

Building and Conceptualising Generic Model Structures to address Fundamental Business Change

Graham W. Winch, Daniel J. W. Arthur, and Colin Grey

University of Plymouth Business School, Plymouth, PL4 8AA, U.K.

graham.winch @pbs.plym.ac.uk

Abstract

The need for models to closely reflect reality seems to imply that the modelling process will benefit from the maximum involvement of users and a transparent model construction process, but militates against the use of generic models. This paper briefly discusses the circumstances where generic models may offer particular benefit. It suggests constructs for generic modelling based on the notion of 'service fulfilment' - the satisfaction of various stakeholders' needs, values and expectations. Such a model has been developed for a project on preparing for change, and the results of trials are summarised. In terms of helping managers cope with change through using a dynamic simulator to pre-experience future scenarios and challenge their mental models, it concludes that, even though models at the heart are generic, they do have potential value. Further, the use of easily calibrated generic models may be the only viable option for smaller firms to gain support in change management from dynamic modelling and scenario planning.

Introduction

The accepted wisdom in system dynamics studies, as with any modelling process, is that any model at the core of a study must be a close reflection of the real world system that it is intended to simulate. Seemingly implicit with this is the presumption that the modelling process benefits from the maximum involvement of the project clients and ultimate model users, and from a transparent model construction process. The advent of specialist software with visually interactive interfaces utilising the intuitive stock/flow and causal feedback structures have contributed significantly to the recent success of the approach. Though established modules or constructs may be adapted to speed up modelling and perhaps contain development costs (e.g. Winch, 1985), the need for close reflection of the real world otherwise appears to militate against the use of generic models.

The reasons for avoiding generic models seem straightforward and well rehearsed: generic model structures may be rejected by users on the 'not invented here' principle, that much organisational learning and collateral benefit may be lost, and that the end model may be perceived as simply missing out or misrepresenting critical structures that will determine behaviour. The development of generic model structures however may have validity in a number of interrelated situations:

- the provision of a means of learning transference, including across business/industry sectors;

- the development of a theory of behaviour in socio-economic systems where particularities are less important than general relationships;
- the provision of a model framework that is generally representative but that can be satisfactorily parameterized to reflect particular cases.

Further, if there is an insistence that all good models have to be constructed largely from scratch, then the time, expertise and costs involved effectively make system dynamics predominantly, if not exclusively, a large organisation approach.

The last of the bulleted situations above provided the context for the development of a generic business simulator that aims to support management thinking when facing a major planned business change. It is suggested that the construction of models for such purposes using a 'service fulfilment' approach may offer particular benefits. This approach is based on a similar concept to sub-system diagrams or sector overviews as suggested by Morecroft (1982) with the relationships between accumulators in major business sectors comprising the flows of service demand and service provision. Morecroft selected organisational or functional units as the major sub-systems; the service fulfilment concept may still apply at inter-functional unit level, but it is not limited to these. It focuses on any major constituency or 'stakeholder' group, and thus brings a more personal angle or 'customer satisfaction' idea of service delivery. In this context, the paper briefly discusses the circumstances where generic models may offer particular benefit, describes the modelling constructs at the core of the model developed for the projects, and summarises the results of trials of the simulator in a firm.

Arguments for Generic Models in Specific Circumstances

The development of the simulator described here has taken place within a research project that characterises how firms prepare for fundamental change and some of the internal communication difficulties that arise in this process. Specifically, it discusses the role of a change-visioning simulator within the preparation process. While an element of the project was 'proof of concept' verification of a simulator in such a change process, it was also intended that such a simulator also might then be available to smaller firms as well as large. The project was designed to investigate how effectively such a business tool can function when used by managers with minimal, or even total absence of, expert facilitation in using a simulator that represents a firm's position at a point in the future after a planned major change has been implemented. (Other aspects of change management, like the processes of change evaluation and implementation, lay outside the research objectives of the project.)

Longer-surviving companies evidently preserve two key aspects of their identity: their core ideology and purpose. (However, if organisational longevity is an important measure of business success, it is worrying that the average lifetime of companies appears to be decreasing - de Geus, 1997; Collins and Porras 1994). Apart from these aspects of identity, they stimulate change from within, often radically changing their portfolio of products and services and even sometimes shifting entire industries. For instance, Stora, the world's oldest company, went through its greatest transformation when it moved from copper mining to forestry. Similarly, the trajectory of the Virgin

company from record stores to music publishing, then to an airline, cola drinks, financial services, and, recently, internet and telecoms provider could not possibly be tracked with model structures based on their business processes at any point in time. The ability to achieve internal transformation whilst preserving identity and culture is a chief aim of organisational learning. However, if the tool is also to be used by smaller firms, then not only must the model usage be streamlined and delivered at minimum cost, then so too must the model construction phase.

The twin objectives of wishing to address fundamental change, where existing structures may be much less relevant, and the desire to make the process deliverable to the smaller firm pointed towards the use of generic or easily adaptable modelling constructs as the core of the model. Also, as the objective of the ultimate visioning tool was primarily to stimulate managers of the future firm to challenge their existing mental models and to re-evaluate current measures of performance and the routes to achieving them, then the precise detail of the future situation may well be less critical than the vividness of the scenarios that the simulator presents. (The debate over the relative worth of 'most likely' versus 'reasonable' - but only marginally likely - futures is well established in the long-term forecasting and scenario planning literature - e.g. Twiss, 1992; Fahey and Randall, 1997; Schoemaker, 1995; Schwartz P, 1991). Ringland (1998) has described the role of system dynamics in comprehensive situation mapping (CSM) - one of the methods available for scenario planning - and the importance of vividness and the benefits of dynamic models in scenarios are discussed in Winch, 1999)

The Basis for Generic Models through Stakeholder Needs, Values and Expectations

The development of a generic model presents considerable problems as to how it should be constructed. In situations as here, where the future business' processes are planned to be substantially different from currently implemented processes, managers' mental models of how the firm and its environments work, how to manage successfully within them, and indeed how to measure success in the transformed enterprise may need to change fundamentally. Any model supporting the development of this new thinking must therefore to be based on the underpinning long-term drivers rather than the transients of present business processes. System dynamics models are based on constructs of levels and rates which are aligned with resource and policy concepts. If these are built from key stakeholder performance metrics, then it is possible to match asset stock accumulation variables (Dierickx and Cool, 1989) with service delivery variables.

This provides an alternative basis for conceptualising computer-based simulations, starting from a 'service-fulfilment' view which addresses the '*needs, values and expectations*' (NVEs) of both internal and external stakeholders – shareholders, customers, clients, suppliers, staff and other collaborators. This process then becomes more aligned with the *raison d'être* of the firm, and matches the attempt to represent such concerns using mission statements or other encapsulations of the firm's fundamental values and purpose, themselves amalgams of the needs, values and expectations of its stakeholders. This also relates to the resource-based theories of business firms (Barney, 1991) and on a need to achieve balanced policies for business

performance, as exemplified through the ‘balanced scorecard’ analysis ideas of Kaplan and Norton (1996). One attempt to define the relationship between overarching organisational culture and beliefs which drive strategy and policy, and the consequent development of the various processes in the firm, was put forward by Wolstenholme (1994). This is summarised in Figure 1. This characterises the relationship between these dimensions, but may lead to the interpretation that operations must therefore be interpreted through the study of the processes in place.

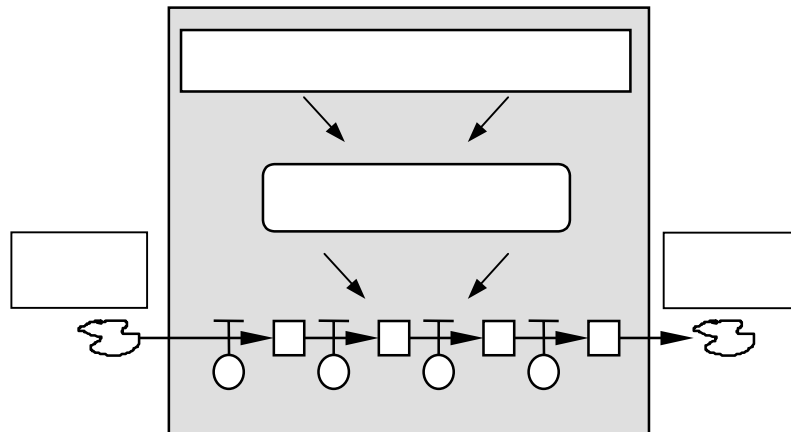


Figure 1 - Operational Perspective of Relationship between Strategies and Processes (after Wolstenholme, 1994)

An alternative view (Figure 2) of the firm takes the diverse set of stakeholder needs, values and expectations as the top level. This recognises that attaining an acceptable balance of ‘service delivery’ or needs satisfaction to differing stakeholders is a key determinant of overall business success. The model allows therefore that through the filter or test of its core ideology and purpose, the firm can be configured, and reconfigured, using whatever processes – product/service delivery, organisational processes, etc. – that will best enable it to meet, in some optimal way, these NVEs.

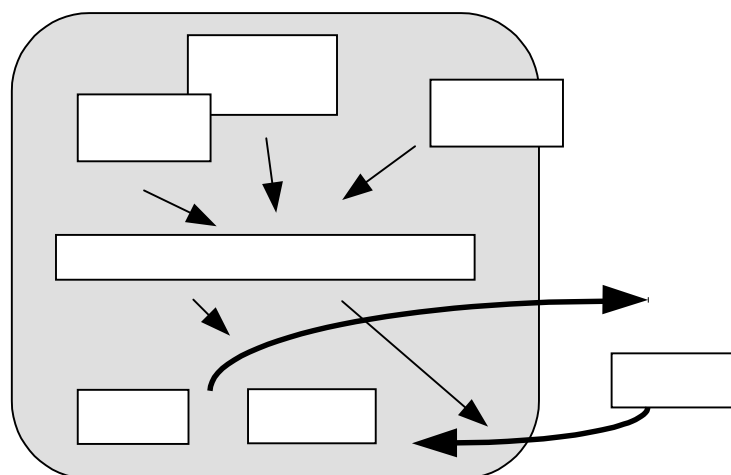


Figure 2 - The 'Fluid' Enterprise Driven by Stakeholder Needs, Values and Expectations

Of course, in attempting to represent the world with generic structures which must later be calibrated to a particular firm, the process does not have a distinctive reference mode. The model is essentially one of a system therefore, not a problem or specific situation, which leads to the attendant difficulties of knowing what should be included. However, this does force the thinking of behaviour drivers into different dimensions and into a broader range of considerations. Arthur and Winch (1998) consider the situation of delivery delays, which might be captured in a traditional business process structure in Figure 3a. The temptation here might be to consider that reducing customer order backlogs leads to a one-pass improvement in delivery delay. In contrast, Figure 3b attempts to reflect on delivery delay in terms of the service it represents to one stakeholder group - customers. Here consideration goes to the drivers of reducing delivery delay and their relationship to that stakeholder groups NVEs - for example, how the strength of a customer service programme would be related to the rate of reduction in delivery delay. This thinking is somewhat contrary to Richmond's 'operational thinking', one of his seven critical thinking skills (Richmond, 1993). One of the possible weaknesses of Fig 3b may therefore be that while the factors causing changes in key variables are shown - separated into those causing improvements or deterioration - there is no articulation on the operational relationships. On the other hand, a benefit of thinking from the Figure 3b perspective is that the direction of contribution may be the opposite to that expected and thinking is free to consider this possibility. The causal relationships should be considered in terms of the other factors remaining constant – the *ceteris paribus* assumption.

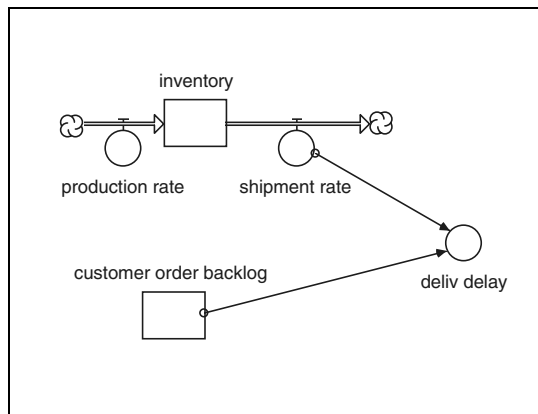


Fig 3a. Conventional Operational View

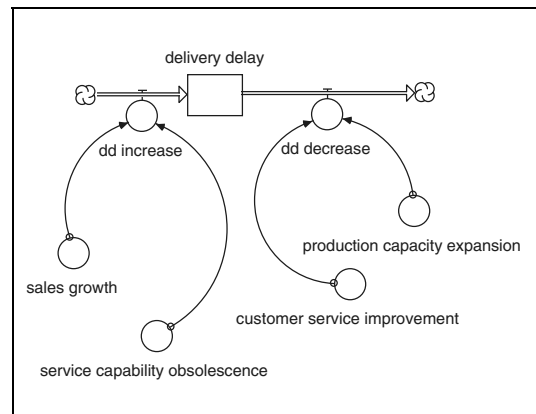


Fig 3b. Alternative NVE View

Consider, for example, the situation of growth in the total market for a product and the implications of firm's market share, where market share might be a key performance indicator or 'service' variable that the executive team deliver to the board of directors. An increase in the total market will tend to depress the market share if there were no commensurate increase in production capability and hence output. There are delays inherent in attaining greater capacity e.g. through recruitment or investment in capital equipment, and consequently, the management team may find itself having to 'run harder just to stand still'. (Indeed this was a frequent phenomenon which challenged the thinking of managers in the simulator's trials.) When mapping such relationships, a conventional process view would might show

market share as either a constant or as derived from a ratio of production rate to total market sales.

Trials with a Change Simulator based on a Generic NVE Model

A simulator has been constructed with the objective of supporting managers in firms facing major change to prepare for the new management challenges the change will bring. The prime purpose is to provide them, through the simulator, with engaging future scenarios for their firm to enable them to :

- challenge their existing mental models about key drivers and leverage points in their firm,
- re-evaluate performance metrics, and reassess the critical conditions in the firm that lead them to managing their portion successfully.

In line with general ideas on the use of scenarios as discussed below, the purpose was not to provide a prediction of what the future will be so that managers could train themselves and tune their thinking to that single future, but rather to open up their thinking to the kinds of new situations that they are likely to face. The focus therefore is on coping with new circumstances that the change may bring, not with the detail of the change *per se*. (Another strand of this research investigated case studies of firms, particularly smaller enterprises, which had faced major change in the recent past, and the methods they had used to prepare their management teams for their new challenges, see Winch and McDonald, 1999)

The simulator comprise a core generic model as discussed above, front-ended with an interrogatory interface designed in *Excel*TM (The technical bases for this approach was discussed in Winch et al., 1997). The interface allowed the senior executive(s) of the firm who had formulated strategy that lead to the change, and who therefore had for themselves a vision of the future firm, to translate that vision into a model. The interface is dynamic and typically asks around 90-120 questions relating to present and future operations. DDE was used to transfer the data to populate the generic *Powersim*TM model. A design target was that the set-up phase by the 'Change Initiators' should not take more than 90 minutes and the process would be unfacilitated. Once the model had been populated it would made available to 'Post-Change Managers' in the firm, to pre-experience future for the firm, changed in line with the change initiators' vision.

To date the interface has been pre-trialed with two firms, one a small manufacturing of sporting kites, and the second a manufacturer of auto-components, and the full simulator process has be trialed with a manufacturing of telecoms test equipment. The full test firm expects major changes in both its market place - due to global telecoms deregulation - and from a significant shift in its core business from the manufacture of hand-held test units to the design and installation of large integrated test and diagnostic systems. The simulator was calibrated by the MD of the firm working with the director responsible for strategy. The session took around 75 minutes. and they indicated general satisfaction with the process, and with the interface. They also felt that the experience itself had been valuable in forcing them think and re-appraise their vision, largely through the need to put discrete numbers to aspects of the new firm. At the end however, they felt that it would be desirable to establish two simulators, one

to reflect the continuing business of manufacturing hand-held systems - the 'box' business, and another to represent the essentially self standing new 'system' business. (Given that the simulator when using a core generic model, rather than a tailored one, is more likely to be used by smaller firms with a single core business, or firms taking a very long-term strategic view, this was not felt to be a violation of the research intent). The senior executives were then given two blank models which they populated completely independently and unobserved.

The simulator has now been trialed with the group of senior managers with key responsibilities for both sides of the business. Seven sessions have taken place with managers working singly or in pairs, typically lasting between 1½ and 2 hours. As this is still at the experimental stage, in all sessions participants were given assistance with any problems of variable definitions or general use of the tool. In three cases, though, the session was unfacilitated in the sense that there was no discussion between participants and observers on the dynamic behaviours observed and their implications, nor on the basis of the model, nor general feedback thinking issues. Three sessions were facilitated, and one was considered to have been partially facilitated. A quick debriefing was held at the end of each session, but a full company debriefing and analysis of the outcomes is not yet complete.

Early analysis of the trial transcripts and debriefings suggests that the simulator experience was judged as successful by all participants, though, not surprisingly the facilitated sessions were generally felt more useful than the unfacilitated ones. Nonetheless, the unfacilitated sessions were still felt by the managers concerned to have been very helpful in making them question their own thinking, analyse more deeply the potential impact of the coming changes, and perhaps to appreciate a little more clearly where the change initiators' strategy was coming from. Most participants would have welcomed longer with the simulator, including the ability to work with it on their own at their own convenience. All endorsed the concept of 'computer-aided visioning' as a route to helping prepare for uncertain futures, and so, at least on evidence to date, the proof-of-concept of this approach is being confirmed. Most suggested that the simulator would have been more useful still if it had included a unique tailored model of their firm to enable them to try policies and actions more precisely. However, there seemed general consensus that the calibrated generic model had given them a satisfactory impression of what their firm's future might resemble, a basis sufficient to stimulate them to begin thinking afresh about the challenges that such a future might bring. Further follow-up meetings with the firm are still taking place, and tailored in-house simulator enhancements are a possibility.

Conclusions

This paper has argued that while in most circumstances best practice modelling involves user engagement and a purpose-built model, there are situations where independent work with generic model structures may prove a beneficial path. Indeed, this approach may be one of the few ways of making dynamic modelling and model-based scenario planning available to the smaller enterprise. It has suggested the concept of 'service fulfilment' between system stakeholders as the core process that underlies all business, or indeed non-business, operations, and that therefore this offers a path to generic modelling. A 'change visioning' project using this approach

has been described which is yielded firm evidence to support the utility, in certain circumstances, of generic structures and an accelerated model calibration process. While the more usual user involvement in model construction, a tailored core model, and facilitation in thinking through the implications of observed behaviour might all have improved the experience, the process can nonetheless be degraded significantly and still be beneficial. Ultimately, what was offered in the trial was an unfacilitated, 'do-it-yourself' process with a core generic model. Yet all participants agreed that in terms of the objectives of permitting them to *pre-experience* possible futures to challenge their own thinking, this was an acceptable and valuable option. This is seen as providing proof-of-concept of CAV as a change support tool and that, potentially, this support might be available to low-budget firms also facing major change, but who would not normally be able to access this kind of support.

Of course, this whole situation poses interesting questions in terms of model validity: how can a model that is hidden from both constructors - in the sense of the change initiators who populate it with data- and the users, that has no company or industry-specific structures, and no reference behaviour or other test runs, be judged as 'valid'? However, the ultimate test of model validity may be considered in terms of the UK's 'Sale of Goods Act' definition of product quality as 'fit for purpose'. If the use of a model-based simulator was successful in its objectives of helping managers cope with change, then under this definition the process is valid, and validity of the model alone is not a separable matter. (A discussion of the question of different kinds of validity is addressed elsewhere - Arthur and Winch, 1999).

Interestingly, an early quote from Jay Forrester (1971) would also appear to point towards this view and the concept of service fulfilment at the core of models to support longer term strategic thinking: "A good computer model is distinguished from a poor one because it reflects more of the essence of the social system than it presumes to represent." This is a very pertinent comment about models intended to represent future scenarios. If a model turns out to be a good one after a fundamental change in the real system, what does this suggest about guidelines for conceptualising future systems? This does indeed seem to promote a *service fulfilment* view because this, at a very basic level, is what social systems are about.

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