Modelling the alignment of information systems and business strategy: an example from sustainable procurement

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Abstract

The implementation of information systems (IS) typically also requires business changes. A crucial success criterion for such projects is the degree to which technology and organisational changes contribute to business objectives, including sustainability. As a consequence, attempts have been made to model the alignment of organisational IT/IS with business objectives. This study examines such a case relating to the implementation of a sustainable procurement policy at a UK higher education (HE) institution.

The study explored the use of a form of VMOST (vision, mission, objectives, strategy, and tactics) modelling which supplied the business strategy (B-S) element in a broader B-SCP framework, which added considerations of context and process. This was used to analyse the assumptions underlying the implementation of the sustainable procurement policy.

Among the lessons learned was the need for a careful distinction between evaluating the characteristics of new/modified systems to be installed and evaluating the programmes of action needed to implement them. The VMOST/B-SCP framework was designed for IS developments, it was found to be also applicable where the nature of the change focused on new policies and clerical processes and the IT elements were minor.

Keywords: Strategic alignment, goal modelling, sustainability, VMOST/B-SCP

1.0 Introduction

There is an increasing emphasis on the need for IT/IS developments to be closely aligned to an organisation's business goals [1-4]. It is not uncommon for some of these business goals to relate to 'compliance' [5]. While compliance requirements are usually mandatory, some commitments may be voluntarily accepted out of an innate feeling of responsibility or to gain public approval. This study examines such a case relating to the implementation of a sustainable procurement policy at a UK higher education institution.

The UK government has recognised the threats of global climate change since at least the start of the current century [6] with successive governments publishing policy statements and instituting actions to address these issues. While action to tackle climate change has many forms, this paper examines action to support sustainable procurement within one part of a higher education institution in the UK. This example is used to illustrate and evaluate a goal modelling approach using the VMOST framework (Vision, Mission, Objectives, Strategy and Tactics) and the B-SCP alignment modelling technique (Business Strategy, Context and Processes).

One aspect of UK government policy is the use of financial incentives to encourage universities to pursue carbon reduction. In 2010, the Higher Education Council for England (HEFCE), which distributes government money to universities, obliged universities to have plans to reduce their carbon emissions [7]. The broader UK government policy, applicable to the public sector as a whole, included the pursuit of sustainable procurement [8].

The accepted definition of 'sustainable development' in relation to global environmental concerns is the Brundtland definition adopted by the UN '*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs'*[9] The context of this definition is environmental and economic, but the word 'sustainable' by itself simply means '*able to be sustained or continued*' [10] and, as we will see, can be applied to other fields.

The university with which the writers are most familiar responded to the call for carbon reduction with a carbon reduction plan. This included a sustainable procurement policy. This expressed the intention of fostering a buying community *'...sharing best practice across the organisation via ad-hoc forums and improved of procurement matters via a greater utilisation of the university's intranet*' [11]. The writers already had a research interest in the effective use information systems to support environmental sustainability. Exploratory interviews took place with key staff responsible for university sustainability policy implementation, and with staff involved in procurement generally. This was followed up by interviews with similar staff at other HE institutions to gauge the extent to which practices were common among comparable organisations. It was found [12] that staff making procurement decisions tended to delegate assessments of 'greenness' to others thought to be more knowledgeable. 'Green' purchasing decisions required access to significantly greater amounts of information, for example, about the sources of

products and their components, the practices of manufacturers and suppliers and the resource efficiency and durability of the products themselves. It would be daunting to hold that information in an internal database. The information resources needed required access to a range of knowledgeable and trustworthy sources via an external information infrastructure [13].

This work had established current practices, but their relevance was undermined by the emergence at the home institution of a new sustainable procurement policy, to be implemented over the period 2011 to 2015, that would lead to changed practices. After some deliberation it was decided to attempt an assessment of the likely effectiveness of the plan by applying goal-modelling techniques.

2.0 Business/IT alignment models

Most business decisions are based on thinking about causality – that by doing X the result will be Y. Even where entrepreneurs take decisions intuitively (‘*Screw it! Let’s do it!*’), stakeholders would expect potential benefits of a proposed action to be identified before committing resource, i.e. that the costs of implementation and operation will be exceeded by the value of the benefits of the business change. [14]

A continuing complaint is that the increasing cost of IT/IS to organisations have not been matched by discernible benefits such as improved organisational productivity [15,16]. Thus there is a requirement for ensuring that business needs are effectively supported by information and communication technologies deployed by an organisation.

One suggestion has been the creation of Business Motivation Models (BMM) – a concept developed by the Business Rules Group (BRG) within the over-arching Object Management Group (OMG) [17].

This standard assumes that a ‘business plan’ outlining the characteristics of a desired system is produced before the physical system design, technical development or even detailed business modelling. This plan includes documentation of the motivation behind the business requirements.

The BMM supports the assessment of the causal relationship between Ends (what the organisation wants to achieve) and the Means (the way in which it is to be achieved). (Note that we capitalise words, such as ‘Means’ which have a specific local meaning in the standard). Several possible Means could be capable of achieving the Ends, e.g. the frequent decision whether to buy or build required software. Ends can be seen as the concern of the business side of the organisation that satisfies customers and generates revenues, and Means as the concern of the IT/IS functions providing an enabling platform of technology – but this can be simplistic.

3 The VMOST framework

The BRG BMM tackles the question of the degree of alignment between the aspirations of a business and the actuality of implementation by fitting the

development into a VMOST framework identifying Vision, Mission, Objectives, Strategies and Tactics.

Each of the elements of the VMOST framework will now be considered in turn.

3.1 The Vision and the Mission

The Vision refers to the future desired state for the element of the organisation being analysed. In the sustainable procurement programme examined here, the HE Institution stated its Vision for sustainable procurement as

> *'…that the university meets its requirements for works, supplies, services and utilities in a way that achieves value for money on a whole life basis in terms of generating benefits to society, whilst minimising damage to the environment and providing for long term financial stability'.*

There could be several ways to achieve the Vision and a premature closing down of options needs to be avoided. The selected Means by which the Vision is achieved is encapsulated in the Mission. In practice this can ambiguous. Mission often seems in practice to identify the activities currently carried out, rather than the new ones needed to create the new desired state. No doubt in some cases the Vision could be achieved by continuing to do what is currently done, but this contradicts the idea of ongoing business change actions undertaken to improve performance.

We assume here that the Mission is effectively what is referred to in the Axelos 'Managing Successful Programmes' [18] as a Blueprint, that is, an outline of the changes needed to an organisation in order to bring about the Vision.

3.2 Goals

These are descriptions of the 'desired states' that together indicate the achievement of the Vision. For example, an organisation might have the Vision of improved customer satisfaction. This could relate to several aspects of the customer experience. The reliability of products could be increased. Helpdesk support could be extended. The 'user-friendliness' of the organisation's website could be increased. All these would be Goals.

3.3 Objectives

Formal distinctions between Goals and Objectives have been made, for example that Objectives have specified target dates and Goals do not. However, in practice, Objectives are just a convenient way of decomposing Goals into manageable units. For example, 'user-friendliness' could be decomposed into two Objectives to speed up the physical response time and to also provide more help buttons. What is important is that Objectives must be related to physical entities and/or measurable behaviours.

3.4 Strategies

These relate to *how* the desirable changes in the business will be implemented. As noted above, there could be several different ways by which the desired Ends of the business could be delivered. In 3.2 an objective was to improve product

reliability. A number of quality improvement techniques exist such as the ISO 9000 series of guidelines, and Six Sigma, and adopting one of these frameworks would be one Strategy to achieve the Goal.

3.5 Tactics

These are a way of subdividing an overall technical solution or Strategy. They define courses of action within a broader Strategy that address specific Objectives. Thus the Tactics of upgrading networking configuration and adding more servers directly address the objective of improving (i.e. reducing) response times for online purchasers. The Tactic-Objective relationship is crucial to ensuring that the technology implementation supports business needs.

The BRG BMM framework states that Tactics could include: '*some device, capability, regime, technique, restriction, agency, instrument or method that may be called upon, activated, or enforced to achieve Ends'* [17 page 13]. Interestingly, it specifically excludes the business processes and workflows needed to exploit Means, and also the responsibility for such tasks. The reason for this appears to be a procedural one: business processes and workflow are the subject of a different BRG model. Business processes can actually be referred to in the BMM, but must cross-refer to another model implemented in Business Process Modeling Notation (BPMN) [19]

The BRG BMM also refers to another entity type called a 'Directive'. This is an official document, or equivalent that enforces a particular Means. Documents such as requirements, specifications and user procedures would be examples of these.

3.6 The Context

The VMOST framework described above would not itself be enough to establish the feasibility of a proposal to change the business. Bleistein *et al* [20,21], following the suggestions of Haglind and Cheung [22] and Walsham [23] have proposed an evaluation framework that examines business/IT alignment on three dimensions: business strategy, context and process (B-SCP). The scrutiny of the business strategy is based on the VMOST framework we have explored above, but is documented using the *i** notation [24].

'Context' relates to the environment in which the proposed business strategy wil operate. This contains organisations with which the business has dealings, including partners with whom it collaborates. The environment also includes other types of constraining or enabling factors such as those categorised as Political, Economic, Social, Technological, Legal, Ethical in PESTLE analysis [25].

The BRG BMM invokes two entity types, Influencers and Assessments, which analyse the impact (for good or ill) of an Influencer on Means and Ends. B-SCP instead cross-relates elements of the business strategy to 'domains of interest' in a Jackson Context Diagram [28]. These capture the key actors, both human and non-human who affect and are affected by the activities within the sphere of operation of a business. They include suppliers and customers, and also non-human actors such as information systems. The use of the Jackson notation was approached with caution. Jackson Problem Frames from which the context diagrams are drawn are

designed for the analysis and structuring of software development. The problem area being addressed in this work had IS elements but, as noted in the Introduction, these were embedded in a dispersed information infrastructure.

Bleistein and colleagues advocated RoleActivity Diagrams (RAD) from Ould's Riva method [27] as a way of documenting processes. As this strategy document referred to a future system the processes in which had not yet been designed, these were not yet relevant.

4. Application of B-SCP to a Sustainable Procurement Application

The next stage was a practical application of using B-SCP to analyse a real strategy document laying out a sustainable procurement policy for a university to implement over the period 2011-15.

The policy referred to and expanded a small subset of the overall university 'Aims and Values' contained in a corporate plan for the years 2007-2012. This defined sustainability as a value in the words: '*responding to the imperative and obligations of sustainable development, financially, environmentally and educationally*'.

This document analysis was supplemented by interviews with procurement staff who, not unreasonably, tended to refer queries back to the document.

Difficulties that might arise could be caused either by gaps or defects in the strategy document or in the analysis tool. It could also be that the document and the analysis were fine in themselves, but not suitable together.

4.1 Sustainable procurement: strategic theme

No 'goals' or 'strategies' were identified explicitly in the policy document, but four strategic themes were described.

4.1.1 Governance

It was stated that this '*ensures that the relevant checks and balances are in place to enable the achievement of university objectives*'. The emphasis was on control and on making staff and other stakeholders aware of required procedures.

4.1.2 Policy

This was '*a clear framework for procurement, giving direction to staff and clarifying the university's position to suppliers'*. The focus here was on guidance about how purchasing decisions were made and how relationships with third parties were managed.

4.1.3 Process

Here the concern was the consistency and efficiency with which procurement was executed. The deliverables would include standard procedures and documentation.

4.1.4 Delivery

This in effect referred to the capability of staff and external partners to carry out rational and efficient procurement activities.

4.2 Some issues about the 'strategic themes'

What is noticeable here is that environmental sustainability is not explicitly mentioned. Instead it is another university aim that seems more relevant: '*to achieve standards of excellence in the way that the university conducts its business, manages its many relationships and delivers its services'*. It can be argued that this is a reasonable course of action: a procurement process that addresses environmental issues (some of which may not be immediately apparent to individuals in their daily work) will not be successful without a way in which standards and policies can be enforced. A tight procurement process is needed to enforce sustainability.

A closer examination of the policy document found 'sustainability' as a subject for staff training in two places. Whole life costing was also mentioned which is often associated with sustainability but there was no explicit link was made.

Another issue is whether the strategic themes listed above should be categorized as a Mission (Means) explaining how the Vision will be implemented, or Goals (Ends) which refine the Vision, or Strategies (Means). We decided to assume that they were Goals as words like 'policy' and 'process' in this setting seemed to describe the end products and deliverables of the analysis and design processes.

4.3 Extracting Objectives, Strategies and Tactics

The way that objectives, strategies and tactics were extracted from the policy document is outlined in this section. The sustainable procurement policy document contained a table identifying the activities needed for its implementation. Table 1 shows the content an example row from of the table.

The wording in the Action column indicates that the row is the equivalent of a Tactic, i.e. a concrete action that fulfils an Objective. In the first exampe the Tactic is '*Centralise use of procurement cards*'. Procurement cards are bank cards used to make payments for items without raising purchase orders. The Reasoning column has content suggesting an Objectives, a desired end-point, in this case'*to ensure compliance with policy'*. There is no evidence of any deliberate misuse of the cards, but the absence of a purchase order obstructs scrutiny of a proposed purchase. For example, one could not ensure that the most energy efficient IT equipment is purchased. The content of the Detail column in the first row brings in the role of the central Procurement Services department as part of a wider policy to improve scrutiny of the nature of purchases. This can be seen as a Strategy.

This demonstrates that the conversion of the content of the table in the Sustainable Procurement Policy into one that supports the VMOST framework is feasible.

Action	Theme	Detail	Reasoning
Centralise the use of procurement cards	1,2,3,4	To centralise the placing of orders via cards in Procurement Services	To ensure compliance with policy

Table 1 Fragment from a policy action plan

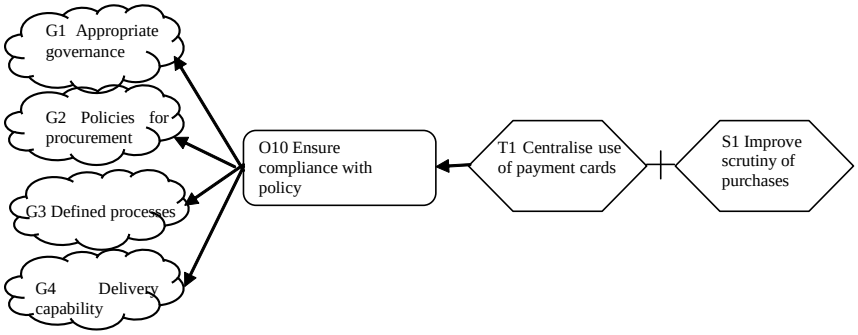

Figure 1 Graphical representation of goal modelling relationships

Figure 1 above shows how the results of a goal modelling analysis can be displayed graphically. Details of the notation can be found in Bleistein *at al* [21]. Clearly this is a small fragment, and a full model would be much more complicated. Cox [28] notes the use of the graphical representation is a powerful tool when presenting results of goal modelling analysis to clients, but are time-consuming to construct. Tables are the most convenient way of doing the initial analysis.

While relatively simple goal models may be the most effective way of communicating with lay stakeholders, larger more complex models may result in information overload. The classic solution to this is a 'divide and rule' approach where a complex problem is decomposed into a number of smaller less complex sub-problems. Jackson [26] identifies alternative ways of doing this:

a) Abstraction/decomposition. This is classic approach that divides a process into component sub-activities, each of which is expanded into more detail sub-sub-activities and so on. Thus process '*purchase goods*' might be decomposed into the sub-processes '*select goods*', '*ascertain price*', '*make payment*'. Good practice is to make each sub-component as self-contained as possible ('loose coupling').
b) Projection. This is similar to projection in relational data manipulation. Occurrences of a particular type of entity with some attribute in common are selected and isolated. The same occurrence can occur in different selections, for example, where someone has dual nationality.

The best approach depends on the particular situation. Bleistein *et al*.[21] have used an abstraction/decomposition approach which appears to reflect a hierarchy of IT/IS hardware devices. The scenario used to illustrate their method was based on the Seven-Eleven Japan system for replenishing stock in their franchised outlets. Three levels of detail related to the corporate centralised corporate servers, distributed clients in stores and the Point of Sales devices attached to the client devices.. Each level looked at the processes that used one of the three technologies. In addition there was a top level identifying the key stakeholders according to an e-business framework from Weill and Vitale [29]. In the case of our sustainable procurement scenario, a simpler approach to analysis used projection to group processes associated with each of the four 'strategic themes'.

4.4 Context

It was noted above that contextual information had been represented in the Bleistein model in the form of a Jackson Problem Frames Context Diagrams. It will be recalled from 3.6 above that the Jackson approach is designed for the development of software solutions. Each context diagram shows a 'machine', (containing software) linked to other 'domains', including humans who interact with it.

In the case of the sustainable procurement, it was difficult to identify a central 'machine' that would provide the information needed to make informed buying decisions. The information needed would need to come from a range of different sources. The paradigm was that of an information infrastructure rather an information system.

The concept of the context diagram valid even if the role of the central machine disappeared. There was still a need to identify the actors affected by each Tactic. For example, the withdrawal of payment cards would affect departmental purchasers. The finance department would have to enforce the change, and the central purchasing department could have additional work processing payment requests. External suppliers would be affected by the change of payment method.

5. Some conclusions

Many of the differences between the two scenarios, the Seven-Eleven Japan inventory control and the University Sustainable Procurement, and the way this led to differences in the business alignment approach adopted have been covered. Three major differences stand out.

a) The Sustainable Procurement analysis examined a document describing a proposed future plan of work. The Seven-Eleven scenario analysis was carried out retrospectively on an implemented system.
b) The document analysed in Sustainable Procurement scenario focussed on the actions needed to create a new system which involving major modifications to existing business processes. The Seven-Eleven analysis, on the other hand, was an assessment of the *functionality* of an installed

new system. The word ‘requirements’ in the title of the paper is quite clear.

c) The Seven-Eleven scenario had at its core a new IT-based information system. The Sustainable Procurement scenario did involve some IT elements, but these involved the use of a range of disparate on-line resources rather than the classic centralised information system.

What is remarkable was how transferable most of techniques involved were despite the differences. We found two areas of difficulty which seem generic to these kinds of analysis.

- Interpretation of terminology. With the modelling approaches used here, the specialist meaning applied particular words (such as the distinction between ‘goal’ and ‘objective’) could be initially confusing.
- Complexity of models. To someone not familiar with the application, the Seven-Eleven Japan model was not initially clear. While the analyst has a responsibility not to abstract away important issues of detail, the possible barriers to understanding of complex models need to be recognised. There is much work to be done reconciling these two needs.

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