Simple systems - simple models?

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Abstract

This paper examines the task of modelling the extended enterprise. It considers: the impact of power imbalances on communication and rationality; the problem of aggregation and complexity; and, the challenge of simplicity.

Keywords

Aggregation, extended enterprise, modelling, power, supply chains

1 INTRODUCTION

This paper presents a note of caution regarding the extended enterprise: three issues are explored which suggest that the hyperbole associated with the area needs to be qualified. There is a need for extended enterprises to be managed, and this management is not just a technical issue that can be addressed by sophisticated software. There is a risk of history repeating itself; firms (and academics) have followed technicist blind alleys before, particularly regarding the use of information technology in production. Just as organisations are learning the language of Enterprise Resource Planning (ERP), the industrial context of the enterprise is itself transforming: what are the consequences for management information systems, and for the academic task of interpreting what is going on?

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The 'extended enterprise' is one of many competing terms: for the purpose of this discussion, it will be taken as synonymous with the concepts of the integrated supply chain, the lean organisation, the value stream and so on. The nuances of meaning between these are acknowledged, but only a pedant would fail to see the unifying thread between these labels. What is under consideration is a system for organising economic activity in which the fundamental transformation processes are linked in substantive ways across commercial boundaries. It is important not to underestimate the significance of this transition; the task of (operations) management becomes not merely the ordering and co-ordination of resources 'within the box', over which managers have *de jure* control (see Alcalay and Buffa 1966); managers are required to act in regard to external resources, which makes operations management inseparable from the management of upstream and downstream commercial relationships. Operational decision making transcends the boundaries of the individual firm.

This paper examines the consequence of these developments for the concept of the *model*, and this is done in two ways, which relate to domains of practice and research. Firstly, an idea is taken from the writings of Stafford Beer (1966; 1984), who in turn was expanding on the work of Conant and Ashby (1970; see also Ashby 1970). The key notion is that the management system that governs an organisation should incorporate some model of the system being managed. For Beer, this initially pointed to some formal, quasi-mathematical model which could be made useful by the newly emerging computer technology, but the concept is more general, and can apply to mental models that are carried around in people's (i.e. managers') heads. For a system to be managed, it is imperative that someone has some idea about how the systems will be affected by management decisions and stimuli from the external environment. This is, by definition, some kind of model.

The consequences of this idea are considerable, although it is an open question whether this is merely a useful and insightful metaphor (with which almost no-one would disagree) or whether this is a fundamental truth about systems in general (as believed by Beer and other cyberneticians, but contested by many others). In any case, discussions about management practice are usefully illuminated by reference to the concept of the model.

The second aspect of the model to be considered here relates to the role of models in academic work. Many writers (for example Voss) have commented on the predominance of modelling-based research in the field of Operations Management; there are clearly close intellectual resonances with the sister discipline of Operations Research. It is clear, however, that there is a considerable gap between the sophisticated modelling as presented in the research literature and the modelling (formal or otherwise) that is undertaken in practice. There are

several potential reasons for this (for example, academic models are too clever for mere practitioners to understand or make use of; academic models are too crude to be realistic *et cetera*), but is undeniably the case that a key weapon in the operations management intellectual armoury is the ability to model idealised production systems.

For both these aspects, the emergence of the extended enterprise presents a number of challenges: three issues are picked for attention here. The first of these is the ability of models to account for the intrinsically political nature of supply chain relationships.

2 POWER AND RATIONALITY

The seductive appeal of the extended enterprise idea is so great that some vital questions are often neglected and downplayed in the prescriptive literature. An intellectual sleight of hand is used to assume away issues of power and agency in the development of the integrated value chain. Some parts of the literature in this field may be guilty of presenting an idealised image of organisations spontaneously and unproblematically reorganising their activities to the immediate benefit of all. There are good reasons, however to believe that this is a naive assumption; organisations' relationships with their suppliers and customers do not exist in a vacuum; although the emergence of collaboration may be the result of mutual advantage, it appears to be rare that the processes that lead towards the extended enterprise are monotonically favourable to all the participants all of the time. This particular idea is explored in more depth elsewhere (see Burnes and New 1996; Ramsay 1995); here the key point is the impact of imbalances of power and perceived power on the concept of the model for practice and research, and in particular the consequences of power differentials on communication and rationality. To develop this line of argument, it is useful to draw loosely on the work of two contemporary philosophers, Jürgen Habermas and Steve Lukes.

Habermas' prolific and sometimes opaque output covers a wide range of topics, but one linking theme in his writings is the interconnection of language, power and rationality. To crudely summarise, Habermas points to the distorting effects of power and interests on individuals' ability to communicate; this is illustrated by reference to the abstract notion of the Ideal Speech situation, which provides an illuminating contrast with our real experience. Outside of the idealised context, communication is a shared experience between parties with different degrees of power and divergent agendas. This means that communication is more than the value free transmission of data or information. Habermas writes:

“Language is also a medium of domination and social power; it serves to legitimate relations of organised force. Insofar as the

legitimations do not articulate the power relations whose institutionalisation they make possible, insofar as these relations merely manifest themselves in the legitimations, language is also ideological.” (1970; 360).

The point here is that the means of communication reflects systems of dominance and Habermas develops this theme to consider the impact on the idea of rationality itself. Rationality - being to do with explanation - is itself a social phenomenon, and so is affected by the distortion of language. It should be recognised that Habermas is not the first to develop this idea of the power-dependency of language; readers of Orwell's *1984* will be familiar with the idea of 'Newspeak', and the political manipulation of language (see also Mueller 1973).

The issue here for the extended enterprise is that one might expect the imbalance of power to affect the ability of organisations to rationally co-ordinate their activities along the supply chain. The impact of power differentials may be, for example, to prohibit the effective use of costing and forecasting systems which require openness and honesty between supply chain partners, and there is ample evidence to suggest that many putative partners do indeed struggle in this area. To further develop this idea it is useful to draw upon the framework developed by Steven Lukes (1974) regarding power. In summary, Lukes argues that power is more than just one party's ability to coerce another to undertake actions that would otherwise not be taken. He articulates two more types of power: first, the type of power that comes with being able to set the agenda; secondly, the type of power that enables one party to organise things so that another party behaves willingly in a way that is in reality in opposition to the latter's real interests (compare the Marxian concept of false consciousness). This expansion of the concept of power adds a further twist to the issue of the distortion of communication; researchers should expect situations in which power imbalances work in ways that are not always visible, and in which organisation's rhetoric on both sides may disguise the complexity (and perhaps brutality) of the relationship.

For modelling, this issue raises some serious challenges. Many of the hypothetical arguments which support the notion of the extended enterprise proceed to demonstrate the potential benefits of integration, but then avoid key questions about the distribution of pain and gain between partners. For example, in modelling work about Electronic Data Interchange, a common trick is to invoke a 'side payment' between the parties to ensure that the benefits are shared. The preceding argument points to this being a rather naive assumption on a number of levels.

3 AGGREGATION AND COMPLEXITY

A further issue for modelling the extended enterprise relates to a fundamental issue for any analytical process within operations management - the question of aggregation and complexity. All modelling efforts are forced to make choices as to the level of detail adopted, with the trade-offs being (generally) accuracy and scope versus usability; I use the label the 'Resolution Dilemma.' This tension is best demonstrated in manufacturing with regard to the choices organisations face in regard to Master Production Scheduling; decisions must be made to the degree of resolution used for the treatment of time, resources and demand. Too much detail, and organisations rapidly reach 'information overload' (see Ackoff 1967) and effective decision making becomes impossibly tortuous. Furthermore, the greater the level of detail, the greater the problems of discerning the significance of variations and establishment of robust forecasts. On the other hand, too great a level of aggregation hides significant problems, and creates plans which while plausible at the aggregate level are unworkable when decomposed. Much academic work in operations management has ignored the problems that arise in this area (see Ritzman et al. 1979; Gilegous 1987; Buxey 1990).

This fundamental dilemma lies at the heart of most problems in production planning, and is one which presents particular problems for the management of the extended enterprise. The reason for this is that the practical response to the Resolution Dilemma depends on trade-offs rooted in the question of significance of various factors for the decision makers. In practice, compromises and fudges are used in modelling (for example, a factory manager may rely on aggregated labour hours as a key measure for medium-term planning in a factory, even if many of the processes are machine-constrained); although there may be technical flaws in the models used (pragmatically) by managers, other aspects of the overall decision-making process may compensate.

In transformation processes which span commercial boundaries, the Resolution Dilemma may become more acute simply due to the scale of the operations under consideration; the more hierarchical stages in the planning process, the greater the difficulty in co-ordinating the plans at the different levels. Furthermore, the problem may be exacerbated by the fact that the task of finding pragmatic trade-offs for planning models becomes more problematic when the interested parties belong to more than one organisation. For example, rough cut models in automotive manufacture may use 'cars' as the unit of analysis at early stages of production planning; this may be inadequate if the model is also to be of use to downstream decision-making.

Advocates of the extended enterprise have largely assumed that the emergence of vertical quasi-integration leads to planning benefits; the co-ordination of production between partners in the chain will automatically be easier and more effective. It is easy to assume that the logical consequence of this is the emergence of large-scale computer-based planning systems. The question of aggregation in modelling, however, points to the difficulties that this entails; the compromises that suit one stage of the process may be inappropriate for another.

4 THE CHALLENGE OF SIMPLICITY

The final issue to be explored here connects with both power and complexity; the strong arguments for simplicity in models and processes within the extended enterprise. Many authors - notably Schonberger (1983; 1986) - have argued that the genius of Japanese Manufacturing has been to substitute the unnecessary complexity of Western manufacturing with simplicity; for example, sophisticated regimes of production control can be replaced with visual control systems (flags, kanbans et cetera) on the factory floor. Walbank (1992) provides an elegant commentary on this contrast, and the idea is reinforced in the normative 'Lean' literature (Womack and Jones 1996; Jones and Towill 1998).

For modelling, the idea of simplicity is also appealing, both in terms of the concept of Occam's Razor (a simple model is *ceteris paribus* preferable to a complex one), and for the reasons that simple models are easier to understand (and so validate) and use (thus encouraging the confidence and participation of 'users'). The arguments for 'constructive' simplicity in modelling are summarised by Ward (1989), although Powers et al. (1983) point out that user's demands for simple models may often really mean they want easy-to-use complex models.

For the extended enterprise, the question of simplicity is crucial. Recent years have seen the arrival on the market place of a wide range of planning tools which combine impressive computational sophistication with the language of the integrated supply chain. The appeal of such tools is considerable, although it may be argued that the direction of this development is contrary to the lessons learnt from manufacturing over the last twenty years. The chequered history of Manufacturing Resource Planning (MRP II) and Computer Integrated Manufacturing (CIM) suggests that the potential benefits of information system-based approaches may be unrealised if systems are difficult to understand, work against participation, and require too ambitious systems of discipline. It seems very likely that systems which work across commercial boundaries, requiring the co-operation of legally distinct agents, will be even more vulnerable to these types of problems.

5 CONCLUSIONS

The preceding discussion has opened up a number of avenues for examination of the management of the extended enterprise. The word 'management' is key here, as it brings to the surface a series of concerns that can all too easily be missed in the enthusiastic promotion of the idea. The enterprise needs management, and for an enterprise which spans commercial boundaries, the type of management that is possible is constrained by the political structure of co-operation; assumptions about rational design and behaviour, which may even have been heroic within a single organisation, become entirely untenable in multiparty arrangements. This issue has particular significance given the fundamental problems of modelling transformation systems, and in coping with the Resolution Dilemma in particular.

For research in this field, several recommendations seem to follow from these observations. Firstly, models of integrated supply chain systems need to take into account the constraints on communication and rationality that arise within the extended enterprise. Complex mathematical models which are predicated on the rational and 'fair' division of spoils are likely to be hopelessly unrealistic. One way of tackling this is the explicit incorporation of game theoretic models within the operations management, although even these suffer from problems of validity in many contexts. Secondly, researchers need to be cognizant of the political aspects of inter-organisational relationships, and so be prepared to interpret the data reported by firms in that light. In this sense, current research models of the extended enterprise may suffer from too much sophisticated logistics, but too simplistic a view of politics.

For practice, managers are faced with a new context for an old problem: the management system needs to be constructed around an appropriate model. A choice must be made between increasing the complexity of the model, or the active simplification of the system to be modelled.

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7 BIOGRAPHY

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