterised Models and the Challenge for SMEs

The core model in the simulator was 'generic' and intended to reflect a wide range of firms and change situations. The concept of using generic models which are tailored to specific circumstances is not new, even in practical studies as opposed to learning situations (e.g. by Alfeld, 1995; Lyneis *et al.*, 2001). It was constructed using high level and aggregated representations of a business for the purpose of capturing the longer-term drivers of the business (Winch et al., 1999). The idea here was that modelling the needs, values and expectations from a top-level perspective was more important than a more concrete operational view that ties the view of a firm to a particular business architecture. There are clear parallels in this with the resource-based view of the firm (Barney, 1991), and notions of 'natural work groups' as discussed by Teerlink and Ozley (2000). The model was tailored to

individual firms participating in the research through provision of an automated front end through which the directors who were driving the business change could parameterise the core model themselves. The high level approach also reduced the number of parameters required and hence the time required for the parameterisation routine, although the parameters then tend to be more abstract. The process of parameterisation of the model and then its subsequent use by company managers to 'pre-experience' possible post-change futures for their firm is summarised in Figure 1.

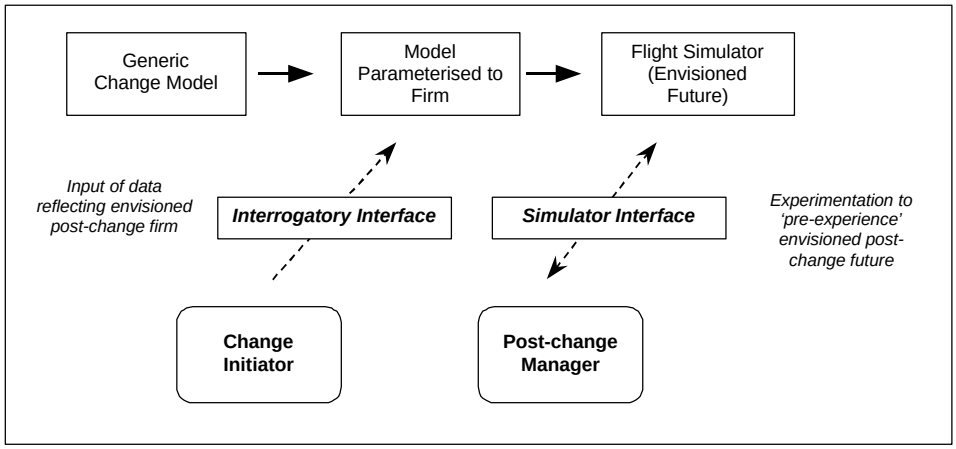

Figure 1 – Schema showing the *modus operandi* of the simulator

The details of this approach are discussed in Winch and Arthur (2002) where it is argued that such user-parameterised generic models may be the only way of making the benefits of SD modelling available to SMEs. The argument is that SD models, custom-built from scratch to a particular firm or issue and rigorous in their structure and detail, are very expensive in time, expertise and cost, and often built with the assistance of consultants and through group participation within the firm. The general belief that a major benefit of modelling can come in the model-building process is not disputed here, but if there is an insistence that all "good" models have to be constructed in this way, then unfortunately the costs involved would appear effectively to make system dynamics predominantly, if not exclusively, a large organisation approach.

Some managers (a growing number but still small) may have had previous exposure to systems thinking and modelling, or have access to subsidies for the cost of such work, although usually not as one-off company-specific problem solving or situation analysis activities. Generally, however, time and cost constraints seem to preclude the use of SD modelling by SMEs, which are often led by entrepreneurs who lack time (and frankly often the inclination) to engage in systems thinking and modelling as a separate activity.

Generic models or archetypes can be used to categorise business situations and their use in a teaching context to make simplified representations of general business cases is quite widespread. Our research concluded that such models could provide pre-packaged tools to make available some of the benefits of model-based scenario planning in the face of major future business challenges. The research certainly confirmed that facilitated workshops with managers using the simulator that had been parameterised by the directors were likely to be more fruitful than unfacilitated ones. Nonetheless there could still be benefit in the latter case in terms of raising awareness of issues surrounding a planned change, emphasising the

probable need for new thinking on the managers' part, and in building confidence to face new challenges. Of course, the structure of the model itself was not visible to the participants and therefore retains the drawbacks of 'black-box' models. Trial users of the system nevertheless reported perceived clear benefits, even in the unfacilitated sessions.

Conclusions

Given the obstacles to introducing modelling into the SME, it is argued here that user-parameterised generic models could be a way of overcoming some of the barriers. Other solutions could include:

- a longer term educational approach to raise awareness among SME entrepreneurs, in particular, of strategy and systems thinking skills, with increasing use of modelling through 'diffusion';
- persuading managers of the benefits of modelling as part of cost- and time-efficient structured approaches to business planning;
- making capital funding contingent upon evidence of structured and holistic systemic thinking in business plans, since this is an inherent part of a vision for a growing business.

However, these other 'solutions' are costly and probably longer term, and have not yet completely penetrated the large firm context. It is worth returning, therefore, to the original premise of this article – namely the assumption that SD modelling is as relevant to SMEs as larger firms. From business development activity in liaison with small firms (<50 employees), the first author has noted a priority amongst managers to focus on the essential elements of keeping the business running: a marketing programme, ensuring product quality, effective management of workloads, dealing with staffing problems, dealing with dissatisfied customers etc. Structured systemic thinking often seems to be both a luxury and somewhat esoteric for many managers. Getting managers to use basic strategy tools such as a SWOT analysis is a challenge in itself. Experience from the second author (Winch, 2000, and other consulting firms) shows that SD has probably the greatest impact to make in very high stakes decisions faced by large firms. Perhaps the best positioning for user-parameterised generic models is in medium size firms, also facing strategic decisions, but with the simulator playing a sensitising role to raise awareness of possible future dynamics. It then serves as a precursor (or "opening wedge" as Forrester, 1961, p 360) for possible later extension and bespoke development.

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