SWP 10/91 BRIDGING THE GAP - IMPLEMENTING INFORMATION SYSTEMS (IS) STRATEGIES

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1. INTRODUCTION

The new and important area of Implementing IS Strategies (IISS) is one that the Cranfield IS Group has been developing since September 89. At the time of writing the thinking is still being formulated and has not reached the stage of a comprehensive and coherent framework. However many issues in this area have been addressed and an embryonic framework has been achieved. The Group's target date for a comprehensive methodology or framework is mid April 1990. At that time it will be relatively untested. Rigorous and extensive testing will take place from April onwards. No doubt significant development will continue for several years.

The starting point for IISS is the realisation that there are additional stages which follow the development of an IS Strategy. These stages are necessary to enable the outputs of the IS Strategy process to direct the operational activities of :

a) planning, managing and executing development projects and,

b) managing the information resources throughout the organisation.

It is only if the IS Strategy "degenerates into work" that it has been of major value.

The key issue to be addressed now is no longer how to develop an IS Strategy. Methodologies abound (though serious further development of this area is still essential). The new issues are for those organisations, public and private, who have in place, or will shortly have in place, IS Strategies. They are around the question of how to implement the IS Strategy. This is particularly the case for organisations who have developed their IS Strategies with significant support from external management consultants.

Clearly the major issue is, "How do we implement this wonderful new (and expensively compiled) document ?"

At first glance this is an area which can be dismissed easily. Is not Implementing IS Strategies simply about doing what the strategy tells you to do ? Unfortunately the reality is that all but very small enterprises have extreme difficulty in implementing strategies of whatever sort, whether they be corporate strategies or functional strategies. Why should the IS Strategy be any different. The answer is, of course, that it is not different. If defining the IS Strategy was not difficult enough, the problems multiply when you start to implement it !

This is particularly the case with IS strategies. This is because IS Strategies will suffer from the same inherent difficulty encountered in all forms of strategic implementation in large organisations. Alas for IS Strategies the problems are compounded by the poor quality of IS Strategies relative to that achieved by other functions. Some elaboration is demanded on this charge that IS Strategies are of poorer quality than other functional strategies.

It is to be expected that older functions within organisations have had longer to develop tools and methodologies for the development of their functional strategies. The methodologies used for IS Strategies are new, largely borrowed from other areas, and relatively untested.

Additionally IS is one of the first functional strategies to "go global". By this I mean that this functional strategy is now inherently cross functional, covering the whole organisation and meshing with the other functional strategies. To be sure, other functional strategies also permeate across the organisation. Marketeers claim that everyone in the company is in marketing. Of course they are. But there is no component of the marketing strategy that is driven by, and serves the operations or human resource strategy. The claim that everyone is in marketing is a battle cry to get everyone behind the marketing strategy not get the marketing strategy behind everyone.

Additionally, by the phrase "go global" I also mean that the IS Strategy may very well extend out beyond the traditional boundaries of the organisation to encompass parts of other organisation's objectives. Eventually all functional strategies may "go global" but for the IS Strategy this means that implementation is inherently a multi-functional, multi-disciplinary, and quite often a multi-organisational endeavour.

Finally there are clear weaknesses visible in the IS strategies that are being developed. Is an unimplementable strategy a strategy at all ? In most functions it wouldn't be. A Finance Strategy that was so stringent that the factory ceased to function through lack of supplies, or a Human Resources Strategy that required the recruitment of personnel in numbers that were simply not available in the labour markets would be unacceptable. No doubt such functional strategies have and do exist, but generally they would not be regarded as strategies of any merit unless they are implementable. In contrast the current wave of IS Strategy development tools are strong on identifying opportunities for deploying Information Systems but are either weak or ignore altogether the constraints (not just resource constraints) that might make much of the strategy unimplementable. Of course this has much to do with the fact that identifying the opportunities is the "fun" part, the creative activity, overmapping constraints on the "wish lists" is a kill-joy activity. Perhaps this is why it is left in so many studies to some unspecified later stage. Whether this calls for additional tools for IS Strategy formulation to ensure that only implementable strategies emerge from the process is debatable. At this stage in the development of the IS profession there is no guarantee (in all probability the reverse) that the strategy approved for implementation is implementable at all !

These three combine to make the implementation of IS Strategies one of the most difficult challenges yet faced. Just when we all thought that we could link IS activities to business objectives via an IS Strategy and it was "safe to go back into the water" a new bigger "Great White" emerges in the form of implementation problems.

IMPLEMENTING IS STRATEGIES (IISS) - THE INITIAL MODEL

The starting model for IISS was derived by the Cranfield IS Group from a group "brain-storm" in September 89. The model, whilst being simplistic, bridged the gap between the IS Strategy process and the systems development process. The model appears below (Figure 1).

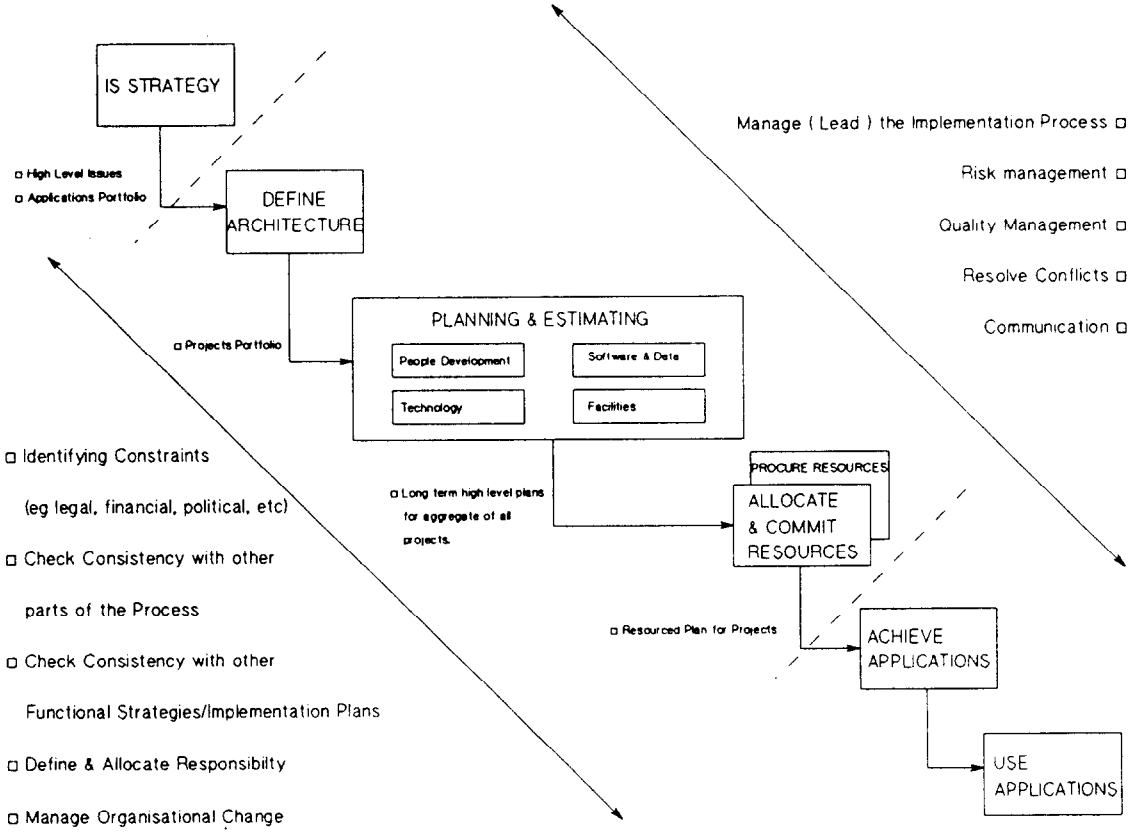


Figure 1 - The IS Group's Early Model

The model can be easily criticised from a number of directions.

It is clearly only addressing really the link between the applications portfolio and the systems development process. This is too simplistic. Whilst this link is important (and maybe the most important) it is only one of the links from the IS Strategy process to the operating processes of the organisation's information systems resources, wherever they exist. There should be links from the IS Strategy to everything that occurs at the operating level of information systems throughout the organisation. So what does this mean ?

It has two clear ramifications for the model. Firstly we must ask the question, are there enough outputs from the IS Strategy process to direct all aspects of the operational level activities of the IS resources. This has major ramifications for the nature of an IS strategy. Not only are many (or is

it most) IS strategies unimplementable but most (or is it all) IS Strategies address only a small part of that which they should address. To be sure, they address the glamourous bits of what wonderful new things we can do with computers, but do they address the less glamourous bits. For example should there be additional policies for the development of manual information systems ? Should departmental systems be incorporated by extracting their development plans from the strategy of the function in which it resides ? Should policies for quality assurance, disaster recovery, computer operations, end user computing, technology monitoring/transfer be included ? Should it include policies for development procedures, project management methods, employee development ?

Some of these may result from Strategy but surely most of them do not simply result, they need planning at a high level with an organisation wide perspective.

The second ramification is at the other end where "achieve and use applications" is ridiculously simplistic. A wealth of information systems activities are occurring at the other end.

So what does this do for the middle ground ? What does this do for IISS ? Model 3.1 (above) is a beautifully elegant cascade of 1:1 relationships. The inclusion of feedback loops increases the complexity of it slightly, but the elegance would remain. However when you increase the outputs from the IS Strategy process and you increase the number of processes (throughout the organisation) upon which implementation of these strategies depends and you consider that most processes will link to most areas of IS policy we begin to see a complex interrelated cascade of many to many to many relationships.

Before we run away in despair it is important to note that some IS strategies have been implemented. This complexity also exists for other functional strategies and it is certainly the case that not all these links are of equal importance.

However the above discussion is important in reinforcing the importance and difficulty of this area.

The other major criticism of the model is that much that is important to the processes in the cascade is pushed out of the model to become bullet points hanging in space with no clear relationship to anything. To be fair to the Cranfiels IS Group, this was recognised and it was clearly accepted that to be of value they must be brought firmly back into the main sequence of processes. To leave them as "issues" to be taken into account (in some situationally dependent way) is not of sufficient help to those who have IS Strategies to implement.

So the initial model was not perfect. It was only a "preliminary rough". It has of course bridged the gap between two of the most important areas, the portfolio of applications derived by the strategy analysis and the systems development process. As such it is a useful starting point. A large part of the discussion below focuses on fleshing out this link.

3. THE OUTPUTS FROM THE IS STRATEGY PROCESS

The starting point for implementing IS Strategies must be where the development of the IS Strategy finishes. As indicated above this fudges the issues of whether the IS Strategy process should finish where in fact it does but for the moment lets leave that issue to one side. Different methodologies have different outputs. An ideal methodology for Implementing IS Strategies would be capable of taking the outputs of any of these methodologies and implementing them.

To achieve this it is necessary to identify the outputs from a sufficiently large number of IS Strategy methodologies to establish the starting point for the implementation process.

The main methodologies examined were :

1. IBMs Business Systems Planning (BSP) [1]
2. James Martin's Strategic Data Planning Methodology (SDPM) [2]
3. Rockart's Critical Success Factors (CSF) approach [3,4,5]
4. Porter and McFarlan's use of Strategy tools [7,8,9].

Several other methodologies can be regarded as combinations of these. LBMS's (Learmouth & Burchett Management Systems, an IS Strategy consultancy) methodology is a combination of 1,2 and 4, Cranfield's methodology (known as DISS, Developing IS Strategies, within Cranfield) is a combination of 3 and 4. The methodology of the Central Computer and Telecommunications Agency (CCTA) covers the whole of the government sector and is a sophisticated combination of all of 1 to 4 above. Other methodologies are hybrids. PA's is a sophisticated hybrid of 1 and 2, Nolan Norton's is a hybrid of 3 (both are management/systems consultancies).

The examination of these IS Strategy methodologies highlighted some interesting characteristics. Two basic approaches predominate. The first is that which seems to have come out of business strategy and moved down (DISS, CSFs, Harvard, CCTA). So called "Top - Down" approaches. The second is that which has evolved out of IBM's database perspectives (BSP, SDPM). So called "Bottom - Up" approaches. These have applied systems modelling techniques to high level issues in the organisation. The above discussion did not cover all the methodologies around, although it included a good cross section.

For the purpose of identifying where these various methodologies finished so as to get the starting point for the general area of implementation issues the position is not ideal. As figure 2 below illustrates, these various methodologies do not end at the same levels.

[See figure 2 over]

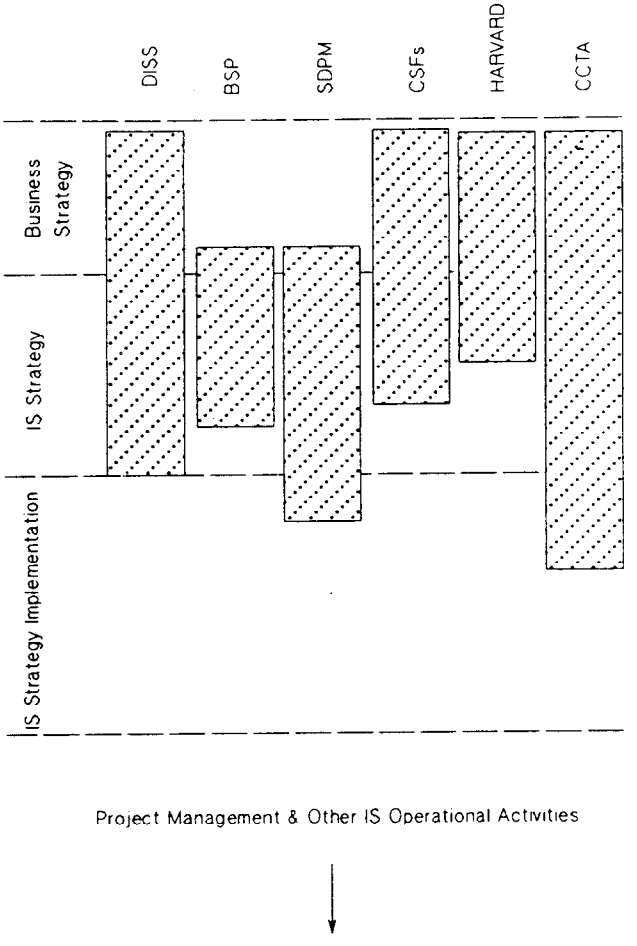


Figure 2 - Diagram of area covered by IS Strategy methodologies

Overall two sets of outputs were clear from the IS strategy process. The first and most clearly articulated is the **applications portfolio.** In some approaches this is too high level really to proceed forward to implementation without further analysis. In general though, the methodologies are collectively strong on identification of applications from high level perspectives. The second output is **IS policies** for the management of IS in the organisation. These are far less well specified than the applications portfolio.

Some methodologies begin to address some of the issues of implementation. James Martin's SDPM identifies an implementation plan as an output but says little about it. The CCTA has some clear outputs relating to implementation [10]. This area of the CCTA's methodology concentrates on the "harder", schedulable aspects of implementation. The DISS approach provides some high level indicators for implementation out of the Strategic Grid analysis. So in general the IS Strategy methodologies do not cover implementation to any significant depth.

The position seems reasonably clear. In general the IS Strategy methodologies provide two outputs as inputs for the IS Strategy Implementation process :

(i) The applications portfolio.

(ii) A set of high level IS policies.

A deeper issue is whether IS Strategy implementation should start in this area at all. A pragmatic fudge is probably required. It is true that IS Strategy methodologies are currently capable of

deriving strategies which are unimplementable, for instance an applications portfolio that the organisation cannot afford to finance. This may mean that IS Strategy methodologies need more development. This is undoubtedly the case. However it does not seem likely that their development will extend far into implementation issues beyond perhaps checking, at a high level, that the IS Strategy is implementable (or at least not obviously unimplementable).

4. IS ARCHITECTURE & INFRASTRUCTURE

The first box in the IS Group's original model was entitled "Define Architecture". Clearly this is a process which defines the IS Architecture from the two inputs of applications portfolio and high level IS policies. However the initial question for this paper to address perhaps is what is meant by the term "Architecture".

ARCHITECTURE

IS is an infant discipline and considerable ambiguity exists concerning the definition of many of the terms used. This is particularly true of the term Architecture. In recent years Architecture has emerged as a major issue but no clear definition of the term exists. Different gurus use the term differently. Rarely do they stop to define it. When they do define it they are often not rigorous in sticking to the definition they select.

Typical definitions from the literature would include :

"Architecture is the structure of information technology for doing business" - Richard Nolan of Nolan Norton, consultants. [11]

"Blue print for the information technology infrastructure of an organisation" - Steven Jenkins of Grand Met.

"The technology framework which guides the organisation in satisfying business and management information system needs" - Michael Earl of Templeton College, Oxford. [12]

These sound fine but are notable for their lack of specificity, but they are a guide to the general meaning of the term Architecture.

What can be said is that generally in the IS profession the term Architecture is used to mean the **technical** Architecture of computers and communications technology. The focus is on technology and less so on the business. However increasingly we have realised that the technology focus leads to an understating of the organisational and people factors which often pose the greater challenge to the successful use of information systems and technology.

Some commentators believe that Architecture is important to the business and consequently the business is important to the Architecture.

"Rethinking business and architecture planning go hand in hand.....Both should be done at business unit level, not at enterprise level, because one architecture is not likely to be able to support several different lines of business" - Larry DeJarnett.

Within the Cranfield IS Group a clear and agreed definition of what is meant by Architecture would be difficult to obtain. For the purposes of the discussion that follows some sort of working definition is important. As such the description of the term Architecture that follows is my own and put up not to be the ultimate definition of the term Architecture but to be a definition specific to this paper. The reader will find many who will not accept my definition.

In this paper Architecture is **all** the components both technical and non-technical which affect the supply of information to the organisation. It is also concerned with how these components are

linked together and how they function as a whole. The whole being the Architecture. It is a very wide concept. For simplicity we will exclude the informal organisation and informal information channels, though these are important and their exclusion can be challenged. Defining the Architecture is very much about asking the question "What sort of organisation do we want for our people to excell within ?" Although, of course, care must be taken not to lose sight of the fact that the total "design" for the organisation encompasses more than the IS Architecture.

The Architecture can be seen to encompass two broad groupings of components. The first is the **applications**. The second is the **"Infrastructure"** that supports these applications, supporting both their development and their usage.

Conceptually the Infrastructure provides the structure upon which applications are created. Together the infrastruture and applications combine to provide the information, information systems and information technology to support the business objectives specifically but also the organisation as a whole.

APPLICATIONS

What is meant by applications ? At Cranfield, as elsewhere, some ambiguity surrounds this term too. The applications are derived from the business objectives and as part of the applications portfolio are the main deliverable from the IS Strategy process. However what is an application ? Is it a project ? Often the "things" within the applications portfolio are referred to as projects. The answer is that an application is a business application of information systems, i.e. a business activity or process to which an information system (or systems) can be usefully applied. In theory the technology underlying the information system which will be applied to the application is not specified, though in practice it is often implied. In theory it need not be a computer technology, it could be a communication technology or a non - computer technology such as pen and paper, or a manual form.

This is the definition used in this paper. An application is a business application; a process or activity to which an information system (of whatever type of underlying technology) can be usefully applied.

Another issue relates to the applications portfolio itself. Do all applications appear in the applications portfolio ? The answer is no !

This is an important point since the whole field of IS Strategy rests on the derivation of applications from high level processes.

No planning process is perfect and IS Strategy planning is no exception. Research in the USA by Lederer and Setti has shown that circa 35% of development projects are not identified by IS strategy planning methodologies. So we must build our Architecture with this in mind. It must have the capacity to accept these "unplanned" applications. This also has important implications for the infrastructure that supports the applications, since it must support, not just known applications, but also these additional unknown applications.

Also the area of end user computing is a rapidly developing area of increasing importance. In some US companies spend on end user computing now exceeds spend on central computer resources. Top down IS Strategy methodologies are unlikely to specify the miriad of applications from this area. However the Architecture must include end user computing issues and the infrastructure must support it.

INFRASTRUCTURE

It is not easy to specify all the elements of infrastructure. It includes both the technology components that support applications and the "softer" people and organisational issues that have so often been overlooked and been the root cause of so much failure in the IS field.

Nor is it necessary to specify infrastructure elements in detail. They are everything of significance that needs to be in place for the application to succeed in achieving its business contribution. Generally infrastructure elements are not specific to one application, they are shared (or potentially shared) by several applications.

The Cranfield IS Group have combined the infrastructure elements into five broad grouping :

1. **Technology**. All forms. Computer, communications, development technology, etc.

2. **Data**. Includes raw data and structures of data (e.g. databases).

3. **Methods**. Systems development, project management, quality assurance, etc.

4. **People/Skills**. Both IS professionals, user and management.

5. **Organisational Factors**. Structure, power, management style, heritage, etc.

These are discussed in more detail below.

So Architecture comprises Applications and Infrastructure. Additionally Architecture is the linking between the two. By this is meant that the two cannot be designed independently. The infrastructure determines, to some extent, the applications that are possible as well as being in place to support the applications. The two have, of necessity to be considered together. They are an inter-related whole.

The diagram below (figure 3) illustrates the relationships between architecture, applications, infrastructure and infrastructure elements.

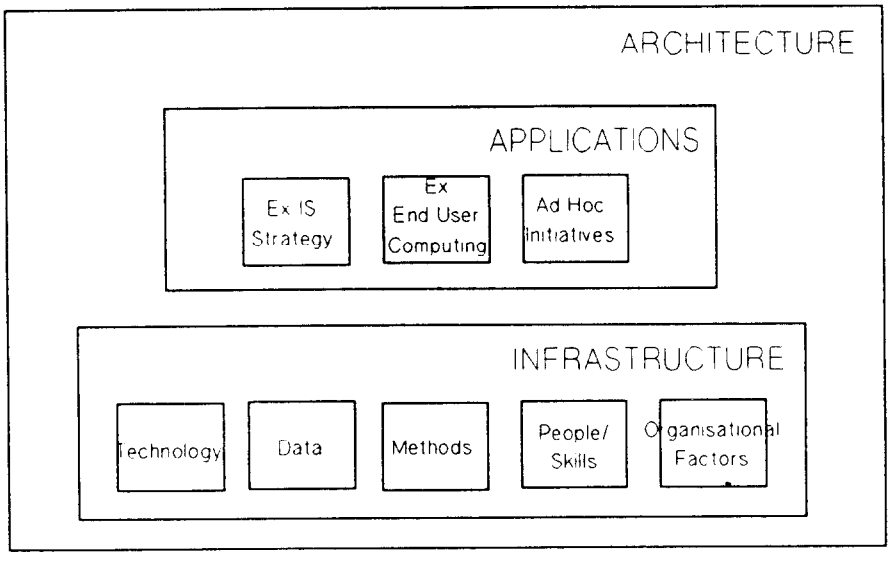


Figure 3 - The Structure of Architecture

The perspective taken on architecture is important. Several views exist in IS generally from a narrow technical view to a very wide organisational view. The view adopted in this paper finds middle ground where the "softer" organisational factors are incorporated to the extent that incorporation is necessary to ensure the successful implementation of the IS strategy.

5. TRANSITION FROM APPLICATIONS PORTFOLIO TO APPLICATIONS PROJECT PORTFOLIO

Although applications are the main output from the IS Strategy process, applications are achieved through the achievement of IS **projects.** These projects fall into two broad categories. The first is the projects which are necessary to achieve the applications. The second is the projects necessary to put in place the infrastructure upon which the applications will be built and managed.

This section discusses the identification of development projects

The starting point is therefore the applications portfolio. This is a prioritised listing of existing and planned "applications" expressed in business terms rather than technology terms. Within the Cranfield framework these would be categorised according to their business contribution into the four types of :

TURNAROUND -	Low current contribution but high potential/future contribution.
STRATEGIC -	High current contribution and high potential/future contribution.
FACTORY -	High current contribution but low potential/future contribution.
SUPPORT -	Low current contribution and low potential/future contribution.

Additionally the Cranfield framework will have assigned to each application some indications as to how it should be managed. The most important of these is the generic IS strategy. Based on the work of Parsons this assigns one of five management approaches to each application according to its business contribution which is derived from its place in the Strategic Grid. The five approaches are :

- Scarce Resource
- Monopoly
- Centrally Planned
- Leading Edge
- Free Market

Clearly projects will always arise from new applications. However projects could also arise from an application because it is an existing application which needs enhancement or modification. This might be because the application's business context has changed, because it is moving around the grid or simply that it has always been deficient.

The mapping from application to project will not always be a unitary, one to one mapping with one application generating one development project. The mapping will take one of three forms :

1. One to one, where an application can be created and should be created by a single project.

2. One to many, where an application can only sensibly be created by executing a number of projects.

3. Many to one, where several applications can be dealt with sensibly in a single project.

This begs the question how should this mapping be determined. For me there are two major criteria :

1. TECHNICAL IMPERATIVES. Technical considerations may mean that it makes sense to bring applications together into combined projects or split an application into several projects.

2. STRATEGIC DILUTION. Strategic dilution refers to the fact that, as strategies are broken down, the original strategic objective gets diluted and very often lost. In the absence of the original strategic objective, local or individual goals, particularly politically motivated goals, can be easily substituted. This is an argument for keeping the mapping as simple as possible, or rather as simple as the technical imperatives will allow.

The issue of strategic dilution, or rather how to avoid it is crucial. This is a phenomenum which does not just apply to the implementation of IS Strategies it applies to all strategic implementation in large companies. Whilst the senior management may understand the strategic importance of the application, it is not senior management that carries out the detailed task to achieve the application. As strategy gets converted into discrete, narrowly focussed, lower level tasks the strategic importance is lost. The lower level operator is not aware of the contribution his or her small operation is having. He/she is simply unaware of the strategic objectives of the project or sub-project. In the absence of the strategic reasons for the task the operator assigns local or personal objectives to the task. When decisions are made, as they will need to be, about the task they will be made according to the local or personal objectives that the operator has assigned to the task rather than according to the much more important strategic objectives that the project or sub-project is ultimately supporting. To say that this sort of communication problem is inevitable in large organisations, is not good enough. Large organisations are a fact of business life and are the norm and will be for the foreseeable future. It is necessary to find mechanisms to prevent the organisation from losing sight of the business objectives as strategic plans are brocken down into tactical and operational plans or projects.

A second question is what about the infrastructure projects ? Clearly some will arise from the applications portfolio. How can these be identified ?

Above, when discussing projects we identified the possibility of a mapping of many applications to one project, where several applications can be dealt with in a single project. In many instances this will be an infrastructure project, perhaps putting in place several infrastructure elements to enhance the infrastructure to support business operations in several areas of the business.

Another approach would be to look at each of the projects and identify the components (for each of the projects) which relate to each of the five infrastructure elements, namely :

1. Technology
2. Data
3. Methods
4. People/Skills
5. Organisational Factors

This clearly can only be carried out at a high level since if this analysis is undertaken in too much detail then analysis paralysis could result and/or it could take too long.

When this high level breakdown of the infrastructural aspects of the initial project portfolio has been achieved for all the projects then we have conceptually a matrix. Figure 4 below illustrates the matrix :

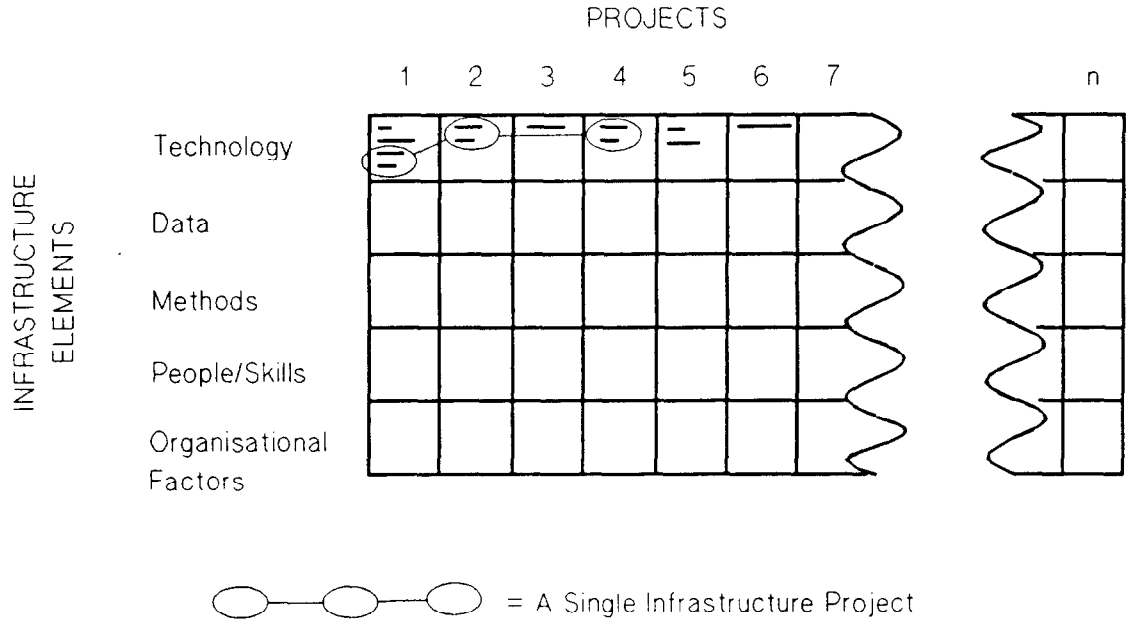


Figure 4 - Infrastructure Requirements Matrix

From this conceptual matrix the aim must be to identify, for each infrastructure element, instances where components of several projects' requirements should be brought together into infrastructure element projects. Again the opposing forces of technical imperatives and strategic dilution must be balanced.

The combination of the initial projects and the infrastructure element projects combine to create the project portfolio.

A third question is how are the priorities, timing, business contribution, etc associated with the applications in the applications portfolio brought through into the projects portfolio ?

This might be achieved during the mapping process by mapping not just the application onto projects but by bringing across other characteristics of the Strategic Grid. This might be achieved using a concept I will call STRATEGIC INHERITANCE.

The most important characteristic of the Strategic Grid to bring across is BUSINESS CONTRIBUTION . This can be viewed as falling into the familiar typology of Turnaround, Strategic, Factory and Support. From the perspective of the project it experiences two main types of mapping :

1. UNITARY MAPPING (one to one). Where it maps back to only one application in the strategic grid.

2. MULTIPLE MAPPING (one to many). Where it maps back to several applications in the strategic grid.

The unitary mapping situation is the most straightforward. It simply inherits the business contribution of its parent application. If its parent was a Turnaround application then the project is a Turnaround project. If its parent was a Strategic application then it is a Strategic project and so on for Factory and Support.

In the case of unitary mapping, strategic dilution is potentially minimal.

The multiple mapping situation is more complex. In this situation each project has several parents back in the applications portfolio. This will be particularly the case for infrastructure projects.

One approach is to extend the concept of strategic inheritance to encompass the idea of DOMINANT GENE.

Under this idea the project inherits the business contribution type (ie. Turnaround, Strategic, etc) of its most dominant parent. In this case dominance has two dimensions :

1. STRATEGIC CONTRIBUTION, where a strategic gene takes priority over all other genes, a factory gene dominates in the absence of a strategic gene and a support gene only dominates if all the parent applications for a project are in the support box.

2. SIZE CONTRIBUTION, where, if in a multiple mapping, the sizes of the parent applications are different (in business terms), as they usually will be, this may affect the inheritance of the project from its parents' genes.

In this way, using strategic inheritance we should be able to derive a **business contribution type** for each project.

Similarly strategic inheritance could be used to bring across the priorities and timings associated with the applications portfolio into the project portfolio.

The project portfolio could now have the same management principles and approaches applied to it as we applied to the applications portfolio in the DISS framework

This is particularly the case for the generic IS strategies attached to each application. The generic IS strategies could be applied to the projects portfolio. This could either be achieved, as for business contribution, by the project inheriting the generic IS strategy from its parent application or applications. Alternatively the generic IS strategies could be applied afresh to the project portfolio according to the business contribution type as it was applied to the applications portfolio back in the IS Strategy process (i.e as follows :

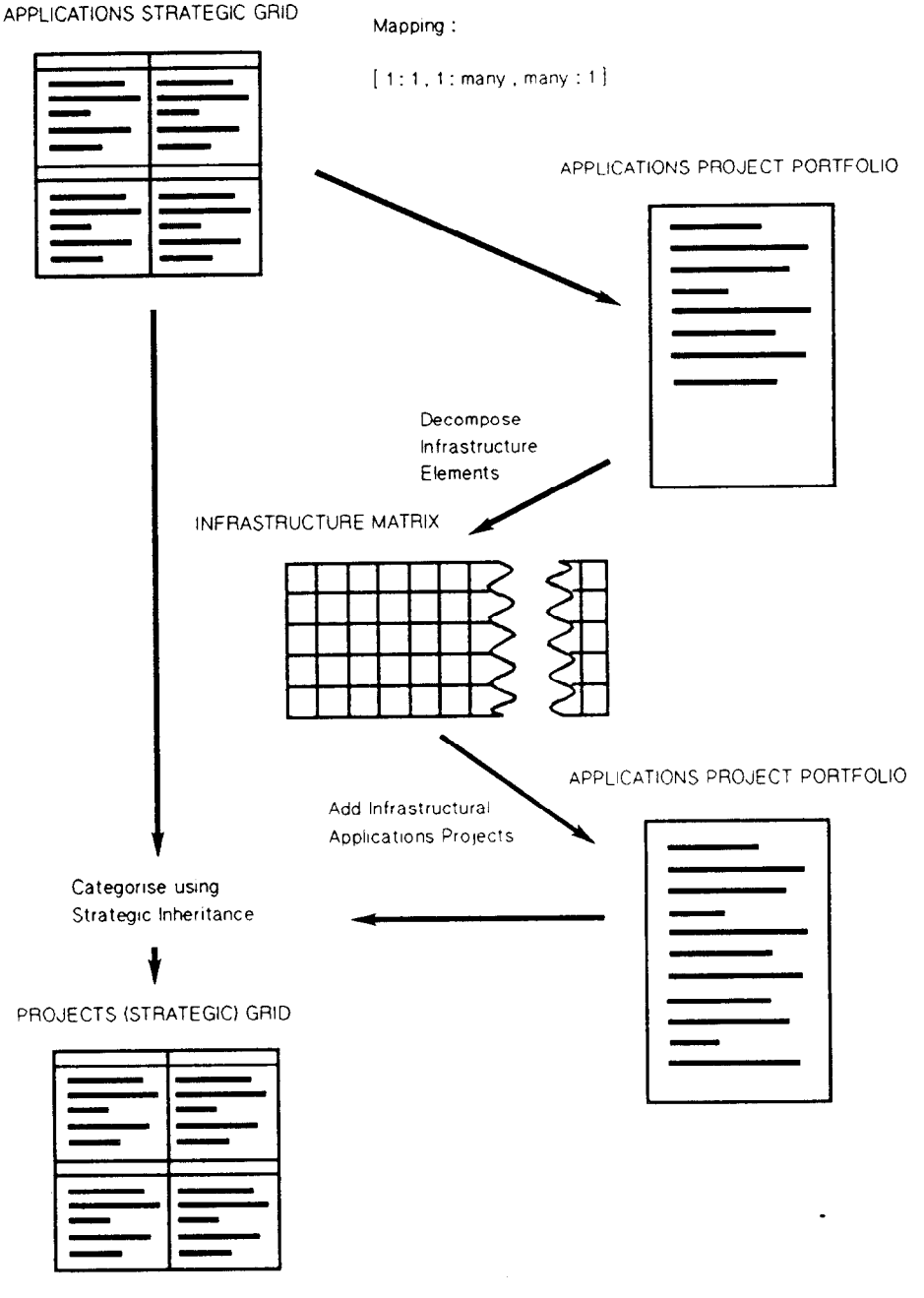
SUPPORT projects - SCARCE RESOURCE Generic IS Strategy.
FACTORY projects - MONOPOLY Generic IS Strategy
STRATEGIC projects - CENTRALLY PLANNED Generic IS Strategy
TURNAROUND projects - LEADING EDGE or FREE MARKET Generic IS Strategies).

Clearly with the case of multiple mapping the amount of strategic dilution is greater. It is probably greatest in the case of the infrastructure element projects since not only will they have multiple parents but they are removed from the strategic grid by an extra stage.

To minimise the loss of focus on business contribution a STRATEGIC ADDRESS could be used, linking each project back to it's parent in the applications portfolio and back through to the business objective it is in existence to support. This strategic address could be extended as projects are broken into sub-projects by project management. In this way the strategic contribution can always be identified from the strategic address.

However, the aim must be to minimise strategic dilution as much as is practicable during the mapping from applications portfolio to project portfolio.

Diagrammatically this might be summarised as follows :-



Clearly the above discussion has introduced a whole set of new concepts but has achieved both the transition from application portfolio to a projects portfolio and the carrying forward of the Strategic Grid concept to the Project Portfolio. This is important below since the portfolio management techniques and concepts which have been developed for the Strategic Grid can be powerfully applied to the project portfolio to increase the effectiveness of IS management at the level above that of single project management.

6. ESTABLISHING THE CURRENT STATUS OF INFRASTRUCTURE ELEMENTS

The current status of the infrastructure elements is an important part of the knowledge base for the design of the overall architecture. It is also an important factor for the Infrastructure Requirements Matrix. Within the matrix some of the infrastructure requirements will already be in place and so no infrastructure project is needed to create them. Infrastructure projects result where they are not in place. Determining their status requires an inventory of the components of the infrastructure elements to be compiled. A SWOT type audit of these components is required to determine the role being played by each.

In outline the status of each infrastructure element would contain the following :

TECHNOLOGY

Details on
- Computer platform
- Communications platform
- Software platform.

This would contain summary level information on the inventory of each, how the components are related, their usage and their efficiency/effectiveness.

The supplier strategy, technology monitoring and transfer policies and maintenance procedures would be included.

Both ISD and end user computing would be covered.

DATA/INFORMATION

Would identify databases and summaries of data elements, relationships between databases, policies on data access, security and privacy, and the approach taken to data distribution.

Again an inventory of data is required at summary level along with an audit of its usage, quality and accuracy. Again at a high level.

APPLICATIONS/FUNCTIONS

An inventory of the current applications, how they interrelate and an audit of their role and their quality from user, business and technical perspectives.

METHODS

Again an inventory of project management, systems development and quality assurance methodologies used, together with information on usage and a SWOT of their effectiveness.

Would probably include the management policies relating to the support of end user computing.

PEOPLE/SKILLS

An inventory of IS related manpower (in both ISD and user areas) their skills, education, experience etc.

Might also usefully include an attitudinal mapping of the organisation as a whole on IS related

ORGANISATIONAL FACTORS

The following need to be mapped out for those aspects of the organisation which are associated with IS :

- Management style
- Culture (History, values, rituals, mores, legends)
- Organisation structure and dynamics
- Power distribution and political/social influence
- Stakeholders
- Capacity for change.

7. DESIGNING THE ARCHITECTURE

From the above discussion the requirements for infrastructure projects and application development projects have been derived. Determining the projects is not a simple process. Clearly it requires a combination of skills. Since business contribution is paramount in the above discussion, business skills and perspectives are required. However several of the infrastructure elements are potentially quite technical and so technical skills and perspectives are also required. These hybrid skills are rare so this probably means that the process needs a multi-disciplined team.

Additionally we must not lose sight of end user computing. Whilst detailed planning for end user computing is virtually impossible, infrastructure planning to support end user computing is very necessary. The infrastructural support for end user computing will have an important influence on how end user computing develops.

Added to these must be two other considerations :

1. **STRATEGIC FLEXIBILITY** Analogous to buffer or safety stock in inventory management, a development and operational capacity over and above the minimum required to achieve the applications/project portfolio is required. Not all the applications will be identified by the DISS process. This is partly because no planning system is perfect, secondly no forecasting is perfect. As indicated earlier research by Lederer and Setti has shown that circa 35% of development projects are not identified by IS strategy planning methodologies.

2. **STRATEGIC ROBUSTNESS.** Organisations will experience unforeseen 'strategic shocks' from their environments. The frequency and magnitude will vary from one organisation to another. Whereas a massive strategic shock such as being taken over by a competitor would mean re-planning the IS strategy, it would be unacceptable for minor strategic shocks to require a complete re-planning exercise. Strategic robustness will have to be built in to the Architecture to absorb minor shocks.

The above two will generate both additions to projects already in the project portfolio and additional projects.

These will not have a strategic address (or origin) back in the strategic objectives of the business, their address will refer to strategic flexibility, or strategic robustness.

The design process itself is an iterative process involving the development and evaluation of alternative architectures until an appropriate architectural design is achieved.

Although detailed constraints are overmapped onto the architecture in the next stage, the architectural design team will take into account high level constraints to ensure that the resultant architecture is at least in the right "ball park".

Diagrammatically the above might be summarised as follows :

[Diagram on next page]

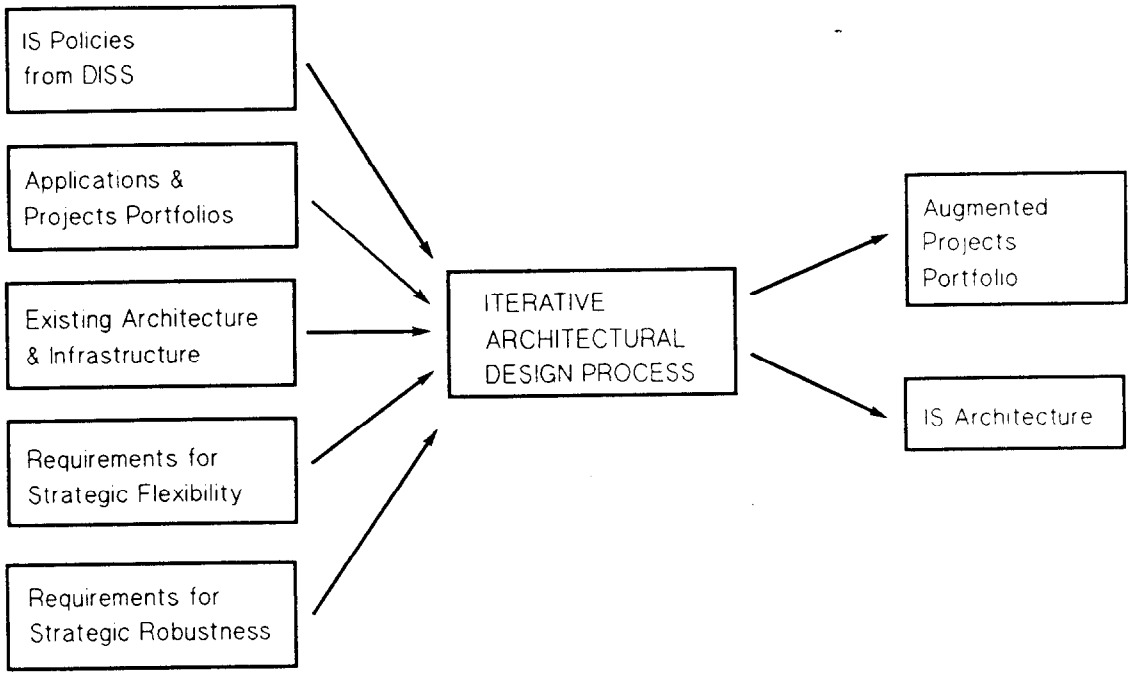


Figure 6 - Architectural Design Process

Split by Infrastructural Element the design process would involve the following :

TECHNOLOGY

- Blueprints for computer, communications and software platforms.
- Policies for technology monitoring, technology transfer, supplier relations.
- Blueprints for maintenance and disaster recovery.

DATA/INFORMATION

- Blueprints for databases, text storage and image recording.
- Blueprints and policies for data access, security and distribution.

APPLICATIONS/FUNCTIONS

- Blueprints of applications and inter-relationships between applications.

METHODS

- Blueprint for methods and the relationship between methods.
- Structure and policies for the support of end-user computing.

PEOPLE/SKILLS

- Projected profiles of IS related manpower levels, and skills, education and experience levels.

ORGANISATIONAL FACTORS

- Mapping of the relationship of other architectural components to management style across the organisation to ensure consistency.
- Mapping of the other architectural components to culture across the organisation to ensure consistency.
- Blueprint for organisational structure, as impacted by IS.
- Mapping of the relationship of architectural components to organisational and political power distribution.
- Mapping of attitudes/roles of key organisational stakeholders in relation to IS.
- Blueprint for IS-related change across the organisation to ensure consistency between necessity for change and capacity for change across the organisation.

The architecture design is a series of time phased views, since the architecture is an evolving entity, The architectural components above can also be viewed as evolving structures over time. What provides the link between these different architectures is the various infrastructure and applications projects which develop, enhance and build the future architectures.

The diagram below (figure 7) illustrates this :

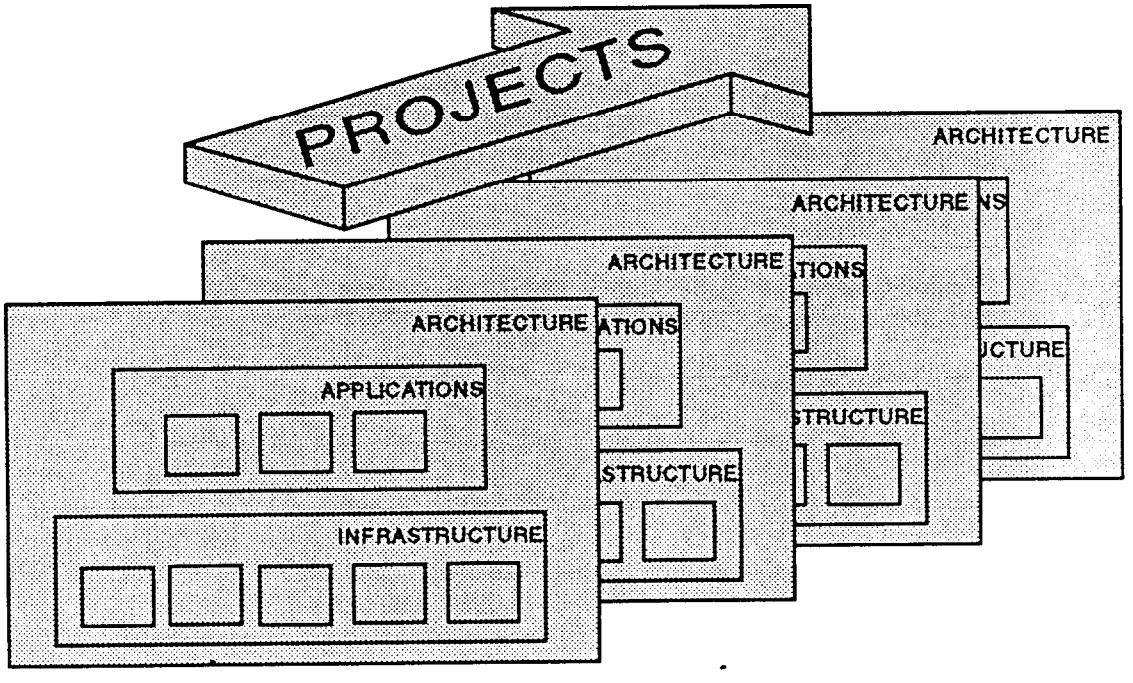


Figure 7 - The Evolving Nature of the IS Architecture.

8. CONSTRAINING THE DESIGN

It is clearly important to constrain the design to ensure that it is in fact achievable. High level constraints will have been applied at the DISS level, during the mapping of applications onto projects and during the design of the architecture.

The purpose of this stage in the process is therefore to apply detailed constraints to the detailed architecture to ensure, as far as is practical, that the plans will be achievable.

The stages in this process would include :

1. Explosion of infrastructure and applications projects to determine high level estimates of resources required.

2. Determine resources which are available or through negotiation, could be acquired. This will of course be related to a very significant extent to the business benefits being offered.

3. Comparing resources to architectural requirements and constraining architecture where necessary. Constraining may require re-negotiation of IS applications, buffers, resources, etc.

Split by infrastructural element the constraints would include the following :

TECHNOLOGY

- Availability of technology
- Lead times from technology suppliers
- Manpower/skills to import and support the technology
- Management/organisational willingness/ability to import the technology.

DATA/INFORMATION

- Availability of data, particularly the build up of historical data
- Ability of the technology platform to enable the building of new data
- The willingness/ability of individuals/groups/functions to accept and action new policies on data access, security and distribution.

APPLICATIONS/FUNCTIONS

- Availability of technology platform and data
- Manpower/skills availability
- Ability/willingness of the organisation to accept and absorb the changes necessary.

METHODS

- Skills/education/attitude of personnel to accept and use properly the methods
- Ability of personnel to change.

PEOPLE/SKILLS

- Ability of organisation to absorb new people.
- Ability of organisation to achieve training/education/development plans.

ORGANISATION FACTORS

The following are all constraints which have to be taken into account :

- management style
- culture
- organisational structure
- the distribution of organisational and political power
- attitudes/roles of key stakeholders
- organisations capacity for change.

OVERRIDING CONSTRAINTS

Three constraints can be identified as applying to the whole package of architecture, infrastructural elements, applications and projects.

1. **Finance/Budgets.** Whilst financial justification will influence the availability of funding, in many situations there will be absolute limits on the availability of finance. Typically will be where borrowing limits are externally set for an SBU by the parent company or the financial markets; or where budgets must be set in advance as in government sectors or where significant borrowing would be inappropriate.

2. **Management/Leadership Skills.** It is the whole as well as its parts which must be managed. The availability of management to lead the implementation and its component parts may impose a significant constraint.

3. **Top Management Acceptance.** Approval for both the whole and its parts will have to be obtained from top management. Their attitudes/values are a powerful constraint. Their paradigms can usually only be shifted with difficulty.

9. MANAGING THE PROJECT PORTFOLIO

The various blueprints, policies and mappings combine with the applications portfolio to represent the goals or milestones for the development of the organisation's IS architecture. These will all exist along a time continuum. As indicated above, the projects in the project portfolio are the means of moving along the time continuum from one milestone to the next achieving the goals and reaping the benefits.

Each project will have its own plan and set of resource profiles required to achieve it. Each project will have its own benefits profile. The benefits will largely derive from the contribution it will make to the organisation's objectives. The strategic address will detail the locus or loci of the contribution, information economics will detail the nature and magnitude of the contribution.

In due course project management will implement the individual projects.

However there is a need to manage the projects as a portfolio at the level of the sum of all projects.

Two mechanisms are clearly available to IS management :

1. **Portfolio Management Techniques.** Many of the techniques applied to the applications portfolio can be applied to the project portfolio. Remember by mapping business contribution over from the applications portfolio we have a project portfolio split into the four categories of Turnaround, Strategic, Factory, Support. It can be argued that some of the things we have historically mapped onto the applications portfolio (e.g. where to use prototyping, CASE tools etc) are better applied to the project portfolio. In this way we can apply management principles to the portfolio and vary our project management according to the position in the strategic grid and vary our management of the project portfolio as a whole according to the composition of the portfolio.

2. **Simple Aggregation Techniques.** Important views of the project portfolio can be obtained by aggregating the high level plans and resource profiles for the individual projects.

This aggregation could be quite sophisticated (e.g. by project category, by infrastructure element, by application, by functional area, by responsibility, etc.) This could allow quite sophisticated project portfolio planning and control techniques to be employed.

The importance of this stage is that it allows the management of the portfolio of projects to be achieved, so that the IS function as a whole across the organisation can be planned and controlled and so that the approaches taken can be tailored according to the business contribution of the projects.

To date IS management at this supra-project level has been almost non-existant. Project management methodologies such as PROMPT do not address this level, their focus has been at the level of single project management.

10. OBTAINING COMMITMENT

Commitment to the applications portfolio will have been gained from the IS Strategy document.

The IISS processes afford opportunities to obtain commitment to the architecture and project portfolio through the involvement of the stakeholders in particular and the organisation as a whole in the IISS decision making. This involvement is important. Unless the key stakeholders were involved in the process of designing the architecture, (at least to the extent of helping to define those business capabilities that they need for the achievement of the business objectives they are responsible for), they may simply reject it because they do not understand it.

Ultimately the top IS management and senior business management must agree the implementation plans. They are required to accept the following :

- Amended applications portfolio
- The overall IS architecture and its consequences
- The project portfolio
- The resource profiles to carry out the project portfolio.

Four issues will be critical for acceptance :

- The quality and credibility of the ISS implementation analysis and planning.
- The economic (in the widest sense) justification.
- The acceptability of the implementation plans to the key stakeholders in the organisation and the organisation in general.
- The management/leadership in place to achieve the implementation plans.

Gaining commitment is, in part, a political and in part a marketing exercise. Stakeholder analysis is essential. Planning the marketing of the architecture and projects portfolio is also essential. Marketing will often extend to parent organisations, industry bodies, government, IT suppliers, and business partners in the value chain.

11. INTERFACE WITH PROJECT MANAGEMENT

The implementation planning process will hand over to project management a clearly defined project. The strategic address will identify for project management, and for all other personnel involved in the project, the contribution the project is making to the objectives of the business. This is important since for most projects it will give a high level meaningful mission for the project team. For example instead of simply setting up a sales reporting system they will instead be contributing towards a business objective of say gaining a 20% increase in market share.

The high level resource and benefits profiles give targets or guidance to project teams.

The project portfolio and aggregation profiles give valuable planning and control information to IS management for the management of multiple projects. As project management establish detailed plans for projects, variances against high level estimates will need to be fed back up to the IISS level where IS and business management can look at the consequences for the whole project portfolio before agreeing to the new estimates.

The management of projects at the dual levels of individual project and at the level of the project portfolio should result in more effective project management. The allocation of project managers and team members can be determined in the context of what is optimal for the portfolio as a whole and the business contribution sought by the project.

12. THE IISS FRAMEWORK - A SUMMARY

The above discussion has outlined a process for the planning and control of the implementation of an IS Strategy. The stages in this process are seen as comprising:

1. Ensuring the appropriate outputs are in place from the IS Strategy framework used. These outputs would at least comprise a prioritised applications portfolio.

2. The transformation of the applications portfolio into a portfolio of applications and infrastructure projects.

3. Establishing the current status of infrastructure elements (including anticipated development). This would include both an inventory of infrastructure elements and an audit of their technical and business contribution.

4. The design of an architecture to support the provision of the applications portfolio.

5. The constraining of the architecture by a variety of technical and organisational constraints to ensure an achievable architecture.

6. Planning projects to create the infrastructure elements, applications and resultant architecture.

7. Obtaining commitment to the plans and the infrastructure/applications/architecture products. Includes obtaining the allocation of the necessary resources to achieve the plan.

8. Hand over of individual projects to project management in line with the implementation plans.

As with the IS Strategy process, the IS Strategy Implementation process is not a one off event but an ongoing process. The extent and frequency of revision will vary from one organisation to another depending upon the volatility of the organisation's environment and the maturity of the organisation. In an ideal situation the IS Strategy development and implementation planning processes would both follow the same cycle as the other formal business planning cycles, typically annual review with major review every 3 years or so. Implementation plans would extend forward in line with the IS Strategy plans, typically 3 to 5 years. Implementation planning for the first 1 to 2 years would incorporate, as it becomes available, the more detailed project planning information for the individual projects currently under way.

For very large global companies such as Xerox, Ford, Citibank, the management of IS is complicated by the presence of a "federal" structure, by which there are IS divisions within operating units as well as at the level of the strategic business unit. As for the IS Strategy process the IS Strategy implementation process needs to be undertaken at the SBU level. Within federal structures this means that the central IS management at SBU level must take responsibility for implementation planning, co-ordinating the plans of the individual operating units and setting standards and policies.

An additional issue is that of the creation of architectures at levels above the strategic business unit. There are three such levels :

- Group level.
- Industry level.
- Societal level (national and global).

There is often scope for group level infrastructure projects to provide infrastructural components for the use of all or some of its strategic business units. Additionally applications at group level to co-ordinate or monitor business units may place IS requirements on the business units which affect some aspects of the applications or infrastructure. Clearly the dominant level is that of the strategic business unit. The group level would co-ordinate the architectural development of the group, identifying opportunities for SBUs to co-operate in joint infrastructure developments.

Increasingly the necessity for the planning of some infrastructure elements at industry or societal level is becoming evident. At these levels co-ordination and co-operation becomes quite difficult, particularly because this is a recent phenomenum. This supra-organisational infrastructure development has often to be co-ordinated. Candidates for the co-ordination role are :

- Government bodies
- Industry bodies
- Dominant companies in an industry
- Technology suppliers

A topical example is the development of EDI links between organisations. Here in the UK the government (DTI) have played a major role in promoting awareness concerning EDI and setting up EDI communities. In some industries, industry bodies such as CEFIC in the chemical industry have played a role in promoting industry wide EDI networks and standards. In other industries, such as retailing, the lead has been taken by the large, dominant retailers. In other cases the EDI network suppliers have promoted their networks and set industry standards.

The interplay of initiatives at these supra-organisational levels can place both constraints and offer infrastructural opportunities for business units.

13 CONCLUSIONS

The paper has outlined a framework for the Implementation of IS Strategies. This framework comprehensively links the outputs from the IS Strategy formulation process to the methodologies for project management. Techniques are suggested for preventing the organisation from losing sight of the original strategic objectives during implementation. The implementation framework addresses the issues of infrastructure development and the overall IS architecture, not really addressed by IS Strategy formulation methodologies. Whether this is addressing a weakness of IS Strategy formulation and should really be an enhancement to the IS Strategy development methodologies rather than part of implementation planning is subject to debate.

It must be stressed that the framework outlined in this paper is neither complete nor formally tested. Plans are in place to research its validity. Nevertheless the IISS framework is based on the collective experience and knowledge of Cranfield's IS Group. It is important because it is a thoroughly considered approach from Europe's largest Business School IS Group and builds on their international reputation in the IS Strategy field.

The IISS framework undoubtedly establishes them as an international leader in the new field of IS Strategy Implementation.

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