LINKING BUSINESS PROCESSES AND INFORMATION SYSTEMS PROVISION IN A DYNAMIC ENVIRONMENT

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ABSTRACT

This paper discusses decision and communication processes which link strategic activity in a business with information systems development activity. We develop a model which illustrates these processes as observed in one company (AXA Sun Life, Bristol HQ), but we suggest there may be generalizable features. We use Role Activity Diagrams as our diagramming method.

In most organizations it is impractical to achieve a fully articulated business model and IS architecture. Organizations do try to make development (or acquisition) of information systems which will serve business needs as orderly as they can, in circumstances which are inherently complex and unstable. We suggest that the degree of regularity which is achieved in IS development within the business context comes not so much from following one overarching plan, as from a continuous process of adjustment, in which local short-term plans are weighed against current understanding of the business's key interests. What is needed to aid this process is a general framework of communication and decision making within which plans can be reviewed and modified in the light of changing circumstances. This paper presents an attempt to reveal and represent such a framework.

Keywords: process modelling, information systems architecture, role activity diagrams, business process, information system development

1. INTRODUCTION

This paper discusses decision and communication processes which link strategic activity in a business with information systems development activity. We develop a model which illustrates these processes as observed in one company (AXA Sun Life, Bristol HQ), but we suggest there may be generalizable features. We use RADs (Role Activity Diagrams) as our diagramming method (Ould, 1995). The model produced is a *passive* one in the sense of Warboys et al. (1999). By this we mean that it is static rather than dynamic (representing the position at the point of observation, but without any particular updating mechanism); and descriptive rather than prescriptive, describing what in fact happens rather than what should or must happen. Our model is not supported by or realized in a software tool, though it possibly could be.

The question which initially exercised us was whether or how the IT provision in business organizations could realistically be linked to or even driven by overall business strategy. The alignment of information systems (IS) and business strategy is a major topic of research and consultancy. Robson (1997), for instance, describes many techniques and frameworks which have been suggested for developing an IS strategy which is aligned with, or subsumed in, a business strategy, or which try to adapt business strategy to take advantage of IS impacts and potential. These goals, though much sought after, remain elusive.

From a software engineering perspective, McDermid (1994) observes that much systems development and software engineering is done at too low a level (in what he calls 'orthodox' approaches): attention is focused at the application level, where the emphasis is on achieving desired functionality. McDermid calls for a shift to a more 'fundamentalist' position, where attention is instead focused at the organizational level and where non-functional requirements (such as integrity, robustness, security, or flexibility) can be considered. In this way, the software engineering effort can address the whole set of business requirements. Existing development methodologies are pitched too low for that.

What is needed, McDermid suggests, is a way of drawing an organizational map which will represent the organization's objectives and the 'causal' connections between units within the organization. The map can then be used to drive the development of an overarching information systems architecture, from which a long term development plan can subsequently be derived. Application development then ceases to be opportunistic and instead becomes an orderly matter of building the IS provision in accordance with the architecture.

We agree on the need to link IS development with the overall business process, and observe that this involves considering how to develop and maintain many applications at the same time (including legacy systems, packaged systems, and systems inherited through company mergers). We note, however, that corporate strategic processes are likely to be quite far removed, in organizational terms, from processes of IS development and operation. The two sets of processes, in general, play out within different organizational subcultures, and against different constraints, timescales, and priorities. An 'architectural' solution may presuppose a degree of organizational coherence and homogeneity which is not found on the ground.

In the general case, organizations will be maintaining (and at the same time developing) a range of information systems produced over a long time span, by a variety of different development teams, on different platforms, using different development methodologies and languages, and perhaps under a variety of project management regimes. The likelihood will be remote that, at any particular time, the overall information systems provision in an organization is in any true sense coherently planned or documented. Furthermore, the business of many organizations may often be too fluid or volatile for it to be possible to draw up a model or blueprint of the kind envisaged by McDermid in any final or coherent way. Changing business and market conditions, dynamic evolution in the organization itself, intensity of competition, complexity and pace of change in IT in general and in the local infrastructure, and rapid staff turnover, are among the factors that militate against formulation of an effective and comprehensive business plan linked to an IT architecture.

In such turbulent conditions, where adaptability and rapidity of response are often paramount, the constant pressure to find quick solutions to current problems does not square well with the idea of comprehensive and considered development planning. The need for a rapid and flexible response in IT will lead organizations towards use of contractors and packages, and towards modification of the existing platform, rather than in the direction of thorough re-analysis of business requirements (since these are unstable) or comprehensive system design (since this takes too long).

In these circumstances, the expectation implicit in software engineering that IS development will be driven by a regular methodology in conformity with strategic objectives is unlikely to be fulfilled. Still, it seems clear that organizations do try to make development (or acquisition) of information systems which will serve business needs *as orderly as they can*, in circumstances which are inherently complex and unstable. Businesses will make attempts to lay down, where possible, regular

procedures for making their common processes efficient and open to audit. There will be regularities in practice in the development of information systems in the business context; a business will generally value such regularities and want to extend and capitalize on them. However, in most cases, the complexity and volatility of the business environment, and of the internal IS development context, coupled with the usually complex legacy of IT systems *in situ*, make a stable or fully articulated business model and IS architecture impossible to achieve.

If IS development practice is *too* orderly, or procedures in the IT Department are *too* rationalized and formal, the likelihood arises that development will be protracted, will lead to the production of systems which do not meet needs prevailing at the time of implementation, and in the worst cases will produce systems which freeze business processes and inhibit business development. On the other hand, IS development is by its nature a complex and logical process which must be formalized to some extent to permit necessary coordination of work and validation of outcomes. Somewhere between these competing imperatives of flexibility and order, each organization must, in the light of its circumstances, find the right balance.

We suggest that the degree of regularity which is achieved in IS development within the business context will not generally come from following an overarching plan or model. It must rather come from a continuous process of adjustment and readjustment of plans and goals, in which local and relatively short-term plans are formulated and weighed against current understanding of the business's key interests. These interests will themselves be shifting in response to events outside and inside the organization. What is needed to aid this process is a general framework of communication and decision making within which plans can be reviewed and modified in the light of changing circumstances. The necessary connection between business processes and IS development will then be achieved in a pragmatic and evolutionary manner. As projects progress, individually and in parallel, they are maintained, we suggest, by a rich flow and interchange of decisions, plans, reports, and ideas. This flow keeps the business managers and the IS developers connected to one another, and maintains a level of mutual understanding and purpose between them, even in a constantly changing situation. This is a view of IS development in the business context which puts more emphasis on the ongoing tactics of development than on the formulation of a strategy to which adherence is simply assumed or demanded.

2. AN OUTLINE MODEL OF BUSINESS/IT COMMUNICATION

The general analysis given above, influenced and reinforced by our understanding of the situation in one organization, as described below, lead us to propose an outline conceptual model of the communication and decision processes which link business strategy and IT operation. The model encompasses a number of organizational levels and makes a distinction between 'business units' and 'IT units'. These are provisional and informal distinctions to which we may be able to give more precise definition if they prove usefully generalizable as the research progresses.

Our model is one in which requests for IS development are formulated, traded, revised, prioritized and re-prioritized, and in which development itself is monitored, adjusted, brought to completion, and assessed. These various transactions span the organizational hierarchy and connect business and IT units in productive communication and collaboration. As we apply this conceptual model to

activities in a real organization, we will develop a process model of the transactions to try to capture and represent significant emergent patterns among them in a readily communicable form.

We want to trace the series of decisions and communications by which business requirements at the highest level are progressively transformed into specific pieces of work in the IT units, and also the flows in the reverse direction by which progress of work in the IT units is reported back through the successive levels. We recognize that several levels of activity exist both within the business side and the IT side, so that our model does not simply depict the business as 'strategic' and IT as 'operational', but rather acknowledges a complex pattern of interaction between strategic and operational business activity on one side and strategic and operational IT activity on the other. In its initial development, our model does not penetrate very far into the operational or the strategic levels, but rather concentrates on the passage of information and the coordination of activity between the various levels.

3. BACKGROUND TO THE CASE STUDY

In the remainder of this paper we begin an exploration of the communication and decision links which connect general business activity with IT activity. We do this by examination of the situation in one company (AXA Sun Life, Bristol HQ) rather than by a theoretical analysis. Through discussion of the single case, we will attempt to draw out some more general points, and indicate what further study could be done to broaden and deepen the research. One of the authors (Sully) works for AXA Sun Life and has been the principal contact there for the other three authors.

In Yin's terms, we have been engaged in an exploratory case study. Yin defines a case study as 'an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident.' (Yin 1994: 13) So, we were interested in how connections were in fact made, in this case, between decisions about corporate strategic direction and decisions about IS development. Our inquiry was exploratory, rather than descriptive (Yin 1993: 5), because it did not set out to be complete, but rather to clarify questions for subsequent study. Without claiming this to be an 'in-depth' case study, we agree with the general position stated by Walsham (1993: 15), that 'from an interpretive position, the validity of an extrapolation from an individual case or cases depends not on the representativeness of such cases in a statistical sense, but on the plausibility and cogency of the logical reasoning used in describing the results from the cases, and in drawing conclusions from them.'

AXA Sun Life (henceforth referred to as ASL) has recently been formed from the merger of Sun Life and Equity & Law, with the majority shareholding held by the AXA Group. The merged company has harmonized each functional part of the organization and adopted the best of breed approach to processes and systems. The governance of the IS function is achieved by representation of senior business managers, and the allocation of the IS budget is undertaken by the Chief Executive and the Corporate Planning Director in conjunction with IS.

IS activity has been centralized under the control of the IS Director. This includes the Strategy, Systems Development and Systems Support functions as well as Computer Services. The application systems developed incorporate the core Life & Pensions systems, Sales Support systems and Support area systems (e.g., payroll, general ledger). The budget/prioritization processes are business led to

ensure that IS is accountable and that the business chooses the developments that are to be undertaken.

On an annual basis, ASL produces a Corporate Strategic Plan covering the next five years, with more detail on the earlier years. Each main division of the Company creates its section of the plan, showing how it will contribute to overall business goals.

IS is one of these divisions, and can be used as an appropriate example. IS has a section which outlines IS's strategy for supporting the business by IT. This incorporates a technical strategy and a personnel strategy. For the year ahead, there is an operating plan produced which demonstrates how the strategic plan will be fulfilled. Having decided which specific areas will be addressed in the coming year, the IS Strategy Department produces a detailed strategy and oversees its implementation in development projects. So, for example, reuse of software in subsequent development is a key strategy plank at present. In signing off new developments, IS Strategy Department check that reusable code is being deployed as much as possible. Overall, the Strategy Department gets involved with the development programmes to ensure that the method of delivery of requirements is consistent with the agreed strategy.

4. MODELLING THE LINKS BETWEEN BUSINESS AND IT AT ASL

We had intended from the beginning to try to find a way of expressing our model in graphical form, believing that such a form would concentrate and sharpen our understanding, and at the same time aid communication and further development. We have chosen to use Ould's RAD language (Ould, 1995) to build a model of the main activities and relationships in the business/IT communication and decision processes, as we understand them. We have used a general-purpose drawing tool (Visio) to produce the diagrams included here, rather than a specialized editor. Part of our purpose in this research is to see how effective the modelling languages and tools we use are, both in modelling the processes, and in facilitating communication about the processes between us and organizational members, and among organizational members themselves.

Role Activity Diagrams (RADs) are a notation for modelling business processes. The basic concepts of RAD were first introduced by Holt et al. (1983), and later enriched by Ould (1995). The models presented in this paper are defined using a variant of RAD, called STRIM ('A Systematic Technique for Role and Interaction Modelling'). Using STRIM, a process is modelled as a number of *roles* which interact with one another. A role can be thought of as a related set of activities which carry out a particular responsibility or set of responsibilities. The activities within each role take place in a certain order. The RAD notation used in this paper is explained in the Appendix.

Our understanding of the processes linking business and IT at ASL was originally formed in discussion and from documents. We identified a number of key agencies and activities, as well as a number of communication channels linking the business and IT units, which we describe and model in the next section. Data for the models was elicited principally from one of the authors (Sully), a senior manager in Information Systems at ASL, by the other three authors, in a series of one- to two-hour interviews. After each interview, the information that had been collected was re-expressed in one or more RADs. Each set of RADs was analyzed for inconsistencies, areas of apparent incompleteness, areas of imprecision, and ambiguities. Questions intended to resolve any such

anomalies found were addressed at the next interview, where the model as currently evolved was reviewed and validated.

Our present model of the processes linking business strategy and IT operation at ASL, is shown in Figures 1-4 below. Figure 1 is a representation of the process at ASL for selecting and completing an IT project. It shows the basic roles (Senior Executive Board, Development Committee, Programme Manager, Business Sponsor, Project Manager, and IS Unit), and their interrelations, as we understood them from our first round of discussions. Figures 2-4, discussed later, show different perspectives on the situation at ASL. These figures are not to be seen as decompositions or refinements of Figure 1 in the usual sense of those terms. Ould (1995: 102) talks about using RAD models in terms of looking through different windows to get new views on a process. Figures 2 and 3 offer new views of the process depicted in Figure 1, while Figure 4 depicts a separate process. These additional figures seemed useful to us as supplements to Figure 1, and arose out of discussions stimulated by reflection on the original figure.

5. INITIAL PROCESS MODEL OF THE PROJECT LIFE CYCLE AT ASL

Figure 1 shows that the process of deciding what new IT-based products to build runs on a yearly cycle at ASL. The process is initiated by the members of the Projects Subcommittee of the Senior Executive Board (SEB): Chief Executive, IT Director, Corporate Planning Director, and Finance Director. They decide how much money will be available in the forthcoming year for developing new IT products. The allocated sum is communicated to the Development Committee, whose membership includes the Business Programme Managers and the IT Director, who manages the IS Unit.

In the course of the preceding year, each Programme Manager will have been collecting ideas for new IT-based products. Such ideas come from a variety of sources. For example, Programme Managers and their staff constantly monitor the external environment. Here, changes in legislation or a new product offering from a rival company might both trigger the idea for a new IT-based product. Again, a Business Sponsor (BS) will often push for a new product. And in addition, the Compliance Department, the Finance Department, and a company employee whose specific role it is to monitor legislative change, also monitor the environment external to the company. As a result of this monitoring, any of these agencies may also suggest new ideas for IT-based products.

At this stage, each idea is expressed in writing on one page of A4. This text includes the following items: a description of the proposed IT-based product, an outline of its benefits to the business, and an estimate of its development costs.

The Development Committee review all such IT-based product ideas and in particular their predicted costs. Eventually they decide how much of the allocated sum will be apportioned to each Programme for the forthcoming year. These decisions are communicated to the SEB, which usually approves them unchanged, but sometimes may make small changes. At this stage, each Programme Manager knows how much they have to spend on the development of new IT-based products in the forthcoming year.

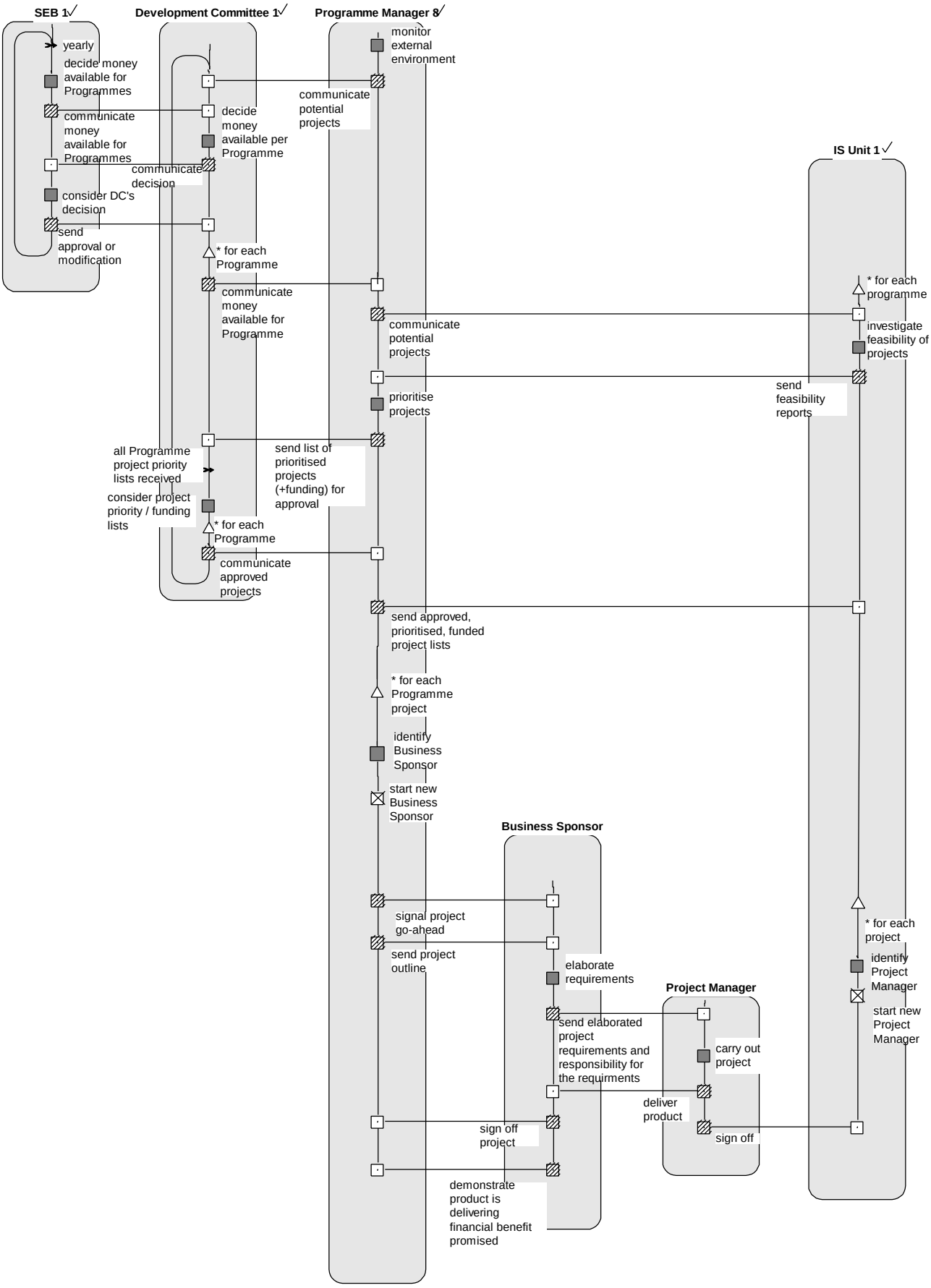

Fig. 1 Process for Selecting and Completing a Project in ASL

Each Programme Manager now sends their set of descriptions of proposed IT products to the IS Unit, with a request that the feasibility of each be investigated. The IS Unit accordingly carries out a feasibility study for each IT product idea. During a feasibility study, the one page of A4 typically expands to a forty-page report, including an elaboration of the requirements for the product, and a more precise costing. Upon completion, all the feasibility reports for a Programme's new products are sent to the Programme Manager.

The Programme Manager uses the feasibility reports to prioritize the IT product ideas, and sends the prioritized list to the Development Committee. When such lists have been received from all the Programme Managers, the Development Committee considers all the proposed products, their priorities and costings. Eventually it approves a set of new IT-based products for each Programme.

Once Programme Managers know what new IT products each is responsible for developing, they initiate two streams of activity. First, each sends a list of their products to the IS Unit. The IS Unit in turn allocates a Project Manager to each new product development, i.e. to each new project (since products are developed within projects). Second, the Programme Manager confirms a Business Sponsor for the project, often the one who originally suggested the idea IT-based product idea. A copy of the feasibility study report for the product is passed to the Business Sponsor.

The Business Sponsor now further elaborates the requirements for the new IT-based product, which are documented in the feasibility study report. Business Sponsors will use either their own staff or systems analysts from the IS Unit to perform this task. The task usually involves establishing a dialogue about the requirements with the relevant stakeholders. Such dialogues are established using a variety of means including interviews and workshops. The results of this work are documented in the form laid down in the company's software development standard, which is used on all projects. The document sets out requirements for product functionality, product quality, project completion times, and project costs. It is passed to the associated Project Manager.

The Project Manager is responsible for satisfying all the requirements for the project. When this has been done, the Project Manager delivers the completed IT-based product to the Business Sponsor, and signs off the project.

At this stage, the Business Sponsor also signs off the project. However, at some later date, the Business Sponsor must try to demonstrate to both the Development Committee and the SEB that the product is delivering the financial benefits that were promised from it.

We have now described, with reference to Figure 1, how ideas for new IT-based products are elaborated and evaluated at ASL, and how some are chosen for development. We have described in outline how such products are built and subjected to a subsequent financial evaluation. Next, a number of refinements are suggested to this initial model.

6. ALTERNATIVE PROCESS PERSPECTIVES

Figure 2 depicts the process for reporting project status at ASL. It shows that during the product development phase every Project Manager produces a project status report once a month for the attention of the associated Business Sponsor. The Business Sponsor reviews status reports for all his or her projects, and writes a summary report for the associated Programme Manager. Each of these, in turn, reviews all their reports, and writes their own summary report for the Development

Committee. The Development Committee only sends on to the SEB summary reports for projects in which the SEB have flagged an interest.

In practice, this status reporting process is the main method by which project status is communicated “up the line” at ASL. Informal status reporting apparently occurs rarely, and when it does occur, attempts are quickly made to fit it back retrospectively into the formal process.

The formal status report carries a variety of messages. For example, it carries requests to cancel projects, requests for more money, requests for changes to project priority, and requests for product functionality changes.

Requests to either cancel a project or to ask for more money may be made anywhere along the line: for example, Project Managers, Business Sponsors, or Programme Managers may make such requests. A request for major changes to a product’s functionality normally originates with the Business Sponsor or Programme Manager.

A decision to cancel a project may only be taken by the Development Committee. And this power extends, at least in theory, even to projects in which the Senior Executive Board (SEB) have signalled a special interest. Similarly, a request to make a major change to a product's functional requirements can be approved only by the Development Committee. (Minor changes to product functionality may be approved by just the Business Sponsor and Project Manager, acting together.) By contrast, a request for more money might be dealt with either by the associated Programme Manager, or by the Development Committee, or by the SEB, depending upon the amount of money requested. For example, a relatively small increase in funding might be approved or rejected by a Programme Manager alone, while a request of an increase in funding in the order of millions of pounds would be decided only by the SEB.

A separate process exists for requesting more physical resources, i.e. people and equipment. Here, a Project Manager makes a bid for such resources from a pool managed by the IS Resource Manager located in the IS Unit (see Figure 3).

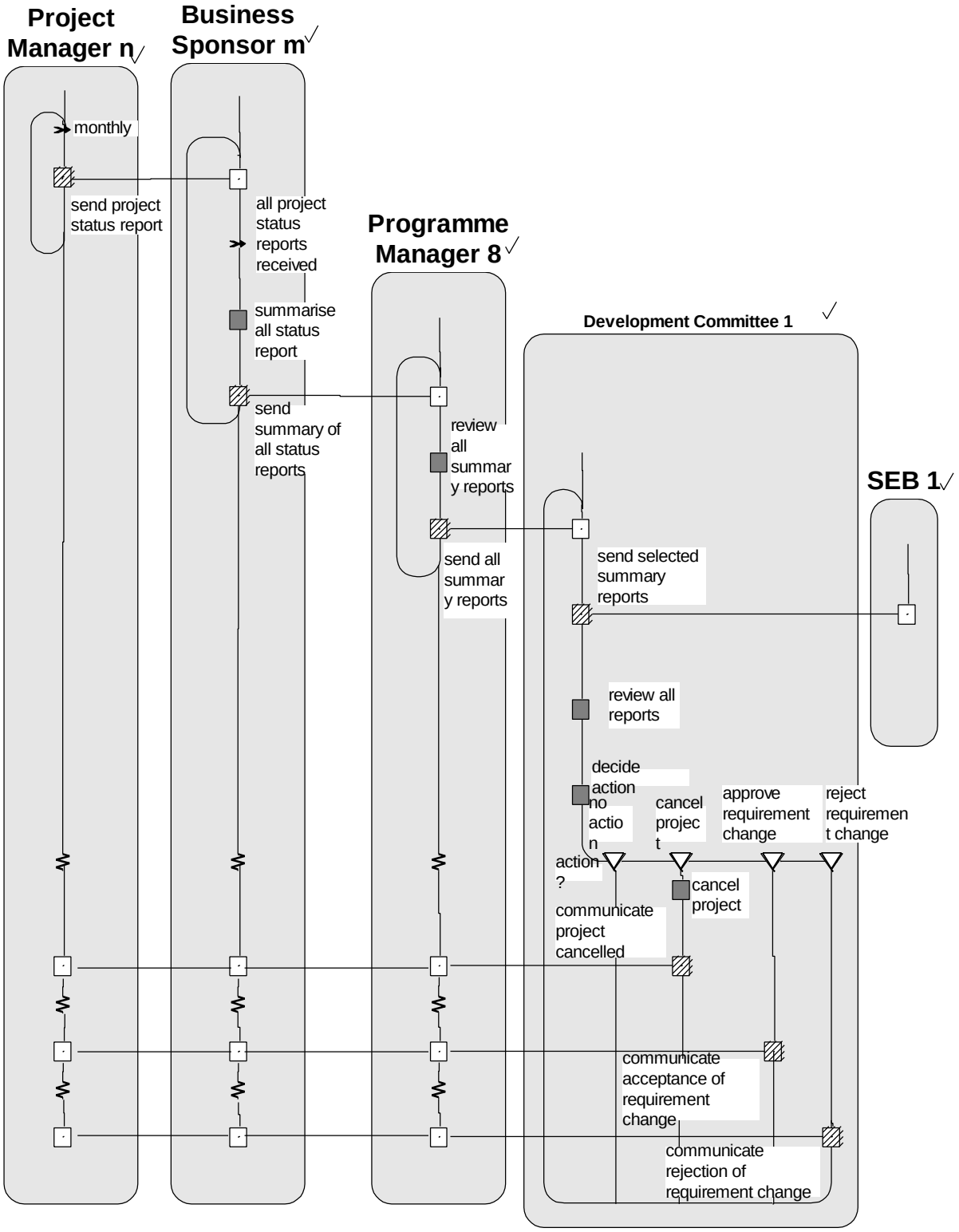

Fig. 2 Project Status Reporting Process

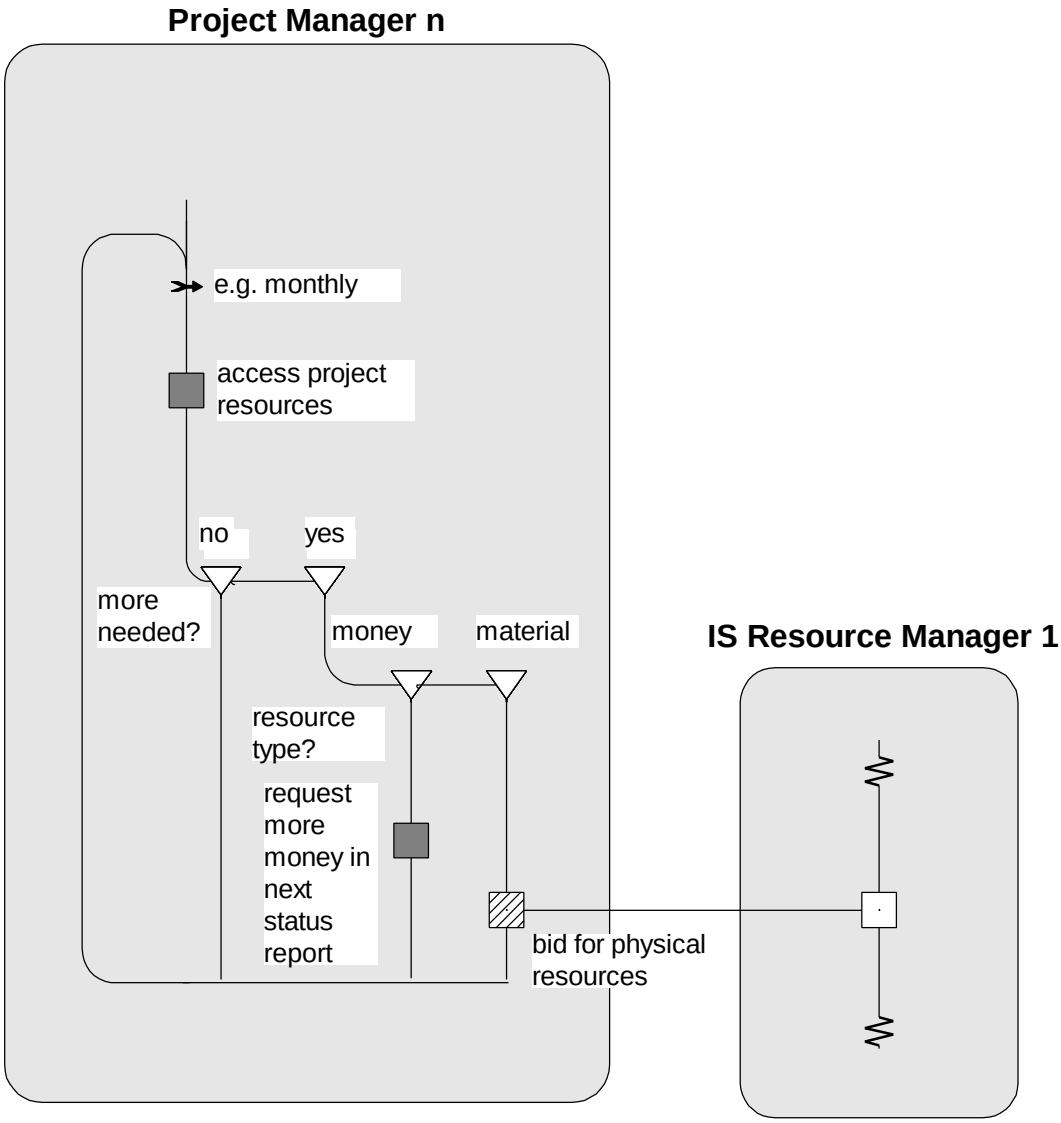

Fig. 3 Process for Requesting More Project Resources

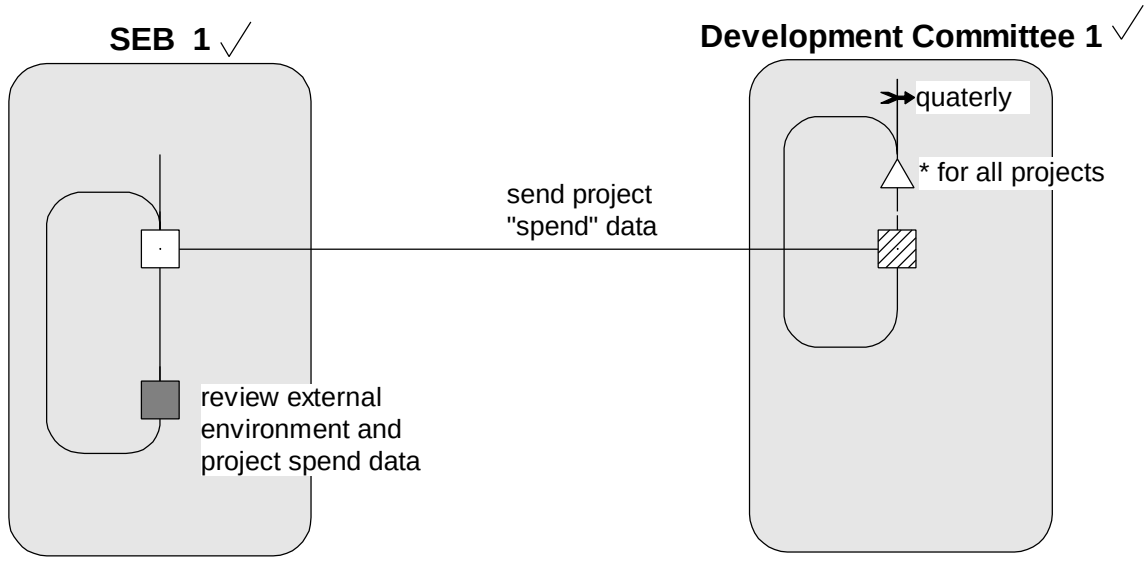

Fig. 4 Process for Reviewing the “Spend” and the Environment

In addition to the monthly cycle of project status reporting, every three months the SEB Projects Subcommittee receives a report from the Development Committee on spending to date for all projects (see Figure 4). As well as considering this spending, the subcommittee also considers the environment external to the company: recent changes or new legislation, the merger of rivals, and new products on the market are examples of what they look out for. As a result of both of these activities, they may decide to alter a project’s funding or priority or both. They may also decide to alter a project’s functionality, or even to cancel a project.

7. DISCUSSION

Through Figures 1 and 2 and the accompanying commentary, we have shown, at least in outline, the series of decisions and communications by which business requirements at the highest level are progressively transformed into specific pieces of work in the IT units, as well as the flows in the

reverse direction by which progress of work in the IT units is reported back through the successive levels. These flows and counterflows can proceed through several iterations, as the diagrams imply.

Although our process models give a clear enough indication that several levels of activity exist both within the business side and the IT side, so that they do not simply depict the business as 'strategic' and IT as 'operational', the primary sequences we have traced and discussed connect the higher business levels with the IT operational level. This has the virtue of reflecting significant transactions in the real situation, but we acknowledge that to give a fuller picture of the complex patterns of interaction between strategic and operational business activity on one side and strategic and operational IT activity on the other, we would have to take our analysis further. The present analysis can be taken as a first step.

How far will discussion of a single case will permit generalization to other cases? The understanding afforded by this single investigation will at least give us some pointers for future work in this and other organizations. More ambitiously, we might contend that we have gained some insight into the kind of communications and actions that must exist for effective links from business to IT to be maintainable in organizations, such as, for example:

1. a strategy formulation and review process
2. a funding mechanism
3. programme management linked to business areas
4. business sponsors or other championing activity
5. a prioritization process for projects
6. a system of project delivery and monitoring
7. processes for information system construction and maintenance
8. multilevel and frequent contact and communication, producing interpretations and revisions of requests and reports, occurring in a continuous process.

Of these, we see items 1 and 2 occurring in or close to the strategic apex of an organization. The people involved will be a powerful and cohesive group, focused on business survival and competitive advantage, well versed in financial measures and methods, and attuned to the external context. Major organizational decisions will be taken in key meetings of this group, who will also have much informal intercommunication. Items 6 and 7 will take place mainly within the IT Department (though the monitoring process is in fact more widely distributed). The people involved will be technically competent and technically focused, well versed in IT and project management, and oriented to systems performance internally and perhaps interorganizationally. We see these two groups of people as functioning as semiautonomous units within the organization.

The link between them is primarily achieved through the intermediating processes 3, 4, and 5. This is where the overall strategy is differentiated by business unit, where champions or sponsors localize strategy and drive forward its practical realization, and where - crucially - the different interests of sponsors are negotiated in the specific and overt context of linking strategy to IS development, in the process of project prioritization.

The dynamic interconnection of the various groups is not achieved, we suggest, by building from an architecture, nor by mechanical translation from an articulated strategy, but rather in our last process in the above list, item 8. Our general emphasis has been on ongoing processes of development and adjustment. We would argue that such a focus is essential to capture the richness, complexity and volatility of evolving business and IT activity. The specific committee, role and activity structures at ASL are of course not likely to be generalizable in detail to other companies, even companies in same sector. Nevertheless, would expect to find similar general channels and activities established to achieve effective business-IT linkage in the areas sketched above.

As a step towards a more general model, we offer in Figure 5 a redrawing of the overall process of selecting and completing a project (given in RAD form in Fig. 1 above), using the role model/goal model style of Warboys et al. (1999). While the roles are still at this stage related to the ASL case, the goals have been generalized. The diagram shows a set of semiautonomous roles, each assumed to have a more or less coherent internal structure, and the main lines of coordination and communication between them. We want the diagram to suggest that the linkages achieved between the various roles are made dynamically in the course of meetings and negotiations (which may follow a regular pattern), rather than through a single coherent top-down process in which a strategy or an architecture is translated through set steps into realized IS projects which fulfil the strategy or complete the architecture. The linkages could not proceed in a single orderly bottom-up process, either. They are instead achieved by a continuing process of adjustment and collaboration between the various partly independent units, with their differing priorities and constraints, and it is to that process that further research attention should be paid.

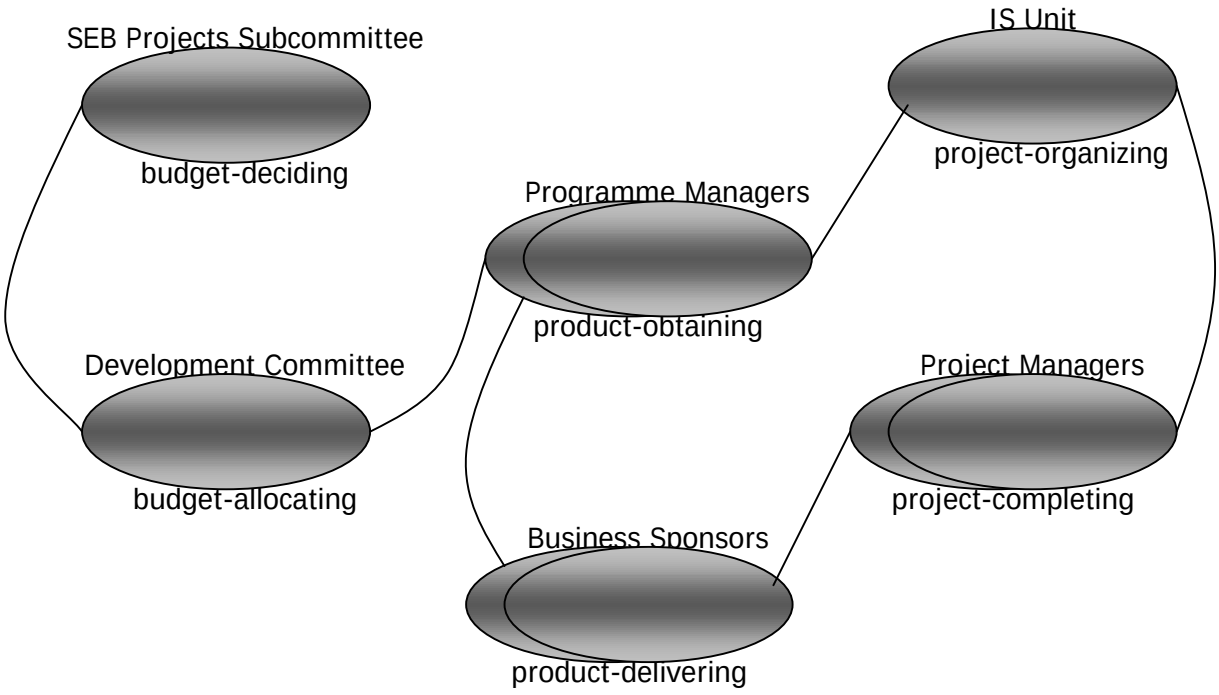

Fig. 5 The Process of Selecting and Completing a Project - Partly Generalized

8. OBSERVATIONS ON THE MODELLING LANGUAGE

One of our objectives in this work was to determine how effective the modelling languages and tools we use are, both in modelling the processes, and in facilitating communication about the processes between us and organizational members, and among organizational members themselves. Our experience so far suggests that the modelling technique is effective in both regards. We have found it useful in enabling us to represent major flows and relationships in the situation as we observe it, and the diagrams produced have become a central focus for our discussions and analysis. We need to extend our use of the modelling language both into the problem context and into the user community.

In modelling the process of the communications between business unit and IT unit, we have found RADs very useful for capturing the essential dynamics and information in the process and stimulating further thought about it. However, we had difficulties expressing some properties using RADs.

In a number of cases, we needed to model multiple occurrences of a sequence of activities; for example, in role IS Unit of Fig. 1, IS Unit needs to start a number of multiple sequences of activities, where each sequence consists of activities for a programme. So, in each sequence, the IS Unit role receives descriptions of proposed projects from a Programme Manager. The IS Unit carries out a feasibility study for each project, and sends the feasibility report back to the Programme Manager (and others). After all of the sequences have finished their activities, the role merges back into the main sequence of activities again. These multiple sequences of activities are modelled using the "triangle with a star" symbol. The problem is that there is no way of indicating when the role starts to merge back into the main sequence again. A possible solution for this is to stagger the state line of the role to the right when it has multiple occurrences, and to move the state line back when the role finishes the multiple occurrences.

A further problem we have identified is that there may be an over-constraint in the sequencing of activities. Sometimes we would like to express the fact that a number of activities may take place after some point, but that their order is unimportant. However, there seems to be no notation in RAD modelling that can capture such property.

9. FURTHER WORK

To get a clearer view on the processes of interest, we need to carry out further fieldwork in this and other organizations, both to be able to establish a comparative perspective and test the generality of our analysis, and to extend the analysis and observation into areas of activity which are still 'black boxes' in our present model (e.g., strategy formulation and project development).

As well as gauging the effectiveness of the modelling method adopted here (by further reflection and user studies), we would hope to enrich our approach and method simultaneously by incorporating elements of other theories and methods, such as those in the Language Action approach (Winograd & Flores 1986; Winograd 1987; Goldkuhl 1987; Flores et al. 1988) and in the Organizational Process Modelling (OPM) method of Warboys et al. (1999).

The Language Action Approach could be used to explore and represent more precisely the nature and types of communication between the parties involved in making the decisions and carrying out the actions involved in linking business strategy to IS development. The virtue of applying this approach would be that it would enable us to probe more deeply the structure of the linguistic action among the parties and trace the processes by which language acts resulted in the production of business strategy and of working information systems.

Warboys et al. go further than we have yet done in linking an analysis of business processes through to direct software support for and enactment of a business model. The adverse reaction to attempts to realize language action models as working software systems (Armenise & Dottarelli 1991; Dietz & Widdershoven 1991; van Reijswoud & Dietz, 1999) gives us pause for thought here. There are political issues which would need to be addressed in order to agree and implement successfully a business process model as a template for working practice. Our proposed future direction would be to continue to working with passive models at this stage, but to deepen the analysis from the accumulation of comparative observation and from application of theoretical perspectives. We would hope eventually to move in the direction of active models, but would need to add a political analysis before we took that step.

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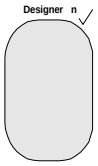
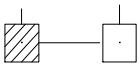
APPENDIX: RAD NOTATION



represents a role. For example, a designer of a software project. The symbol tick indicates that the role is currently active. 'n' indicates the number of instances of this role that are currently active.

represents an internal activity. For example, write a design document.



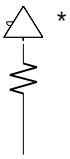
represents an interaction (between two roles). The shaded box indicates the driving party of the interaction. For example, send a design document to the implementor.

represents an external event. For example, start of the year is reached.

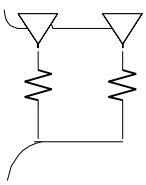
represents that another role is started. For example, start a new project manager.

represents an omitted fragment of a role.

represents repeatition.



represents a number of concurrent sequences of actitivities.



represents case refinement, i.e. alternative sequences depending on a condition. For example, if the design is agreed, send it to the impementor, otherwise, re-design the document.