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Executive Information Systems: A framework for their development and use

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Abstract

The development of Executive Information Systems (EISs), incurs risks. Success depends highly on how well the implementation process is managed in terms of technology and the users. Factors during the development process and especially during the use of he system can affect its eventual success. To study these factors we need to examine EISs use separately from the rest of the development cycle. To do that effectively we need to have a structured framework to classify the various components involved and highlight the relations between them. This paper proposes such a development framework for Executive Information Systems.

1. Background.

The potential for utilisation of computers as part of information systems in the business environment was realised as early as the 1960s. The first applications were mainly aimed at automating existing tasks (Watson et aI., 1991; Willcocks and Mason, 1989). As computerisation evolved, systems were designed to support the management of the organisation. The earliest approach was the introduction of Management Information Systems (MIS). These systems were operated by systems professionals and were used to generate regular, pre-defined, reports containing information about the organisation (Millet et aI., 1991). A later attempt to assist managers in their jobs, is the utilisation of Decision Support Systems (DSS). These provided assistance with specific decision making tasks. However, despite the superiority of both of these approaches over non-computerised systems, and their relative success with lower and middle management, they failed to provide the necessary support to executive managers in organisations (Watson et aI., 1991).

"Executives are managers with formal authority over the whole of an organisation or an important functional unit of one" (Thierauf, 1991). They have responsibility and are accountable for the results of their actions, to either other executives (higher on the organisational scale) or to the owners of the organisation (McLeod and Jones, 1986). A prominent characteristic of the executive's role is the making of decisions (Mintzberg, 1975). This refers to evaluating possible courses of action and selecting and initiating one of them. In order to take effective decisions, executives need to have access to 'high quality' information. Such information needs to be relevant to the variables affecting the outcome ofthe decision, accurate, timely and up to date. Moreover it needs to be accessed easily and presented in a format that makes it easily understood.

Since efforts to satisfy executives' information needs through computerised systems operated by other people had not proved successful, Information Systems professionals took up a new challenge: the development of information systems to be used directly by executives. This challenge was met by the emergence of Executive Information Systems (EISs). This was an attempt to solve many of the problems experienced with previous types of information systems for management. They focus on executives' information needs and provide them with direct access to information. The idiosyncrasies of executive managers as users of information, bring forth particular constraints for computerised information systems.

The term 'Executive Information Systems' was introduced in 1982 (Rockart and Treacy, 1982) to describe the kind of systems a few senior corporate officers were using on a regular basis to access information they needed. Unfortunately, there is no standard, universally accepted definition as to what the term EISs encompasses. Different researchers use a different working definition which usually refers to some characteristics of what the term 'Executive Information Systems' describes. In much of the literature the term Executive Support Systems (ESS) is used interchangeably with EISs to describe the same kind of system. Rockart and Delong (Rockart and Delong, 1988), make a distinction between the two terms. They define and use the term ESS to refer to systems with a broader set of capabilities than EISs. While the term EIS denotes providing information, ESS implies that other support capabilities are provided. These might include communications support, like electronic mail and teleconferencing facilities, data analysis capabilities such as spreadsheets, query languages and Decision Support Systems and other organising tools, e.g. electronic calendars. What is important about this distinction is that the extra options available in an ESS, increase the system's technical requirements, as well as provide extra functionality (Watson et aI., 1991).

For the purpose of this research, EISs are defined as computerised information systems designed to be operated directly by executive managers without the need of any intermediaries. Their aim is to provide fast and easy access to information from a variety of sources (both internal and external to the organisation). They are easily customisable and can be tailored to the needs and preferences of the individual executive using it. They deliver information of both soft and hard nature. This information is presented in a format that can be easily accessed and most readily interpreted. This is usually achieved by the utilisation of multiple modes of accessing data and the use of Graphical User Interfaces (GUIs) . This will form the working definition of an EIS.

Under various disguises, true computer terminal-based Executive Information Systems have been available for about two decades (Paller and Laska, 1992). Since the term was first introduced, the trend of senior management having direct access to computers, has grown. EISs are slowly becoming a significant area of computing. The increasing amounts of money invested in EISs development projects and the subsequent operation of these systems is an indication of the growing significance of EISs. (Millet et aI., 1991, Belcher and Watson, 1993). Recent work by Kolodziej demonstrates this rising trend in EISs expenditure by giving actual figures. These figures could be significantly higher in practice, since costs of systems developed or enhanced in-house, are difficult to determine and include in such surveys (Ryan, 1989).

This trend is attributed to more powerful machines becoming more affordable, the decreasing costs of off-the-shelf EISs software and the fact that more people learn EISs developing skills (Paller and Laska, 1990). Despite this trend of decreasing EISs building block prices, the cost of development and maintenance of these systems is still relatively high (Paller and Laska, 1992). Therefore EIS development projects incur risks. Although very few EISs failure cases have been documented (e.g. Volonino and Robinson, 1991), the multitude of articles of prescriptive nature based on experience, suggests that EISs failures are not an uncommon phenomenon. Moreover, even organisations which claim to have installed a successful system have experienced an EIS failure prior to an EIS success (Watson and Frolick, 1993).

Assessment of success (and consequently identification of failure) in the area of EISs is hindered by the fact that evaluation of the benefits of these systems is difficult. This is mainly due to the intangible nature of these benefits (Thierauf, 1991). The concept of failure in the area of information systems is generally ill-defined (Lyytinen and Hirschheim, 1987): Many researchers consider failure as evident needing no further clarification. Even those who attempted to define it, have gone only as far as discussing one type of failure or a reason for failure. Lyytinen and Hirschheim refer to work done by various people discussing situations where Information Systems have been found to fail. Some examples include: when the potential benefits of the system are not realised (Alter and Ginzberg, 1978), when the Information System is not used (Lucas, 1975), when the users have a negative attitude towards the system (Bailey and Pearson, 1983), when there is substantial user resistance (Markus, 1983) and when a functioning system is not delivered (Gladden, 1982). Lyytinen and Hirschheim propose the concept of expectation failure which tries to integrate all of the above types of failure. This describes the notion of identifying a system failure when the system is unable to fulfil one of the stakeholder groups' expectation.

With EISs, the focus is to provide improved information to executives, fast. Although savings in the time taken to deliver information are increased significantly, the actual benefits are not always direct. Savings in time can be tied to an improved mental model, of the executive about the organisation, and its relation to various other external variables, which in turn results in better decision making. The value of the system depends on how useful the executives using it, perceive it to be, and how much it is being used (Delong and Rockart, 1992).

Unfortunately in the existing literature on EISs, there is no clear agreement as to the factors that are most significant in making the implementation process successful (Delong and Rockart, 1992). It is however agreed that for an EIS, success or failure to a considerable extent depends on how well the implementation process is administered
both in terms of technology and the users (Watson et aI., 1991). A number of complications which can arise during development can affect the success with which these systems will be used. Moreover the position of the users within the organisation, their job requirements and their informational needs present a set of unique and difficult problems that need to be overcome if the system is to be successful. In other words, success for an EIS is affected by factors during the development process, especially during the use of the system. For this reason the use of EISs needs to be examined separately from the rest of the development process. The term 'EISs usage' is used in this paper to refer to the operation of the system by its users. 'EISs development' is used to

refer collectively to all the activities that take place to create or expand an Executive Information System, up to the stage where the resulting application is delivered to the users.

To ensure a minimal risk of failure, we need to be aware of the various factors that could potentially affect the success of the system. The most effective way to gain such an awareness is by having a structured approach to facilitate the study of these factors. This is provided by the construction of a suitable development framework for the classification of relevant issues. A development framework is "helpful in organising a complex subject, identifying the relationships between the parts and revealing the areas where further developments will be required" (Sprague, 1980).

2. Four frameworks for EIS development.

As part of research done in both the academic and professional communities, a number of frameworks and models of the EISs development process have emerged. Four frameworks are reviewed in this paper. The purpose of the examination of these frameworks is to identify features useful in identifying elements of EISs development and usage that influence the success of these systems. These features, once identified can be combined in a single framework which will serve as the foundation for a deeper study of the factors associated with the success of EISs.

2.1. ESPRIT

The first framework isa model of the installation of *Resolve*, a commercial EISs software package marketed by Metapraxis. (Meiklejohn, 1989; Bird, 1991). The people responsible for its marketing, suggest that the framework was developed after experience gained from installing *Resolve* in client companies on what they considered to be successful EISs development projects. ESPRIT is a sequential framework in the form of a six-phase approach. It essentially describes an evolutionary prototyping method. It starts with a feasibility study and follows on to other stages of development up until installation of the final system and training of the users. Metapraxis claims that it is applicable to all organisations. A diagram of the outline of the framework is given in the following figure and some issues relevant to each phase, are briefly discussed below.

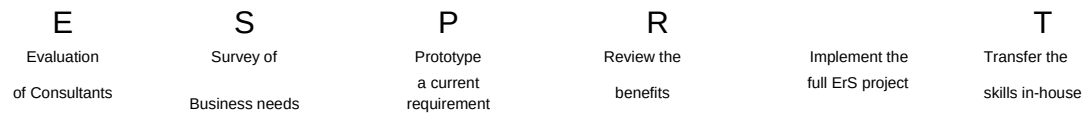


Figure 1. Outline of the ESPRIT framework.

In the first phase, the consultants undertaking the development project are committed to carry out a joint survey to assess the EIS requirements. The suitability of the consultancy team is then evaluated. Among the things that need to be considered is whether the team has experience in the particular industry in which the system is to be implemented and also a full understanding of the criteria by which the organisation measures success.

The second phase consists of a survey and feasibility study to identify a suitable prototype project. End-users of the system and other people affected by the system are involved in the project. The software and hardware to be used for the prototype are selected. It is also necessary, at this stage, to assess availability of data. A formal proposal comprising timescales, costs, benefits and detail of activities is then drawn up. This forms the terms of reference for the project and the consultants should obtain authorisation to go on with the prototype.

Once the prototype is finished it is presented to its users. This is best done at an executive meeting. It is a way for the system to establish credibility for itself. The presentation should focus on giving a realistic impression of what the system will provide when it is complete. Any data displayed should be checked to ensure accuracy relevance and timeliness before they are used. This occasion provides an opportunity for potential users to explore the system and ask questions about it.

The prototype is installed in the executive sponsor's office to demonstrate how the sponsor will use his/her time more productively, and how money can be made or saved when using the system. A formal cost/benefit analysis takes place at this point. Based on this, and in the light of experience gained so far, the full EIS proposal is updated with full project costs and timescales set out. The proposal is then submitted for authorisation to proceed.

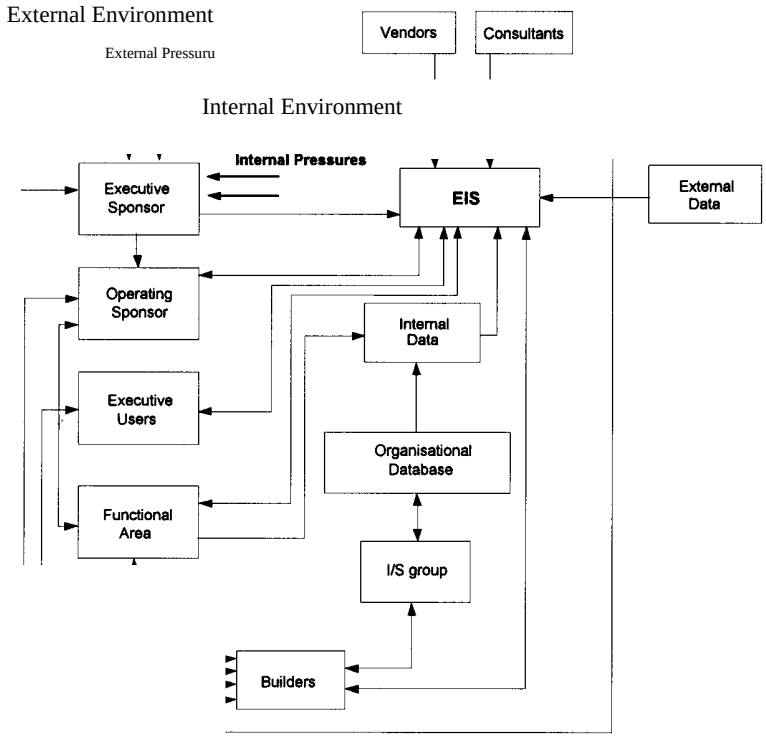
It might be necessary to make changes to the prototype even to the extend of starting all over again with a new organisation structure in mind. New hardware may need to be acquired. The choice of software is re-evaluated in the light of the new changes. Procedures for the automation of collection of information are designed and implemented incorporating extensive checks on the data for suitability. Then the format of the reports (both paper and on-screen) delivered by the system is designed and the EIS is ready for use by the developers at key executive meetings.

The last phase involves the design and implementation of training courses for the users of the system. Training of the senior executives is then done on a one-to-one basis. The pace of the sessions is taken slowly. Training courses for planners, analysts and the system manager are also planned and implemented. Any documentation supplied with the system, about the facilities the EIS provides, is produced in different versions for each type of user. The users are then interviewed and their comments about the benefits gained from installing the system are documented in order to justify the costs of running the EIS on a permanent basis. At this point, the next EIS project should be identified and plans made about its implementation which should be an easier undertaking.

2.2. A **Structural** EISs Framework.

This framework was put forward to classify the results of a study on EISs practices conducted in the US, in 1988. The study involved 50 companies that were either using an EIS or were very near to having one operational. The framework stems from practical experience in developing EISs, a body of literature on EISs and discussions with EISs vendors, consultants and EISs staff members (Watson et aI., 1991). The framework consists of three components an outline of which is given below.

The first component, is a structural perspective of the development of EISs. It illustrates key elements, important to the development process and the interactions between them. The following diagram summarises the structural perspective.



Structural Perspective of EISs development

The authors identify a number of elements associated with the structural perspective. These elements are classified into two categories: Personnel and Data. The first category, includes people involved in developing an Executive Information System. The other one makes the distinction between data internal to the organisation and data used from outside the organisational boundaries.

The framework takes the view that EISs development is a dynamic process that places the elements making up the structural perspective in motion. Issues relevant to the development process form the second component of the framework. They are included in the framework to focus attention on issues relevant to activities undertaken to develop an EIS, since these activities play an important role in the success of the final system. Issues put forward in this component include, the development time for a system, the development methodology used, the hardware and software used for the system as well as issues about the evolution and spread of the system to other members in the organisation.

The third component is the user-system dialogue. Various issues in relation to the users of the system are addressed and classified into three categories. The first of these, involves issues concerning the knowledge users need to operate the system. The second category addresses issues pertinent to the operation of the system, such as system response time and the user-system interface. Finally, the last category looks into how information is presented and the effect of the use of colour and multiple presentation formats. The 'usersystem dialogue' component is important as it incorporates the users' perspective in the framework.

2.3. A path framework for EIS.

Most literature on EISs focuses on either prescriptive suggestions for EISs development and implementation, or descriptive explanations of how EISs work. The path framework puts forward a new perspective. It draws attention to the importance of timing and co-ordinating EISs development so that it is appropriately matched with the organisation's level of decision-making maturity and technical capabilities. It also describes how, "EIS evolve from the MIS foundation to answer managers' needs for integrated focused and accessible information" (Millet et aI., 1991). The framework places emphasis on the importance of choosing and managing the appropriate path of transition leading to the installation of an EIS.

According to this framework, EISs development happens as a result of an evolution through stages of technological and organisational capabilities. The evolution of an EIS from traditional Management Information Systems requires changes in two areas. Firstly, there has to be a shift from a batch to an interactive environment, and then, an increase in information focus and integration. Each of these transitions requires and results in technological and organisational change. Attempting changes in both dimensions simultaneously might affect the success with which the resulting system is used. The diagram below summarises the two dimensional framework:

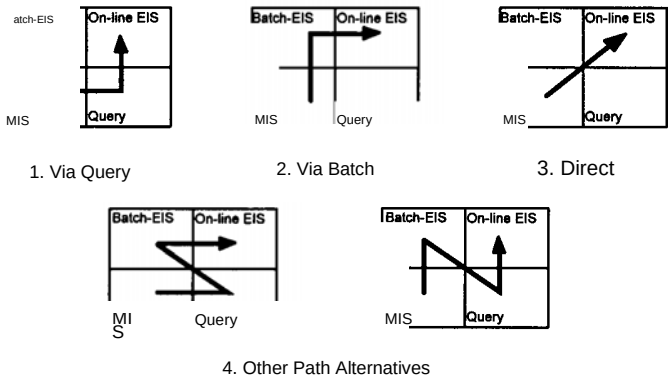
Focus and Integration	Mode of Operation: Batch	Mode of Operation: On-line
High	3. Batch EIS . Key Performance Indicators . Critical Success Factors • Integrated Information . Periodic Paper Reports	4. On-line EIS . Selective, ad-hoc frequent monitoring . Key indicators and backup detail
Low	1. MIS . By-product . Bottom-up . Isolated, Scattered, high volume reports	2. Query . Selective, ad-hoc access for query and analysis . Used by staff

A path framework for EIS

The 'focus and integration' dimension is concerned with the system's ability to provide and integrate information about specific performance measures relevant to various functional areas in the organisation. 'Mode of operation' differentiates between batch systems (designed for periodic reporting) and on-line systems (allowing interactive retrieval of information). The two dimensions result in four types of systems, as shown in the diagram above.

Typically the starting point is the operation of a traditional MIS with the 'on-line EIS' stage representing the most advanced stage in this framework. There are a number of paths an information system can follow that can lead from MIS to an on-line EIS. Some possibilities are illustrated in the following diagram. In practice an organisation might,

after achieving on-line EIS capabilities, implement transitions along either one or both dimensions to add other types of functionality to facilitate the needs of different users.



Possible paths leading to an on-line EIS

2.4. A Structurational framework.

The need for Information Systems research that focuses on social and organisational problems has led to the use of Anthony Giddens' work in relation to information systems. Giddens' Structuration Theory is an attempt to identify an appropriate way to address social issues by integrating different schools of thought within the social sciences (Walsham and Han, 1991). It is essentially a high-level conceptual scheme in which other theories and methodologies can be contained.

The theory has been used in a variety of contexts in relation to Information Systems. Some examples include, analysing how the introduction of new technology influenced actions of people involved (Barley, 1986), the appropriation of Group Decision Support Systems (Poole and Desanctis, 1989), the use of the theory as a model of understanding the nature of technology in organisations (Orlikowski, 1990) and the development of a framework for the investigation of the interaction between human actors and social structure during information systems development (Orlikowski and Robey, 1991). This last framework can be used for analysis and interpretation of the installation of an EIS. The diagram that follows summarises the framework which is based on Giddens' model.

Realm of Social Structure	Systems developers are informed by systems development methodologies and knowledge about their organisation to build IS.	Systems developers work within the constraints of time, budget, hardware, software and authority to build IS.	Systems developers draw on the values and conventions of their organisation, occupation and training to build IS.
Modalities	*Interpretive Schemes*	*Resources*	*Norms*
Realm of Human Action	Systems developers create meaning by programming assumptions and knowledge into Information Systems.	Systems Developers create IS through the organisational power capabilities they wield in their organisational roles.	Systems Developers create sanctions by designing and programming legitimate options and conventions into the IS.

Orlikowski and Robey's framework

Although the authors give a number of examples of the operation of the events described in the framework they observe that empirical evidence is generally lacking. Later work has used this framework to analyse the development of an EIS in a Large Manufacturing Company, to see if the phenomena described in the framework can be observed and determine the value of the framework as a useful guide to research (Jones and Nandhakumar, 1993). Their conclusion was that Orlikowski and Robey's structuration framework was useful in drawing attention to important issues in the EISs development process. Many of the issues identified from applying structurational analysis on EISs development could have been identified using other socially-oriented approaches. These elements do not appear to be particularly unique. This is not because of the deficiency of the approach but rather due to the fact that it correctly identifies issues that are important and should be addressed. Moreover, the framework has a number of features which suggest that it can make a distinctive contribution to the analysis and understanding of EISs in organisations. Finally they suggest that the framework's utility is in the fact that it provides a means of integrating the elements in a coherent manner and of linking them explicitly to human action.

3. Comparing the frameworks.

Each of the above frameworks, has a considerably different perspective of EISs development. This is mainly due to differences in the purpose, nature, emphasis and focus, of each framework. A comparison of the four frameworks helps to assess their usefulness in describing EISs development and use. The criteria that this comparison is based upon are described below:

1. *Nature.*
The first of these criteria is the nature of the frameworks. With the exception of ESPRIT, the rest are formal or semi-formal frameworks. ESPRIT, although referred to as a framework by its creators, fits more the definition of a formal model. This is mainly because of its specificity to the installation of a particular system and its linear, step by step structure.

2. *Perspective.*
To understand the motivation behind the frameworks an important question we need to consider, is how they originated and whose perspective they represent. ESPRIT is a framework developed by practitioners and consequently reflects the point of view of consultants in how the development process should take place. The structural framework proposed by Watson et al. is from an academic's perspective trying to outline what happens in practice. The path framework proposed by Millet et al. is also from an academic's point of view but it does not take as pragmatic an approach as the structural framework. Finally Orlikowski's and Robey's structurational framework gives a purely theoretical perspective from an academic's point of view.

3. *Purpose.*
The purpose for which each of these frameworks was built, is the next issue that needs to be considered. ESPRIT, was constructed to formalise the installation of *Resolve* and provide a structured approach on how to go about developing an EIS application. Watson et aI's structural framework aims to bridge the gap between practice and the academic

point of view. It is supported by an in-depth study of the real world. The path framework attempts to give a new perspective on EISs development by highlighting issues of timing and decisional maturity of organisations. The structurational framework aims to provide a structure to interpret social processes and interactions that go on during an information systems development process.

4. *Level of abstraction.*
The next criterion considered, is the level of abstraction of each framework. This refers to how specific the framework is to a particular empirical situation. The structurational framework has the highest level of abstraction. Due to its theoretical nature, it can be applied to describe a wide range of system development situations and not just EISs development projects. The academic nature of the Structural and Path frameworks gives these approaches a wide range of applicability. However, this is not as wide as the applicability of the Structurational Framework. Finally ESPRIT inherently has the lowest level of abstraction since it is very specific to the installation of a particular system.

5. *Emphasis.*
Where emphasis is placed is another aspect of the frameworks we need to look into. ESPRIT places emphasis on a series of steps and methods that need to be followed in a sequential manner to achieve the development of the EIS. Watson et aI's framework places emphasis on how the various elements involved in EISs development are interrelated, but also considers aspects of usage like the system dialogue which is considered important from the users point of view. The transition in organisational systems and timing considerations are the main themes in the path framework. Finally the structurational framework places emphasis on the social processes that go on during an information systems development process.

6. *Scope.*
The scope of each framework in relation to the EISs development process also needs to be considered. ESPRIT and the path framework both concentrate on just the development phase although they approach that from a different perspective and highlight different issues. Orlikowski's and Robey's structurational framework and Watson et al.'s structured framework consider the usage of systems as separate from the development process.

7. *Detail.*
The level of detail each framework goes into, to address issues relating to EISs is the last criterion we need to consider. The ESPRIT framework is the most detailed of the frameworks. The structural framework also goes into a high level of detail by considering the structure of the development process, the people involved and the usage of EISs. On the other hand the Path framework, approaches EISs development with little detail about procedures or people involved. It only considers the issue from an organisational perspective. The structurational framework itself does not go into much detail due to its abstract nature, but when applied to specific situations it can be used to represent
situations in a high level of detail. This amount of detail is dependent on the nature of research undertaken.

The above set of criteria is summarised in the following table:

	ESPRIT	Structural	Path	Structurational
Nature	Fonnal model	Semi-fonnal framework	Semi fonnal framework	Fonnal framework
Perspective / Origin	Practical - from consultants point of view.	Academic - trying to represent reality.	Academic - less pragmatic approach.	Academic - purely theoretical perspective.
Purpose	Represent installation of Resolve.	To serve as a tool for reporting the fmdings of survey.	Highlight new issues about EISs development.	Interpret social processes that go on in organisations.
Abstraction Level	Low	Medium	Medium	High
Emphasis	Series of steps to be followed linearly.	Relations between elements involved in EISs development	Transition in organisational systems and timing.	Social processes that go on during development.
Scope	Development (low level)	Development and use.	Development (high level)	Development and use.
Level of detail	High	High	Low	Can be high.

Comparison of the four frameworks.

4. Evaluating the Frameworks.

The examination of the frameworks in relation to each other was essential in identifying the deficiencies and strengths of each. In other words, a comparison of the frameworks showed features highlighted in some of the frameworks which were not considered in others, (although they are important to EISs development and use). As a result of this analysis, the deficiencies of each framework with respect to the representation of EISs development and EISs use, have become apparent. These strengths and weaknesses are outlined below and then summarised in the table that follows:

ESPRIT is a sequential framework featuring an evolutionary prototyping method, starting with a feasibility study and following on to other stages of development up until installation of the final system and training of the users. However, despite the great amount of detail it goes into, not much emphasis is placed on the methods of extracting the information requirements for the system, no relations to other procedures or systems operational in the organisation are made explicit. Moreover no timing considerations are taken into account. These are implicit in the feasibility study. Furthermore, since it is specific to the installation of Resolve, no reference is made to aspects relating to the usage of the system.

Watson et al.'s structural framework proposes a structure of how people and data are involved in EISs development. The framework covers both the development process and system usage, but the two (development and usage) are kept separate from the part that describes the structure of the process. Consequently, despite the interesting results that emerge from the study the framework supports, the relationships between the three parts of the framework are not considered in detail.

The path framework proposed by Millet et al. approaches EISs development from a completely different perspective. It looks into aspects of timing and decisional maturity in organisations, and the transition path followed to develop an EIS from an MIS infrastructure. Although it presents an interesting and useful view of the process, the level of detail that it goes into is not very high. The focus of this framework is not on features of development at an individual's level but rather on an organisational-wide level. This perspective, although not very appropriate to the level of detail of this research, helps highlight issues that are of importance. The relation of EISs with other organisational systems and timing considerations are important features of this framework that need to be addressed.

Orlikowski's and Robey's structurational framework tries to interpret social processes that go on during the development of an information system. It approaches EISs development from yet another perspective. The aim is to interpret the interactions between people and the organisation in a systems development context. It provides an integrated coherent way of linking the various elements of EISs development to human action. However there are inherent limitations associated with attempting to model social processes specific to each individual situation. Although this research will not go into any great depth in exploring the interpretation of social relations in the context of EISs development, this framework is important in indicating that there are relations between the various groups of people involved in EISs development and use.

The strengths and weaknesses of the frameworks identified here, are summarised in the following table.

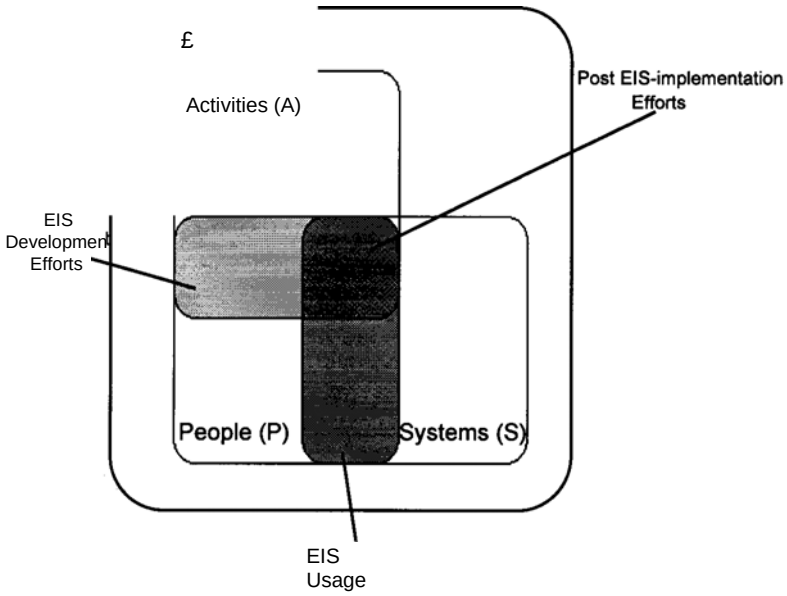
	ESPRIT	Structural	Path	Structurational
Scope	EISs development (low level)	EISs development and use	EISs development (high level)	EISs development and use.
Strengths	8 Sequential approach. 8 High level of detail.	8 Completeness of issues covered.	8 Timing consideration. 8 Decisional maturity of organisations.	8 Coherent way of linking elements of development to human action.
Weaknesses	8 No emphasis on methods of extracting information. 8 No links between other systems in organisation. 8 No timing considerations taken into account.	8 Relation between the relevant parts of the framework is not made clear.	8 Not high level of detail. 8 Issues discussed at organisational level.	8 Inherent limitations in approach.

Strengths and weaknesses of each framework
with respect to EISs development and use.

5. The PAS framework.

From the above evaluation, it is obvious that each framework has some deficiencies with respect to describing EISs development and use. These are inherent from the different. perspective, and the purpose for which the frameworks were put forward. We now go on to propose an alternative framework which overcomes these shortcomings. This framework is an attempt to integrate the advantages identified for each of the frameworks above and provide a tool for a coherent classification of the elements involved in developing and using an EIS.

The elements making up the framework can be summarised in three words: PEOPLE, ACTIVITIES and SYSTEMS (PAS). These elements form the main components of the framework. They are elements within an organisation, which have an effect on and describe EISs development and usage. The relation between the three components is shown in the following diagram:



The PAS framework for EISs development and use.

5.1. Framework Components.

The framework can be described using set theory. Each of the three main components, can be considered to be sets containing elements present in an organisation during systems development. These three sets are:

P = Set of People in an organisation.

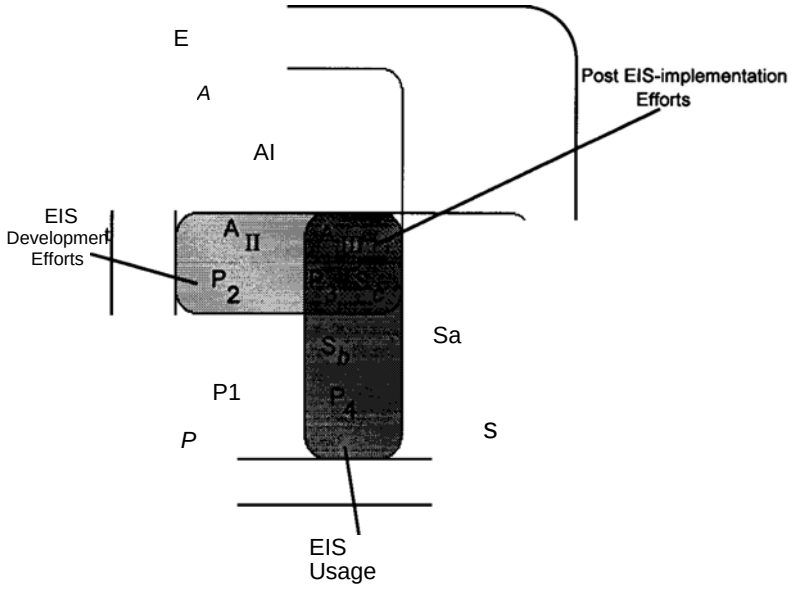
A = Set of Activities taking place in the organisation.

S = Set of Systems present in the organisation.

In addition the universal set is the environment the organisation has to operate in.

E = Organisational Environment

The three main components intersect, giving rise to three new areas that divide the each of the sets into a number of mutually disjoined subsets. This structure is illustrated in the diagram below:



1. *People.*

The first and most important component of the framework is *People*. During an EISs development project and during its subsequent usage, *People* is the main element that determines the success of the system. Success does not only depend on people who are involved directly with the system (Paller and Laska, 1990). Other people that are not involved in the system might also be stakeholders in the system's success. It is therefore reasonable to assume that factors like organisational politics, can play an important role in the success of EISs. There are groups of people who might not be involved directly with either the development or the use of the system, and yet could influence its success. Some examples of this are: (a) people whose information the system does not use and (b) executives who do not have access to the system. If these people are viewed as stakeholders in the system, the framework is consistent with the concept of expectation failure.

As can be seen in the diagram above, People are the central component in the framework. According to the framework People within an organisation can be classified according to their membership in one of the four subsets making up the set of people. These four subsets are:

Pl= Set of People in the organisation that are not involved in EISs development activities, and are not users of the resulting EIS. This area is represented by

$$P - ((P \cap S) \cup (P \cap A))$$

or using the distributive law,

$$P - (P \cap (S \cup A))$$

P2 = People involved in the development process, but are not users of the system. This subset is represented by the area defined by

$$(P (J A) - (P (J S (J A)$$

P3 = People actively involved in the development of the system and are also users of the system. This subset is represented by:

$$PnAnS$$

P4= People not involved in the development process but are users of the system. This subset is represented by:

$$(P \text{ n } S) - (P \text{ n } S \text{ n } A)$$

Various people outside the boundaries of the organisation can also affect the success of these systems. These are discussed in the section about the environment in which the organisation has to operate below.

2. *Activities.*
Information system,s development can be viewed as a project. In order for a project to be completed a set of activities need to be undertaken. The second part of the framework includes *activities* or procedures that typically take place in an organisation. Using the same rationale as for People involved with EISs, there are activities that might be directed specifically towards EISs development and others that go on in the organisation but affect EISs development indirectly. All activities can be either formal or informal in nature and are classified in three groups:

AI= This subset represents organisational activities not directly related to EISs which could nevertheless influence the development or use of EISs. This subset is represented by the area defined by:

$$A - (P \text{ n } A)$$

An = This subset represents EISs development efforts. These are activities which directly contribute towards the development of the EIS. This is the area represented by the intersection of the set of activities with the set of people and can be defined as:

$$(P \text{ n } A) - (P \text{ n } A \text{ n } S)$$

AnI = This subset of activities represents Post-implementation efforts. These are activities that take place to expand or enhance the initial EIS application.

$$(PnAn\ S)$$

3. *Systems.*
The last main element of the framework is *Systems.* This comprises any information systems that the organisation employs to carry out its operations. This element of EISs, as noted by Millet et al. is important since the installation of EISs is usually a transition from other forms of management reporting systems. The existing infrastructure can place limitations and constraints on EISs and influence the success by which these systems are employed. According to the diagram various organisational systems can be categorised as follows:

Sa= Various other systems operational in the organisation. These systems are represented by the area defined by:

$$S - (P_{11} S)$$

Sb= This subset of the systems in the organisation represents Executive Information Systems applications operational in the organisation. This area is represented by:

$$(P_{11} S) - (P_{11} AilS)$$

Sc= This subset of systems includes enhancements on, or expansions to the initial EIS implementation. This area can be described by the intersection of the three main components of the framework, i.e.:

$$(P_{11} AilS)$$

4. *The Environment and Time.*
An integral part of the framework, that completes the view of how EIS are developed and used is the *Environment* the organisation operates in. This is important, since there are connections with the first three components in the framework that have an influence upon EIS development and use. This comprises various factors outside the organisation. These could be either various people or legal entities that come in contact with the organisation, or be in the form of environmental constraints affecting the organisation.

A time dimension for each activity is also an important consideration. For reasons of clarity this was not shown on the diagram above. The assumption is made that EIS development follows a linear time pattern. In other words, EIS development efforts take place before EIS usage and post EIS-implementation efforts, such as enhancements to the EIS, happen after EIS development and use.

5.2. Features of the framework.

As mentioned earlier, factors which could potentially affect EIS success to the development and usage of EIS. These can be classified according to the three components of the PAS framework. Each area of interest is illustrated by a shaded region on the diagram.

1. *EISs Development Efforts.*
EIS development can be viewed as a project. This implies that a set of activities are undertaken by people making use of resources to reach the goal of the project, which in this case is the development of an EIS. The intersection between People and Activities, illustrated on the diagram by the shaded region, represents EIS development efforts. People actively involved in EIS development are within the shaded area. Other people, not be involved in development, but could still influence the successful development of the EIS are in the area that is labelled 'PI' on the diagram of the model. Similarly activities directed towards EISs development are within the shaded area, and other activities that could affect the success of the system are found in the area labelled 'AI" People, activities and other factors that could also affect the development process arid therefore the success of the system are not restricted within the organisation but could originate in the environment in which the organisation has to operate.

2. *EIS Usage.*
The context for the various issues relating to the use of an EIS is provided by the shaded area represented by the intersection between People and Systems. The assumption made here is that this can only take place after an EIS has been developed in the organisation. In other words the time dimension that was not shown on the diagram of the framework is assumed to be present. Successful EISs usage could be influenced by people that are not users of the system, various attributes of other systems that the EIS might rely on for input of data. The way the framework is constructed implies that the use of the EIS could also be affected by other factors external to the organisation.

3. *Post Implementation Efforts.*
The intersection between people activities and systems, reflects development efforts directed towards the expansion and enhancement of the EISs applications already built. This is represented by the intersection of the two shaded areas in the diagram. The people involved in these post-implementation efforts are both users and developers of the system. Again the framework suggests that people that are neither users nor involved in the development of the system could influence the success of the system in the long term. The systems included in this area are the EISs applications already developed. Again the assumption about an implicit time dimension is made here. The various external factors that affect both the development process and use of EISs inherently can affect post-implementation efforts.

4. *Automated activities.*
The obvious question when someone looks at the framework is why there is no intersection between Systems and Activities and what would such a relationship represent in the context of the framework. The answer to that is simple. The intersection of systems and activities would represent automated activities which would not require the intervention of people to be carried out. These could be triggered by time or any other events. An example of such a relation would be a transaction processing system updating a database at the end of each month. These kind of interaction was not included in the framework for two reasons. First it is not consistent with the concept of expectation failure where people have to be involved, and secondly these interactions are characteristic of other systems and not directly relevant to either EISs development or use.

6. Discussion.

A number of frameworks addressing EISs development were analysed and compared with the intention of identifying their strengths and weaknesses with respect to this research. Based on the insight and understanding gained from this analysis we have proposed an alternative framework to address issues relevant to EISs development and use in a structured manner. The PAS framework addresses the following issues identified in the previous analysis.

1. *EIS development and EIS use.*
As identified earlier, factors which can influence and determine success or failure of these systems can be classified into two areas: the development process of EISs and the usage of these systems. The framework provides a coherent, structured context to represent and classify elements included in these two areas.

2. *Stakeholders.*
The idea of systems failure discussed earlier and the notion of expectation failure in relation to information systems, is addressed by the framework. The structure of the framework imposes the identification of a more complete set of stakeholders of the organisation. People that could have an interest in the system are divided into one of four categories in relation to their involvement in the use or development of the system. What is novel about the framework is the recognition of the importance of people who are neither users or developers of the EIS, to the success of the system.

3. *Activities.*
The EISs development process can be viewed as a project with a set of activities taking place and resulting in the development of an EIS. A project is: ' ...a collection of human and non-human resources pulled together in a 'temporary' organisation to achieve a specific purpose' (Cleland and King, 1983). This definition highlights two components: human and non-human factors. These can be viewed as inputs to a set of activities which result to the development of an information system. Besides activities that are specifically directed towards EISs development there might be other activities happening in the organisation that might have an indirect effect on success. The need to include these two sets of activities is addressed by the framework.

4. *Other Systems.*
The installation of an EIS usually involves the transition from an already existing management reporting infrastructure (Millet et aI., 1991). The level of technological advancement of an organisation and the culture of the organisation have an effect on the systems and the path that is followed to reach a full EISs status. The framework considers EISs development in relation to other systems operational in the organisation.

5. *External factors.*
EISs development is initiated by a set of external pressures as well as internal ones. Many other researchers indicate a set of external factors can influence the development and use of EISs both directly and indirectly. Some of them include the competence of consultants (Watson and Frolick, 1993), vendor support and ensuring availability of data held external to the organisation (Houdeshel and Watson, 1987). The framework allows interactions with the external environment to be included in the analysis.

The framework shows that although development and use of EISs takes place within the organisation, these processes are also influenced by factors external to the organisation. These factors could change with time and usually an organisation has little or no control over them. This interaction between external elelments influencing EISs development and use and elements internal to the organisation (People Activities and Systems) facilitates the description of these processes using systems theory, and the concept of open systems in particular.

6.1. Further Work.

To examine the development process and the use of EISs in more detail, we first need to identify the elements that could influence success. Once this is done the framework can be used to classify those elements. The next step is to explore the relationships between the components described in the framework. The following diagram shows all the possible relations that could exist between the framework components.

/eOPI\

. activities systeQ

Set of possible relationships between components of the PAS **framework.**

Out of the six possible relations that could exist between the components of the framework, three are of significance to this research. These are:

- *People - People relations.*
  The examination of the relations between various people and groups with respect to EISs development and use, gives an insight into interactions that go on in the organisation. This is helpful in identifying conflicts of interests among the different entities. This feature of the framework proves useful as it helps highlight issues about organisational politics which can have a detrimental effect on the success of an EIS.

- *People - Activities relations.*
  These relations represent EISs development efforts. Analysis of this relation gives an indication of who is involved in what procedure and allows further examination of the significance of the roles of people in the context of EISs development.

- *People -Systems relations.*
  Issues in connection to the various systems (both EISs and other) or attributes of these systems in an organisation, and the people involved highlights issues about the usage of this type of systems.

Using these relations, the elements contained in each set can be further analysed and a model of how EISs are developed and used will be constructed. This model will essentially give a structural description of what interactions exist between people and what activities take place during EISs development and use. The model will then be used as a tool to identify critical success factors in EISs development and use.

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