Making the Business Case

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Version: February 10th 1999

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Preface

Purpose of document

The purpose of this document is to show how SCIPIO models can be used for understanding and presenting business cases for implementing systems changes in federated organizations and networks, especially where these changes involve the acquisition and deployment of open distributed processing technology and services.

> ➢ To state the requirements for an effective and successful approach to the forumulation and negotiation of business cases.

> ➢ To describe the SCIPIO approach to cost-justifying federated organizations and networks.

> ➢ To describe the SCIPIO approach to cost-justifying distributed software systems and software components.

Audience

This document is intended for the potential vendors and purchasers (funding authorities) of open distributed processing technology and services, and their advisers. It is also relevant to people setting and implementing procurement policies for such technology and services.

Questions for reader

The text is interspersed with open questions, which the reader is invited to consider.

> Q   How will technology procurement and management practices need to change, if they are to accommodate Component-Based Development and Open Distributed Processing?
>
> Q   How soon do you expect these changes to be widespread within the software industry?

Acknowledgements

This material draws on research carried out under the Enterprise Computing Project. This work benefited from the participation of John Dobson, David Iggulden, Rob van der Linden, Ian Macdonald and Sally Jack.

Introduction

What is a business case?

A business case is a management argument supporting an investment or procurement judgement. Specifically, it supports the adoption by a specific organization of a specific solution, and is centred around what people might actually do.

A business case methodology should cover both the formulation and the evaluation of a business case.

What is the nature of a business case for open distributed processing?

There are three levels of a business case for open distributed processing: (i) generic benefits of open distributed processing; (ii) application of this generic pattern to a specific organisation; and (iii) application of this generic pattern of benefits to a specific requirement.

In procurement terms, we need to differentiate procurement *policies* from specific procurement *decisions* in response to a specific requirement.

What impact does open distributed processing have on business cases?

Much of the thinking about business cases can be carried forward from previous technologies. However, open distributed processing does introduce some new elements:

➢ distribution of benefits, costs and risks across multiple management domains

➢ business case for federation / federated solutions

➢ need for a business to work out likely business cases for likely business partners before entering negotiations, before knowing prices/costs

➢ open distributed processing provides new ways of putting businesses together, via new mechanisms for linking information systems

➢ new issues for information system practitioners (possibly not so new to business people, but not formally addressed by business case methods) - information as commodity, service paradigm

➢ heterogeneous financial disciplines / practices between federated organizations

➢ identify, quantify and allocate synergy benefits

➢ business process re-engineering across organizational boundaries

➢ new modes of payment - by use of information, by licence to software, by connection charges, by advertising

➢ increase liquidity of assets, speed of liquidation, ability to liquidate/mobilize information/systems

Business case requirements

Quality of investment/procurement judgements

An investment or procurement judgement assesses the **value** of a design.

Often the value of a solution is to be compared with the value of a previous solution. This incremental, differential or Δ-value is called the **benefit** of the new solution, or the benefit of the designed change (in a socio-technical system).

The business case for the new solution or change then compares its benefit with the cost of making the change.

Quality of business case as end-product

A good business case should be:

Legal	Demonstrably adhering to any applicable regulations.
Decent	Politically correct.
Honest	Reveal all possible sources of personal interest or bias.
Truthful	Accurately represent the costs and benefits of the proposal.
Convincing	Making a strong case for the desired change/system
Bold	Daring, making innovative use of argument, prepared to take risk,

Quality of business case process

We can also identify the process quality criteria for the business case methodology:

➢ Minimum 'thrashing' - i.e. going round in circles before agreement can be reached

➢ Maximum learning for participants and entire organization

➢ Efficient & effective - i.e. achieving a good result with a reasonable expenditure of time and energy

Business Case Context

Introduction

One of the key components to a methodology for open distributed systems is a process for formulating and agreeing the business case for development and change. Both investment and procurement decisions are supported by such a business case, which shows benefits (tangible and intangible) outweighing costs and risks, on some scale to be agreed. The business case formulation process, which is iterative and requires negotiation between stakeholders, needs to be fully integrated with the development and change processes.

Existing information systems development methodologies rather gloss over this area. Business case methods exist in management science and operations research, but these are seldom integrated into information systems development methodologies [Symons and Walsham 1988].

Feasibility and finance

At the core of a business case is a formal statement of the business feasibility of a proposed change to the systems supporting an enterprise. In general, such changes incur costs.

In an accounting view of the world, businesses should spend money only when this results in the acquisition of assets (resources). These assets can be physical (such as hardware) or intangible (such as software or information or expertise).

In principle, all resources (including human resources) can be accounted for in financial terms, and shown on the balance sheet. In practice, however, they may not be. For example, some companies capitalize software development projects, while others treat software development as an expense item. Few (if any) companies show staff training as an investment, rather than an expense.

However, these financial accounting practices need not concern us here. Business cases operate within the world of management accounting, rather than financial accounting.

Business feasibility can be explained as "this change is worth doing", or "this asset is worth acquiring". It evaluates a proposed change or asset against a measure, usually financial. The business case should also clarify the conditions under which the change will be worth doing, the asset worth acquiring. In other words, the business case should make its assumptions explicit, and identify the critical success factors of the proposed change or acquisition. If the business case is approved, these assumptions and CSFs will be fed into the project management process.

Information and infrastructure

There are several levels or types of infrastructure in information technology:

> ➢ Production infrastructure - the hardware, software, procedures, skills, and other facilities required to run information systems

> ➢ Development infrastructure - the hardware, software, procedures, skills, and other facilities required to build and maintain information systems

> ➢ Information infrastructure - the central core databases, on which all information systems are dependent, such as Customer database or Product database.

> ➢ Decision-support superstructure - general-purpose query and data manipulation facilities that sit on top of the information systems, including report writers, data extracting, spreadsheet and graphics facilities

> ➢ Management overhead - including all required administration and coordination

Development and cost-justification of information technology infrastructure is discussed in [Veryard 1994].

Planning and accounting

Although planning and accounting are closely linked within most organizations, it is not necessary that they follow the same structure. Planning says: this is a good idea, it will generate more benefit (over time) than it costs. This infrastructure is worth having, because it **can** be paid for. It doesn't necessarily specify how it **will** be paid for, in terms of how the costs will be allocated between different organizational units over time. This is a matter for accounting.

Obviously, nothing should be planned unless there is a cost distribution algorithm that will leave everyone no worse off (and at least some better off). How can we prove (or at least produce a plausible and reasoned argument) that something can be paid for?

The investment decision may be made by a single manager or board (single funding), or may be shared between several different managers (joint funding). In the case of joint funding, there will be some agreement in advance how the costs and risks are to be shared, although this agreement may sometimes be vague or implicit, with the details to be negotiated later, perhaps after the actual costs and benefits can be measured.

In a hierarchical organization, the infrastructure is usually owned centrally, with some hierarchical charging mechanism to allocate actual costs to the relevant organization units. In a market-oriented organization, infrastructure is owned by the unit or units that have funded its development, who can charge horizontally for its use.

Among market-oriented organizations we include highly decentralized holding companies, where the subsidiaries may trade voluntarily with one other, or not, without interference from the parent company. We also include confederations and associations of companies, with separate ownership, but with some shared operations or interests. For example, many Stock Exchanges and Commodity Exchanges can be seen nothing more than an organization owned jointly by member companies (i.e. brokers and dealers) for the purposes of infrastructure; these members may elect a council for central planning of investment in infrastructure, or they may adopt the market approach, with the larger members selling operational services (i.e. infrastructure) to the smaller members.

There are four combination of these factors, with one or two approaches per combination, making five alternative approaches altogether.

	Single funding	Joint funding
Hierarchical transactions	1 Centralized	2 Decentralized 3 Coalition
Market transactions	4 Entrepreneurial	5 Joint enterprise

Coordinated funding - alternative approaches

1. Centralized	Top management estimates the total benefits, which are compared with the estimated total costs and the project risks. Although the organization units may be consulted before the investment decision is made, and may participate in the detailed specification of requirements, they are usually given no choice whether they use the infrastructure or not. Top management has the power to allocate charges between organization units as it sees fit.
2. Decentralized	A provisional allocation of the costs between organizational units is produced. If the manager of each organizational unit is prepared to bear his/her share of the costs (based on a calculation that his/her estimated benefits exceed his/her estimated costs), then the investment goes ahead.
3. Coalition	The organization units funding the investment need not include all of the organization units expected to benefit from the investment, as long as they can estimate enough benefit between them to justify the project. The use of the infrastructure can be extended later, which will bring further reduction in costs to the original participants, but this is an added bonus.
4. Entrepreneurial	One organization unit invests in infrastructure, on the assumption that this infrastructure will be of use to other organization units. Depending on the nature of the organization, the use of the infrastructure can then be traded horizontally, either on the basis of a negotiated financial cross-charge, or in return for some other benefits.
5. Joint enterprise	A group of organization units agrees to fund infrastructure costing more than they together can justify internally, on the assumption that this can be traded with other organization units later.

From a rationalist point of view, the central planning approach is clearly best. It is the only one that completely balances the total costs with the total benefits, and ensures everything is included, nothing is counted twice, and all risks are properly considered. So why don't we do all our planning this way?

The rationalist point of view ignores two things. First, that the amount of information available at the centre is limited. Its knowledge is necessarily less (in quantity, accuracy and timeliness) than the sum of the knowledge of the parts, since there will always be some selection, distortion and delay in reporting information from the periphery to the centre. This selection, distortion and delay is repeated at every level of the hierarchy, even with the most up-to-date computerized communication systems. And second, that the ability of the centre to handle complexity is also limited. In a totally centralized system, it is only in the centre that decision-making skills can be developed, and these skills will always be over-stretched.

Therefore, based on inadequate information, and limited capacity for coping with complexity, the centre may not be able to make any better decisions than the periphery, and its mistakes will be bigger and more disastrous. After all, if central planning worked perfectly, the Soviet Union would not have collapsed.

To say this is not to dismiss the idea of central planning altogether. Many centralized organizations do survive and thrive. Central planning is common in Japan and Western Europe, and is not unknown in the United States of America. All successful organizations have a moderate amount of central planning, balanced against some local autonomy. The right balance varies from one organization to another, and from one culture to another. Some organizations, seeking the ideal balance, swing violently from one extreme to the other: total decentralization one year, followed by central power the following year. Pragmatists (and Taoists) stick to the middle way.

One of the problems with the coalition solution is the fear of the free-rider. Managers of organizational units often find it difficult to forget that they are competing with one another. Thus if one manager doubles revenue at reduced cost, only to find that another manager has trebled revenue and halved cost, the first will be made to feel a failure. Even if the costs are shared equitably between organizational units after the project has been completed, the manager(s) who took the original risk may feel inadequately compensated for having taken the risk in the first place.

Business case for open distributed processing

Open distributed processing raises new issues for business case formulation. Most approaches to investment and procurement assume a central design and funding authority, but with federation we have to abandon this assumption. Openness problematizes the scope of the business case. In the specific context of open distributed processing, we might need business cases for several purposes:

- ➢ to persuade managers of an enterprise

    - ➢ to acquire open distributed processing technology & solutions for a specific business problem (as represented in a SCIPIO model);

    - ➢ to acquire open distributed processing technology & solutions, for unspecified business problems;

    - ➢ to adopt a specific methodology, specific architectures and Open Distributed Processing standards;

- ➢ to persuade vendors to develop products and services conforming to particular architectures and the Open Distributed Processing standards;

- ➢ to persuade funding bodies to continue to support research projects in the open distributed processing arena.

Our focus is on the business case for acquiring open distributed processing technology and solutions. This one appears to be the primary purpose for a business case, the others being secondary, derivable (in some perhaps complex way) from it.

Business case process

The general situation is that a person or committee is responsible for making an investment decision. The business case is needed so that the person or committee may fulfil the responsibilities to invest properly. The business case process is integrated with the procurement process.

When one invests one's own money, one doesn't really need a business case. There are few private purchases to which standard cost-benefit analysis can be applied - perhaps utilities such as domestic heating and insulation, or savings plans such as pensions.

Business cases are required in business. It is precisely because one is an agent for others that the business case is required. Often the managers of an enterprise know what they want to invest in; the business case is required for reassurance, and so that shareholders' questions can be properly answered. Even sole proprietors may need properly worked-out business cases to show to the bank manager.

Thus the business case can be seen as an act of communication between a decision-maker (who may be a stakeholder) and other stakeholders. (This may merely be a potential act of communication: the decision-maker must have the business case prepared, and be able and willing to show it to the stakeholders on demand.)

We can picture the process of formulating a business case as follows. All the agents are described as individual persons, but they may equally be groups, such as committees or Boards.
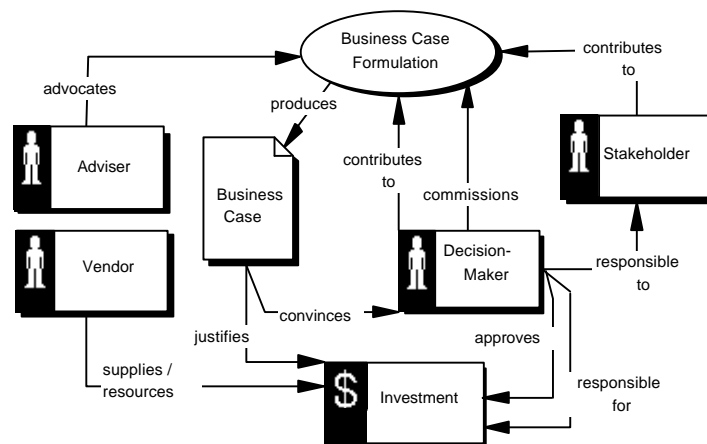

Relationship between business case and agent/responsibility/resource

As we see, there is a crucial role for an adviser or **advocate**, who is the person putting the case to the decision-maker. There are several possible relationships between the advocate and the **vendor**, from complete identity to complete impartiality.

There are two ways of looking at this system. The first is to regard the business case as the focus of the system. The second is to regard the business case formulation as the focus of the system, with the business case documentation being merely a record of the business case formulation process.

Levels of abstraction
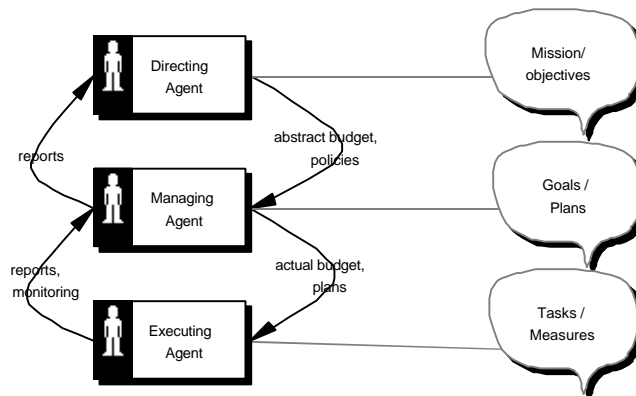
The other dimension is that there is some relationship between some technical decision and measures of distance, and the values put on these measures of distance in terms of the intentions of relevant agents. We now have a multi-dimensional measure. "Here is what the business case looks like in this case, and here is what it looks like in this case: make your choice M^r businessman."

Abstract business case: change from mainframe to network of workstations

Actual business case: change from 3 x 3090 to 1 x 3090 + 47 DOS-WINDOWS workstations, etc.

The intellectual challenge is to produce the abstract business case from the SCIPIO model, based on some notions of distance or whatever. Producing the actual business case from the abstract business case is perhaps an easier task.

Scoping the business case

Various scoping decisions have to be made/clarified: What kinds (levels) of benefit to include? Whose benefits to include? From whose perspective? What timescale? What risk threshold? What is the level of commitment for which the business case is required: next phase of development, pilot implementation, or whatever?

The coalition-building process

With open distributed processing, we are often trying to formulate a business case for a given stakeholder either to initiate or to participate in a federated solution.

It may sometimes be necessary to formulate a business case for one stakeholder before starting negotiations with other stakeholders. At this stage, we probably don't know what prices might be charged for the services required from (or delivered to) these other stakeholders. For such a business case, we therefore need to ask not only 'is it worth our while participating in such-and-such a system, at a given transfer price' but also 'is it likely to be worth their while participating'. In other words, we may need to (at least roughly) formulate the business case from the perspective of the other parties to the federation, as well as from our own perspective. This then enables us to make an opening offer to the other parties that they are likely to find attractive.

Understanding costs and benefits

Distribution of benefits

To understand benefits, we need to recognize that benefits are distributed in three ways:

➢ over time

➢ over multiple stakeholders

➢ over different future scenarios, with different levels of probability

Traditional business case methods collapse these onto a single value, assessed from a centralized decision-point. Since the distribution of benefits is three-dimensional, it follows that there are three dimensions to this collapse:

➢ Accounting techniques of discounted cash flow (DCF) reduce the future to the present. (This is known to have some distorting effect, but the techniques are still widely used.)

➢ Stakeholder weighting techniques reduce multiple stakeholders to a single (virtual or abstract) stakeholder. Sometimes multiple stakeholders are just ignored or overruled.

➢ Uncertain benefits are converted into benefit expectations, using probability theory. This collapses branching future scenarios onto a single probabilistic future space.

With inter-organizational systems, and even within most large corporations, this notion of a centralized decision-point is a dangerous myth. There are many important issues.

➢ Who counts as a stakeholder?

➢ How do we cope with conflicts of preference between stakeholders?

➢ How do the costs of shared infrastructure get distributed between the beneficiaries?

If the decision-making is distributed - each stakeholder acquiring local technology in order to connect to a network - we may need to depart from the traditional business case methods, towards one that looks at critical masses [Markus 1990].

The business case methodology will therefore need to support a range of decision-making styles:

➢ Central decisions require benefits to be collapsed to a single perspective, as discussed above.

➢ Central policies (especially where these do not have mandatory force, but aim to achieve a critical mass of a certain technology within an organization or consortium) need to be analysed in terms of a dynamic take-up model. We can look at other communication technologies such as fax and EDI to help us build this kind of model. This kind of analysis also supports analysis of market opportunities by service vendors.

> ➢ Local decisions may be taken in isolation, but are also likely to be coordinated/negotiated. The business case methodology needs to support negotiation between autonomous or semi-autonomous agents, by predicting the costs, benefits and risks of particular infrastructure to each stakeholder, and therefore helping them agree on a fair basis for cooperative acquisition or development.

Classic cost-benefit analysis

Classic cost-benefit analysis attempts to evaluate an investment by comparing the aggregate costs with the aggregate benefits, usually expressed in a single ratio scale such as money. This may create the illusion of a well-founded measure of value. [FENT91]

One complication is that cash flow distributed over time cannot be treated as a simple ratio scale. It is perhaps not even a linear scale. This means that various accounting techniques need to be applied, to reduce cash flow distributed over time to a single measure, so that different investment options can be compared. This technique is sometimes known as Discounted Cash Flow (DCF). There are three standard ways of doing this, which can result in different answers:

> ➢ Future cash flows are discounted, at a fixed discount rate, and their present values are calculated. These present values are summed, to yield a **net present value** (NPV).

> ➢ The **internal rate of return** of a proposed project is calculated as the rate of discount that would result in an NPV of zero.

> ➢ **Pay-back period**: i.e. the period of time when the NPV at a fixed discount rate becomes positive.

Operational benefits

Operational benefits are those within the business operation system itself. They have to do with such properties as efficiency, which we can define as obtaining the maximum output from the minimum resources. (Within Business Process Reengineering, elapsed time may be regarded as a resource.)

Cost-reduction

It is worth investing to reduce ongoing operational costs. For example, downsizing (in the sense of swapping large computers for small) can perhaps lead to reduced costs.

Direct revenue enhancement

It is worth investing to increase revenue. For example, making a commercial software produce available on additional hardware platforms can lead to additional sales.

Cycle-time reduction

In Business Process Reengineering, cycle-time is treated as a resource, based on the observation that there is usually a fairly direct link between cycle-time and such measures as efficiency and quality. This leads to attempts to optimize operations across a business process chain, which are intended to increase quality and reliability, and/or to reduce cost and/or cycle time.

Operational costs

Operational costs are those directly incurred in operating the enhanced system. For example, the savings in inventory may be offset by increases in transport costs. Or savings in travel may be offset by increases in telecommunications costs.

Obviously, for an investment to be taken seriously at the operational level, the operational costs are expected to be less than the operational benefits.

Capability benefits

Whereas operational benefits are largely to do with adaptation to a fixed situation, capability benefits are largely to do with adaptability to future situations. Capability benefits refer to what you *might* want to do. Words like flex<u>ibility</u>, port<u>ability</u>, distribut<u>ability</u>, all refer to capability benefits.

Capability benefits are sometimes referred to as **strategic** benefits. This jargon is used particularly by sales and marketing people, trying to persuade companies to buy their products and services, in the absence of obvious operational benefits. Capability benefits are also sometimes known as **intangible** benefits.

Capability benefits are at a different logical level to operational benefits. They cannot be described purely in terms of the business operation system itself, but require an understanding of the set of possible changes (and their operational cost-justifications) that might become necessary in the future.

The benefits of open distributed processing are thought to be mainly at this level. The combination of **openness** and **distributability** is expected to give the enterprise the flexibility to do things that would previously have been impossible without great redevelopment expense:

> ➢ to combine systems from different vendors

> ➢ to achieve portability between platforms

> ➢ to grow systems organically

> ➢ to get operational synergy benefits between merged organizations, or temporary joint ventures.

Flexibilitytherefore comprises business flexibility (adaptability, stability, survival) as well as technical flexibility (portability, distributability, maintainability). These kinds of flexibility are generally agreed to be useful. What seems to be very difficult is **measuring** such flexibility in any meaningful way. This makes it difficult to judge **how much** it is worth investing for a given increase in flexibility. This is a general problem for all capability benefits.

Ideally, we should like to be able to quantify capability benefits. Suppose we are asking a CEO to spend 10 million euros on a major investment programme, to increase capability in some well-defined ways. The CEO might agree that this increase in capability is desirable, but is it worth 10 million euros? Suppose there is a cheaper alternative, with reduced benefits, costing 5 million euros: is there any sound way of justifying the more expensive option?

The dilemma in quantifying capability benefits is as follows. For a method to be reasonably accurate and comprehensive, it is likely to be too complicated to win the confidence of the decision-makers. Mathematical formalisms have been attempted, but have not become widely

adopted. Part of the problem is that these formalisms omit organizational culture and politics, which are almost impossible to formalize.

Some mid-point between total mathematical rigour and total gut feel would however be valuable. Techniques exist within general decision-support systems, which might be applicable in this area.

Capability costs

It would be illogical to consider the capability benefits without also considering the capability costs. Here are some examples of hidden (indirect) capability costs:

➢ Going for the cheapest solution in the short-term may cut off opportunities for organizational learning. For example, contracting out may improve cash-flow, but erode control over quality.

➢ Single-sourcing purchases may enable volume discounts in the short-term, but may make for vulnerability in the longer-term.

➢ Opportunity costs must probably be regarded as capability costs. Churchman has pointed out that these can only be reckoned within (arbitrary) system boundaries.

Conflict between operational and capability levels

There will often be a conflict between operational benefits and capability benefits. This is not the same as the conflict between short-term benefits and long-term benefits, although there is a relationship between the two conflicts.

> *"Many years ago, Sir Ronald Fisher noted that every biological system had to face the problem of present versus future, and that the future was always less certain than the present. To survive, a species had to do well today, but not so well that it didn't allow for possible change tomorrow. His Fundamental Theorem of Natural Selection said that the more adapted an organism was to present conditions, the less adaptable it tended to be to unknown future conditions. We can apply the theorem to individuals, small groups of people, large organizations, organizations of people and machines, and even complex systems of machinery, and can generalize it as follows:* **The better adapted you are, the less adaptable you tend to be.***"* [Weinberg, pp 29-30]

One criticism of Business Process Reengineering is that it concentrates on adapting the organization to the current environment, without having any formal method of measuring the effect on the adaptability of the organization.

Levels of benefit

We have distinguished two levels of benefit: operational and capability. As the name suggests, **operational benefits** are the immediate benefits of the business operational system. To describe these, we merely need to think of the operational system, and need not look beyond this. **Capability benefits,** on the other hand, are benefits within the broader system of managing the enterprise over time.

Although a business case may sometimes **refer** simply to the operational system, the business case processes themselves (from formulation via agreement to implementation) sit within the broader management system.
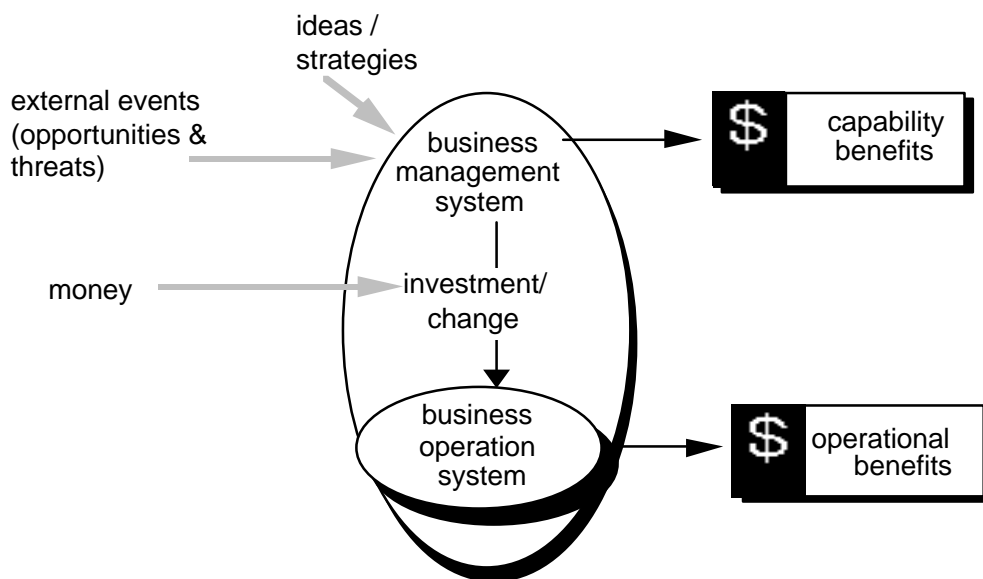
Figure 1: Levels of benefit

External and internal benefits

The benefits from open distributed processing to an enterprise may be from improvements in external communications (in other words, better communications with other enterprises) as well as internal improvements.

We must carefully distinguish between the benefits to an enterprise gained by communicating better with other enterprises, and benefits gained by these other enterprises.

But of course, if the enterprise can recoup financial or other benefits as a result of offering benefits to these other enterprises (e.g. through increased customer revenues or decreased supplier costs), or can otherwise improve its competitive position, this becomes a benefit for the enterprise itself.

Summary of costs and benefits

Classic cost-benefit analysis is a reasonably good technique for evaluating operational benefits. It is not so good at evaluating capability benefits. For one thing, even if we can quantify the financial benefits of being able to respond quickly to a particular event (such as the disappearance of a preferred supplier), we usually cannot reasonably estimate whether, when or how often this may happen.

Furthermore, classic cost-benefit analysis tends to concentrate on operational costs, and ignores capability costs (including, but not restricted to lost opportunity costs).

Orders of benefit

Several attempts have been made to identify levels or orders of benefit. For example, Venkataraman identifies five levels:

1.   Local application

2. Enterprise-wide integration

3. Business process re-engineering

4. Business network redesign

5. Business scope redefinition

In the section above, we distinguished between first-order (operational efficiency) benefits and second-order (capability) benefits.

In addition, there is a third order of benefit can be identified, which we can think of in terms of organizational learning or organizational intelligence. We can therefore identify three **orders** of benefit:

1. More **efficiency / effectiveness** of a given process in a given environment

2. More **flexibility / stability / capability / negotiating power** of a given process or organization relative to a set of possible scenarios

3. More **intelligence / creativity / learning power** of a given organization or consortium.

Note: these three orders do not map onto the five levels of benefit identified by Venkataraman. They do however seem to map fairly closely to the three levels of transformation sketched by Blumenthal and Haspeslagh.

Note: the first of these three orders is sometimes subdivided into (1a) cost and (1b) quality. For example, MacCormack et al identify four areas of business leadership: cost, quality, flexibility and innovation (which they interpret rather narrowly as time-to-market).

Interaction distance and benefit

We can identify specific patterns of the usage of open distributed processing that promote each order of benefit. We can characterize some of these patterns in terms of **interaction distance**.

Efficiency / effectiveness

Efficiency / effectiveness may be increased by reducing the distance along the (business value-added) process chain. Open distributed processing provides a variety of mechanisms for interconnectivity between systems and subsystems, thus allowing closer communication both technically and socio-technically.

Examples of this level of benefit can be found in business process re-engineering (BPR) and total quality management (TQM). We can understand BPR as an attempt to reduce the total interaction distance along a business chain. BPR often requires information systems redevelopment, using client/server techniques to link heterogeneous legacy systems [Mills & Mabey]. Tools exist to support BPR [Spurr]; we expect that tools to support these modelling aspects of SCIPIO will resemble extensions of some such existing tools. In a complementary way, we can understand TQM as an attempt to reduce the interaction distance between the supplier and the customer, in order to increase responsiveness to the customer [Bowles & Hammond].

Flexibility / stability

Flexibility / stability may be increased by reducing the dependency on any particular component, component type, supplier or technology. (As we have pointed out elsewhere, this usually involves an increase in dependency on some other technology or architecture.) ODP provide standard interfaces, and enables more choice, even to the extent of real-time service procurement (selection, negotiation, agreement, provision, settlement).

How can this be characterized in terms of distance? In some respects, we are increasing the interaction distance, by putting the particular device at arm's length, interposing various (distancing) mechanisms between the user (client) and the ultimate server. But surely this is not the same concept of interaction distance as in (1).

Organizational intelligence and learning power

Organizational intelligence and learning power is increased by increasing the effectiveness of certain special processes, including those of modelling (understanding), planning (action), implementation (change) and learning (knowledge). These need to be collective processes, taking place across a distributed or federated organization. Any technological support will probably fall within the CSCW arena.

However, the CSCW research community has not yet tackled the crossing of organizational boundaries. Their notion of workgroup appears to follow the model of the research group itself, with cooperation between coequals, and without internal contracts. These assumptions are of precisely the sort that SCIPIO modelling is designed to explore.

As with (1), we want to reduce the distances within each of these processes, as well as the distance between any two of them. But because these processes are not the ordinary business value-added processes, so the notion of interaction distance is rather special.

Thus we have three different concepts of interaction distance, according to the order of benefit we are interested in.

Benefits of Specific Solution

Scoping

A major difficulty of formulating business case is that existing methods are notoriously sensitive to scoping. Investment and procurement judgements depend not just on the scoping of the solution, but also on the boundaries of the target organization(s) in which the solution is to be implemented, whose costs and benefits are to be considered.

Analysis of strategy in terms of interaction distances

For an example of how the concept of interaction distance works, let us consider a typical product manufacturer. We can produce a very high-level model of the enterprise, with three internal agents, and three external agent classes, as shown below.
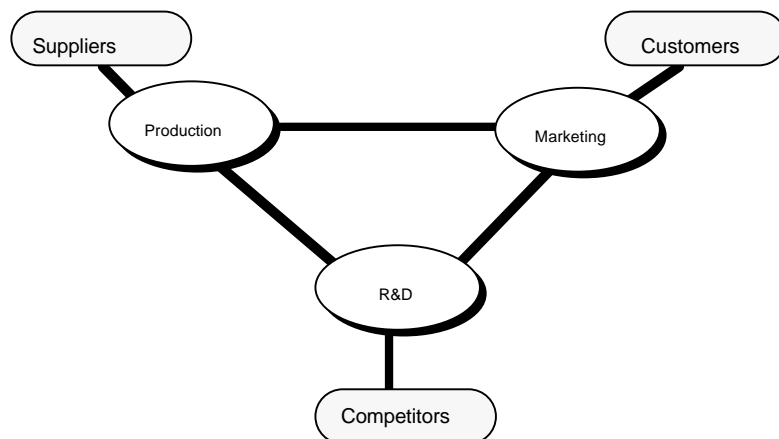

Figure 2: Business relationship model for product manufacturer

As argued by Tidd, different technological strategies demand different balances between these agents. Thus a technology breakthrough strategy is ideally led by R&D, often in close collaboration with companies that would normally be regarded as competitors. By contrast, a strategy of technology fusion would require a much stronger role for production, with close links to suppliers of component technologies. Obviously, such business synergies will need to be supported by information systems that communicate across and between organizations in an appropriate manner. Some strategies may require so-called Chinese walls, providing a level of protection from information leaking prematurely to competitors.

MacCormack et al formulate similar links between business strategy and proximity (which we take to be equivalent to our notion of interaction distance). 'For businesses where cost leadership is the sole driver of competition, location is important only as a driver for reducing transportation, labor and inventory costs. For markets with stronger emphasis on other factors, however, location has an expanded role: leadership in quality places higher demands on both the workforce and the suppliers. Competing through innovation and time-to-market requires customer proximity, a coordinated design-manufacturing link, and, potentially, local

development resources. Achieving best-in-class flexibility may again require customer proximity and, potentially, a different set of production techniques and skills.

The chosen strategy can then be defined in terms of the desired interaction distances between the agents. Some strategies may require a level of distance verging on intimacy. (Business jargon calls this 'getting into bed with' your supplier or customer or business partner.) Meanwhile, 'Chinese wall' strategies demand deliberate distancing between specified agents.

Analysing dynamic interaction with other 'players'

Often, a business case for a networking solution of some kind depends on a prediction of the behaviour of other players. At the same time, their behaviour will be based on predictions of your behaviour. This establishes an **ecology** of dynamic interaction between the players. A recursive analysis may be required, to determine the possible/plausible equilibrium points in this ecology.

The modelling of this ecology is an outstanding issue. An ecological model needs to relate to the models (whether formal and explicit, or informal and implicit) from the perspective of each player.

Snowballing

The value of an object (such as an idea, a language, or a skill) increases with its use. Suppose $V_i(o)$ is the value of the ith use of the object o. The aggregate value of an object that will be used n times is given by the formula:

$$\sum_{i=1}^{n} V_i(o) \ .$$

Now if we have m users of the object, each using the object n times, their coordinated use of the object would be worth

$$\sum_{i=1}^{n*m} V_i(o)$$

whereas their separate use of the object would be only worth

$$m* \sum_{i=1}^{n} V_i(o) \ ,$$

which is less, because $V_i(o)$ is a monotonically increasing series. This is what makes the coordinated use of an object by several stakeholders worth more than the separate / independent use of different objects.

Therefore, estimates of the value of an object depend on the number of other users and the extent of their usage.

Analysing benefit

Potential benefits can now be classified and ranked in terms of distance and other key concepts, derivable from the SCIPIO model.

Business case method

Introduction

The business case is not an end in itself, but a means to an end: rationally justified (and justifiable) investment decisions. We need to consider how it contributes to this end, and how the business case process needs to be embedded within the business management system.

Business case scope

A business case compares costs and benefits within a defined system. This system may be an entire enterprise, or a portion thereof (such as an operating division). The system may even encompass several autonomous enterprises, particularly in an open distributed environment.

When there are benefits to two or more enterprises from improved inter-enterprise communications, the costs may need to be shared according to a discourse that compares the quantity of benefit accruing to each.

Purpose of business case method

A business case methodology for ODP could yield the following benefits:

➢ demonstrating understanding of ODP

➢ encouraging use of ODP

➢ raising confidence in the ability of vendors to produce useful devices

➢ raising confidence in the ability of purchasers to justify and deploy ODP technology

➢ providing vendors with a template for selling odp products

➢ supporting negotiations between organizations to divide the costs of shared technology.

Components of business case method

A business case methodology needs to contain the following components:

➢ a method for formulating business cases (perhaps based on a business case template)

➢ a method for coordinating business case formulation with solution formulation

> ➢ a method for presenting and agreeing business cases (in relation to the proposed solution, or a range of possible solutions)

> ➢ a method for implementing the solution (as a set of inputs to project management).

As the business case is bound to leave some elements of the solution unspecified or open, we need to understand the extent to which agreement to the business case implies agreement to at least some elements of the solution. Once the business case has been agreed, and its implementation delegated to a project manager, how much flexibility does the project manager have to interpret the business case?

Use of business case

When the business case has been accepted, it is then embedded in a project plan. The project manager and project sponsor are jointly responsible for ensuring that the business case assumptions remain true, that the business case CSFs are managed, that the benefits are at least as great as those foreseen in the business case, and that the business case as a whole remains valid.

Iteration

"When we mean to build
We first survey the plot, then draw the model;
And when we see the figure of the house,
Then we must rate the cost of the erection;
Which if we find outweighs ability,
What do we then but draw anew the model
In fewer offices, or at last desist
To build at all?" [Henry IV Part 2]

The formulation of the business case is part of the solution process. Although we may sometimes imagine solutions without thinking of their business feasibility, such solutions may have to be heavily revised when business feasibility is considered.

Summary of business case method

The need for coordination and iteration between the business case formulation and other activities, as discussed in this section, leads to a view of business case-making as a process, rather than of the business case as a static product. This is shown in the following diagram.
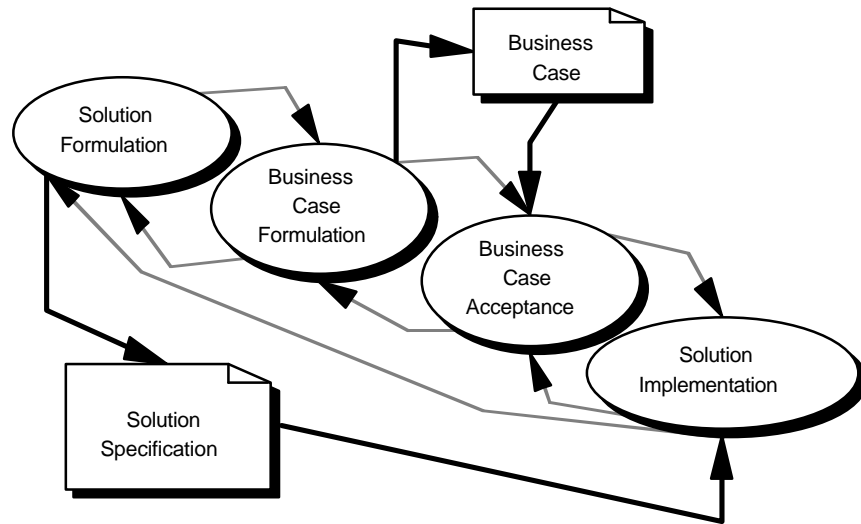
Figure 3: Business case methodology

The business case-making process is itself an important part of the organizational learning process.

How does SCIPIO support a business case for open distributed processing

Introduction

In this document, we have outlined several methods associated with cost/benefit analysis. These generally attempt to derive a single figure of merit from a series of benefits and costs measured in money terms and to compare different figures of merit arrived at from different standpoints of the likelihood of the benefits and costs occurring.

We have also noted the notion of capability benefits. Although these may accrue from the project under consideration, measures in cash terms are typically more difficult to assign and therefore to analyse using NPV techniques. They can be regarded as organizational benefits, which improve performance of the enterprise because of, for example, increased levels of satisfaction and understanding.

The view taken here is that in the distributed environment the capability benefits may be more important than the operational benefits, and that attempts to explore the capability benefits, possibly within the context of the classic cost-benefit procedures, would be necessary. This may result in changes in the way the classic procedures are used.

Operational and Management Models

We have distinguished two levels of benefit: operational and capability.

To analyze operational costs and benefits, we need a business relationship model containing operational enterprise concepts. To analyse the capability benefits (and costs), we shall need to use the management level of business relationship model as well as the operational level.

A business case that merely refers to operational costs and benefits can be supported by a model of the business operational system. A business case that refers to capability costs and benefits may need to be supported by a model of the business management system.

Scenario planning

One way to use SCIPIO models to develop business cases is to formulate a series of future scenarios, and estimate the potential response to these future scenarios:

> ➤ to enable some operational benefits to be obtained

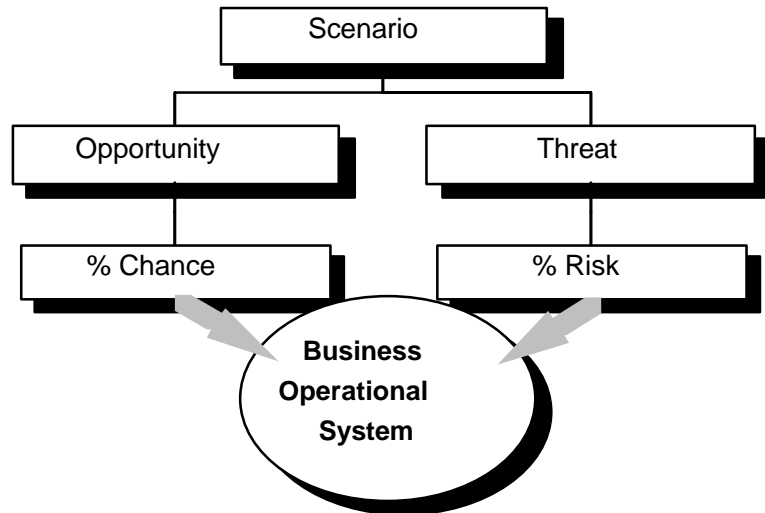> ➤ to enable some business cases to be made.

Figure 4: A systematic framework for analysing capability benefits.

We should be able to derive the opportunities and threats from the model (management level) and from the characteristics of the technology being considered. Thus we can at least partially formalize the process, and produce checklists of the capabilities that need to be considered.

Interaction distance

Value of distance

Expressing communications between agents in terms of interaction distance allows us to quantify the value of reducing (or in some cases increasing) the distance through technology.

Value of reduced distance

The effectiveness of coordination between two or more agents is reduced as the interaction distance between them is increased.

We can imagine a current system where documents are printed from a computer in one city, faxed to an office in another city, where they are rekeyed into a different computer.
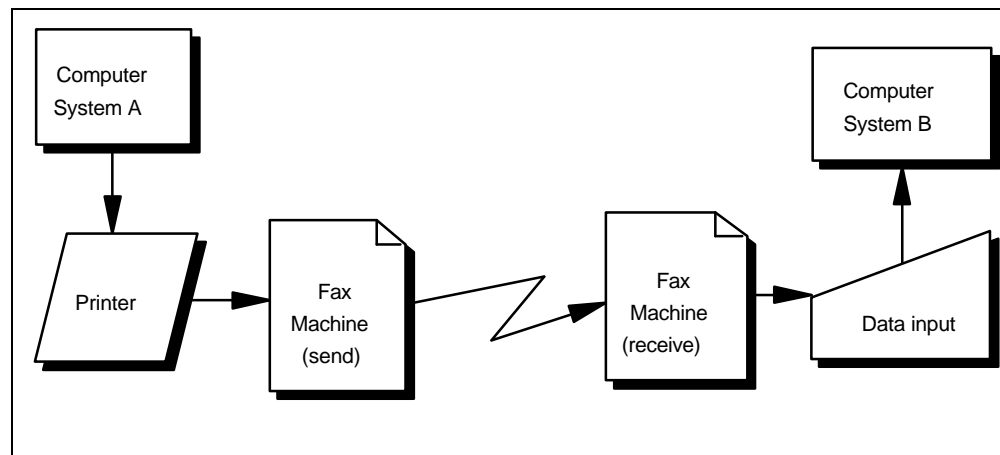

Figure 5: Communication between A and B via fax link

We can measure several dimensions of the **current distance** between A and B: delay, cost, accuracy, reliability.

If we also have a model that shows the **required distance** between A and B (for this particular type of communication), this may give us a basis (i.e. cost-justification) for improving the communications by reducing the distance.

Value of increased distance

There are some situations where some interaction distance between agents is desirable or even necessary.

1. Chinese walls of various kinds, where certain kinds of conversation between certain agents are supposed to be difficult, if not impossible. Controls based on a separation of responsibilities can also be included here.

2. Concepts of **security** and **privacy** can be defined in terms of imposed distance. Virus barriers and database firewalls are further examples.

3. Independent corroboration of information. A manager may want to obtain information from two different sources. This fails if the two sources only appear to be different, but are actually the same.[1]

4. Large highly interconnected networks of systems are found to be vulnerable to intermittent and unpredictable bursts of chaos. This **turbulence** has been found both by TRW and by Xerox in different computer configurations. The effect has also been produced by Japanese scientists within superconducting switches. There appears to be nothing wrong with the design of these systems; the problem appears to be something inherent in the complexity of networks when they contain feedback loops of a certain kind; mathematicians refer to this property as **non-linearity**. [BRIG89, p62] Distance between the parts of the system may be necessary to damp such effects.

Examples

In a certain international consultancy and training organization, there are managers responsible for scheduling consultancy activities and assigning consultants, and other managers responsible for scheduling training activities and assigning lecturers. Sometimes the training manager 'borrows' a consultant to assign to a scheduled training activity; sometimes the consultancy manager 'borrows' a lecturer to assign to a scheduled consultancy activity. This requires an ad hoc conversation between the consultancy manager and the training manager.

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[1] "As if someone were to buy several copies of the morning newspaper to assure himself that what it said was true."[WITT53 §265]
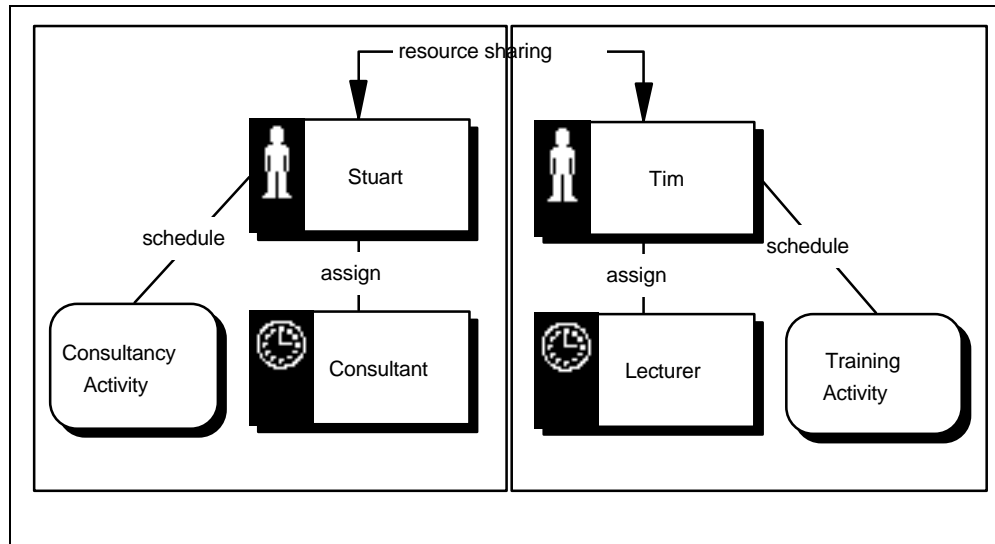
Figure 6: Ad hoc conversations to swap resources

The interaction distance between the UK consultancy manager and the UK training manager needs to be fairly short. This is based on the frequency of conversations, and the speed (short notice) with which scheduling and assignment decisions have to be made.

However, the interaction distance between the UK consultancy manager and the US training manager can be rather greater, because there are fewer opportunities to exchange resources.

For a second (larger) example, consider a typical oil company. Oil companies have three main stages of operations: acquisition of crude oil (by purchasing and/or drilling), refining, and marketing the refined product. This is thought of as a pipeline or stream: production (i.e. acquisition and refining) is 'upstream', marketing is 'downstream'. Some oil companies optimize upstream (production-driven), some oil companies optimize downstream (market-driven), and some attempt to optimize upstream and downstream independently. (Complete optimization of both upstream and downstream operations together is much too complex to be a practical option, at least for the major oil companies.) The choice between these three optimization strategies must be made at the highest level of management; this choice clearly affects information coordination policies and information system requirements.

The diagram below shows one possible set of information coordination policies, for a typical oil company. The refinery is a complex piece of engineering, with high safety requirements, and demands high levels of integration within the information systems that support the operations. For the retail marketing operations, on the other hand, a more relaxed top-down coordination approach will be more appropriate. And as for coordination between the three main stages, this is managed ad hoc or on a network basis.
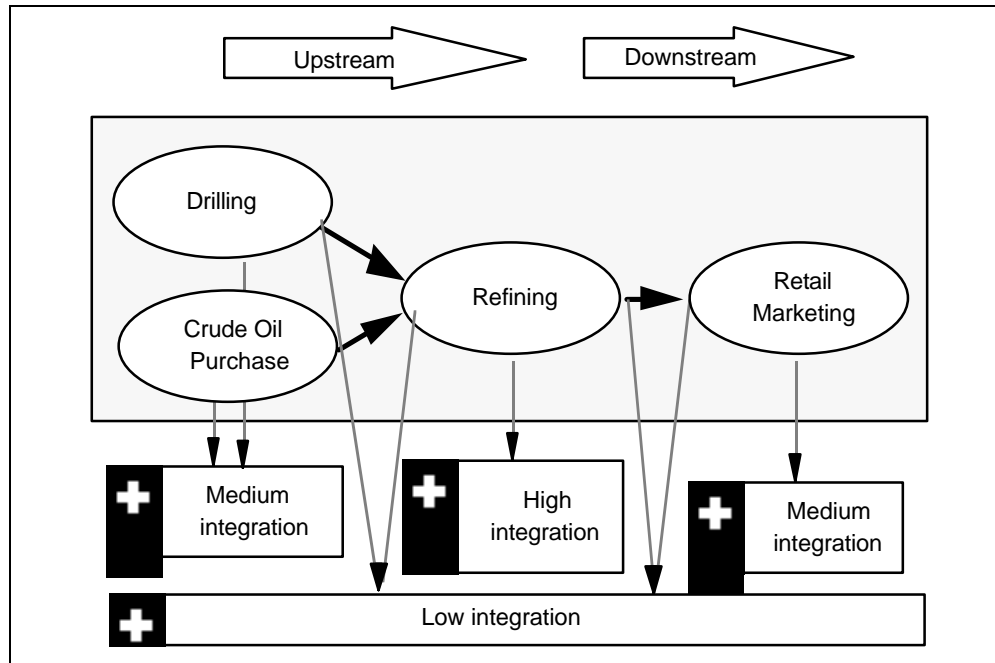
Figure 7: Levels of integration within oil company

High integration entails very low interaction distance. The computer systems controlling the refinery cannot tolerate delays, inaccuracies or unreliabilities. Whereas low integration implies somewhat higher distance.

Further investigation is required to allow these concepts of distance to be refined and perhaps quantified.

Quality of Service

In commercial negotiations, the concept of **quality of service** often takes centre stage. This is particularly the case when some resource or activity is **outsourced**, with a market (or pseudo-market relationship) between the agent providing the service and the agent using the service.

In a particular situation, this can be analysed in terms of agents, activities and resources.

Flexibility

As we have seen, capability benefits can often be described as some form of flexibility, which may be either business flexibility or technical flexibility.

Flexibility of an enterprise can involve the flexibility of the business operational system, or the flexibility of the wider management system.

As Kenwyn Smith points out, 'rigidity/perseverance/flexibility or whatever is not a characteristic of the entity itself. It is a characteristic of the relationship between the entity and its context, even though it may be expressed or made visible in the actual behaviour of the entity.'

It follows that analysis of the benefits of flexibility of a system requires a model whose boundaries extend beyond the boundaries of the system whose flexibility is of interest. Indeed, as Smith also points out, whether something will count as flexibility **at all** depends on where you draw the boundaries. This emphasises the critical importance of scoping.

Towards a business case for ODP

Introduction

Borgmann views technological progress as a progressive separation between means and ends, between the technological device and the technological commodity (or service) provided by the device. This separation generally increases the availability of the commodity, while reducing the visibility of the device. Availability is decomposed into four components [BORG84, p41]:

Immediate   whenever you want it

Accessible   wherever you want it

Safe   without risk, however you want it

Usable   without hassle, to whomsoever wants it

This is a useful way of thinking about ODP and the benefits to be obtained from its deployment. ODP can be seen as a coming-together of two halves: openness (interpreted in various ways) and distribution/distributability. The ODP standard builds on the two concepts of openness and distribution, allowing both commercial and geographical separation between the client and the server.

We have distinguished between **operational benefits** and **capability benefits**. A device, used in a particular context, may have operational benefits. A commodity may have operational benefits to the user, again in a particular context. The benefits of technology as such, however, have to be seen as capability benefits, because technology is about availability of commodity from devices. This turns out to be particularly true for ODP, whose potential advantages can be analysed as a combination of the advantages of distribution, distributability and openness (in both senses).

Distribution

Distributed processing can be seen as a technological advance over centralized or local processing, because it allows a geographical separation between the machine or device providing a service (the 'server') and the user (or 'client').

We can analyse the potential advantages of this in terms of Borgmann's four categories of availability:

Immediate   Access to data or service without having to wait for transport of physical media.

Accessible   Access to data or service from anywhere on the network.

Safe	Distributed systems are less vulnerable to certain types of disaster. Technical back-up can be provided remotely. However, other aspects of distribution may complicate reliability.
Usable	It is not clear for whom distributed systems are more usable than centralized systems, and under what circumstances.

These are essentially operational quality-of-service benefits, as discussed earlier in this chapter.

Distributability

This is a capability benefit associated with distribution. It is the increasing availability (immediacy, accessibility, safety and usability) of distribution and its benefits.

These benefits can be analysed for a particular enterprise in terms of the **intention to distribute**. This is a special case of business intention. This analysis therefore requires a modelling language that in some way includes the concept of business intention.

We shall need to analyse, not merely the business intentions that exist in the enterprise at present, but the business intentions that might emerge under certain future scenarios. Under what circumstances might we want to distribute, and what forms of distribution might we want. Our models must therefore include contingent business intentions as well as actual (current) business intentions.

Openness (versus proprietary)

Open systems can be seen as a technological advance over proprietary systems, because they allow a commercial separation between the system user and the system vendor.

We can analyse the potential advantages of this in terms of Borgmann's four categories of availability:

Immediate	Quick transfer of systems from one hardware platform to another.
Accessible	You can buy hardware and software nearly anywhere that complies with open standards.
Safe	The purchaser can rely on the fact that systems complying with open standards have certain desirable properties.
Usable	Easy transfer of allegiance from one vendor to another.

These benefits can be analysed for a particular enterprise in terms of the **intention to renegotiate**. Like the intention to distribute discussed above, this is a special case of business intention, and requires a modelling language that in some way includes the concept of contingent business intention.

Openness (versus closedness)

If we contrast open systems not with proprietary systems but with closed systems, a different set of potential benefits emerges.

In a closed system, the scope of any information request is fixed. The user can be provided with all information that is contained within the system. This is predictable and, in a sense, 'safe'.

An open system, on the other hand, allows for new information and new services to become available, sometimes in a complex and unpredictable way. An open system is always in some sense incomplete, but this very incompleteness provides the capability for new ideas to enter, new opportunities to be taken, new capabilities to be developed. This is a 'metacapability': the capability to develop capability. Chris Argyris calls this double-loop learning. [ARGY78]

ODP controls

ODP is a technology that increases the availability of certain commodities. We can analyse this as a series of capability benefits.

The other side of the coin: if ODP increases the availability of certain commodities, and separates the technological commodities (ends) from the technological devices (means), it therefore reduces the visibility of these devices.

This is part of what is going on with vendor-independence and 'transparency'. The user no longer knows (or cares) whether the data are being stored on a Hewlett Packard machine in Cairo (Illinois) or on a Tandem machine in Cairo (Egypt).

The user therefore relies on an increasingly sophisticated and anonymous control system, including data protection provisions as well as technical security and back-up. These are operational quality-of-service benefits.

Conclusion of subsection

It should be clear from this analysis that ODP is not a **device**, but a **technology**; it increases the availability of certain commodities from certain devices.

It follows from this that many of the ODP benefits must be categorized as capability benefits rather than operational benefits.

We have seen how the model of a particular enterprise in a particular situation enables these capability benefits to be analysed.

Conclusion of section

This section has discussed how SCIPIO models can be used to analyse the benefits and costs of ODP systems and technology. The benefits will be both operational and capability benefits. We expect that many ODP investments will only be cost-justifiable when capability benefits are included and in some way quantified.

SCIPIO therefore enables formal methods for the formulation of business cases for ODP.

Business case formulation depends crucially on the scope of the system and its boundaries with its environment, and the scope of the benefits and costs to be analysed. It depends also on the identification of stakeholders. The formulation of a business case is therefore a negotiation process, which can be made explicit through appropriate models. Scoping and stakeholder identification are always going to be important issues in the modelling process.

Conclusions

Outstanding Issues

➢ Further formalization of the concept of interaction distance is required, together with the development of suitable analytical tools and techniques.

➢ Ecological modelling tools and techniques will be required.

References

RM-ODP - the reference model for Open Distributed Processing.
The official website for RM-ODP is http://www.iso.ch:8000/RM-ODP/
There are some key papers downloadable from the ANSA website http://www.ansa.co.uk but the website itself is so badly signposted that you would be unlikely to find what you wanted. See instead http://www.dstc.edu.au/AU/research_news/odp/ref_model/

SCIPIO. For more information on SCIPIO, including a detailed task structure, please see the SCIPIO website at http://www.scipio.org/

C. Argyris & D.A. Schön, *Organizational Learning: A Theory of Action Perspective* (Reading MA: Addison-Wesley, 1978)

B. Blumenthal & P. Haspeslagh, 'Toward a Definition of Corporate Transformation' Sloan Management Review **35** (3) Spring 1994, 101-106

Albert Borgman, *Technology and the Character of Contemporary Life: A Philosophical Inquiry* (Chicago: Chicago University Press, 1984)

Bowles, J. & Hammond, J., Beyond Quality (New York: G.P. Putnam's Sons, 1991

J. Briggs & F.D. Peat, *Turbulent Mirror: An Illustrated Guide to Chaos Theory and the Science of Wholeness* (New York: Harper & Row, 1989)

C. West Churchman, "Thought and Wisdom", in Rolfe Tomlinson & István Kiss (eds) *Rethinking the Process of Operational Research and Systems Analysis* (Oxford: Pergamon Press, 1984) pp 67-77

Norman E. Fenton, *Software Metrics: A rigorous approach* (London: Chapman & Hall, 1991)

J. Fulk & C. Steinfeld (eds), Organizations and Communication Technology (Newbury Park CA: Sage, 1990)

A.D. MacCormack, L.J. Newman III & D. B. Rosenfield, 'The New Dynamics of Global Manufacturing Site Location', Sloan Management Review **35** (4) Summer 1994, 69-80

M.L. Markus, 'Towards a "Critical Mass" Theory of Interactive Media', in [Fulk & Steinfeld 1990] pp 194-218

Mills, M. & Mabey, C., 'Automating Business Process Re-Engineering with the Business Design Facility' in [Spurr 1993] pp 153-176

Spurr, K., Layzell, P., Jennison, L., & Richards, N. (eds), Software Assistance for Business Re-Engineering (Chichester UK: John Wiley & Sons, 1993)

V. Symons & G. Walsham, 'The evaluation of information systems: a critique' (Journal of Applied Systems Analysis, April 1988) pp 119-132. Reprinted in [Veryard 1991] pp 71-88

Tidd, J., 'Technological Innovation, Organizational Linkages and Strategic Degrees of Freedom' Technology Analysis and Strategic Management **5**(3) 1993, pp 273-284

N. Venkataraman, 'IT-enabled business transformation: From Automation to Business Scope Redefinition' Sloan Management Review **35** (2) Winter 1994, 73-87

R.A. Veryard, 'What are methodologies good for?' (data processing **27** (6) July/August 1985, pp 9-12

R.A. Veryard (ed) The Economics of Information Systems and Software (Oxford: Butterworth-Heinemann, 1991)

R.A. Veryard, Information Coordination: The Management of Information Models, Systems and Organizations (Hemel Hempstead UK: Prentice Hall, 1994)

Gerald M. Weinberg, *The Secrets of Consulting* (New York: Dorset House Publishing, 1985)

L. Wittgenstein, *Philosophical Investigations* (tr E. Anscombe, Oxford: Basil Blackwell, 1953)