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An empirical taxonomy of IS decision-making processes

Albert Boonstra

SOM theme A

The human and technical side of production: the management of interdependencies

Abstract

Decisions to invest in information systems (IS) are made by many organisations on a very regular basis. Such decisions can vary from quickly identifying the problem, screening options and choosing a solution in a very straightforward way, to very extensive and repeated search, screen, design and negotiation activities which can take many years.

There has been little explicit research into the process by which managers and organisations decide to develop IS applications. This research addresses this by analyzing 20 IS decision-making processes, using a phase-based as well as an attribute-based approach. Mintzberg's typology is used to characterize seven types of IS decisions from a phase-based or process-based perspective. For the attribute approach, the decisions have been analyzed on the basis of subjective/objective and offensive/defensive contrasts and placed in one of four categories: innovative, rational, necessary or political.

The paper concludes by identifying five factors that result in major differences in IS decision-making processes. These issues are: (1) whether there is scope to *design* a solution, (2) whether distinct alternatives have to be *searched* for, (3) the degree of *urgency* and *necessity* from the perspective of the decision-makers, (4) whether the decision can be *subdivided* in order to follow a gradual process path (planned versus incremental) and (5) the number and power of *stakeholders* involved in the process and the extent that their interests vary and contrast. The paper suggests that managers deciding on IS applications should be aware of these factors in order to design a process that fits best with the specific circumstances: no single process should be considered universally applicable. This conclusion is in contrast with many decision-making models rooted in the MIS-field, which suggest to use prescriptive and rational approaches to organise IS decision-making processes.

Introduction

Organisations invest billions of dollars in information technologies, hoping to improve their effectiveness, efficiency and innovative capabilities. Prior to these investments, decision-making processes are followed that may lead to decisions to invest in IS. Because of the impact of many of these investments, it is important to understand how such decisions are made, and to relate this to what we already know about decision-making in organisations. IS decisions are often fundamental decisions that shape a firm (Galliers et al., 1998; Keil et al., 2001; Murray et al., 2000; Sauer, 1997; Venkatraman, 1994; Yates, 2001). More insight and understanding into such decisions may help practitioners to organise such processes in ways that are more in line with the characteristics of IS-related problems and with organisational features, and thereby help to improve the quality of IS decisions (Butler, 1991; Cray et al., 1991). This paper aims to provide such deeper insight and better understanding into decision-making processes relating to IS.

Researchers have paid relatively little attention to the process organisations use to decide to develop and implement IS applications. This absence of a theoretical foundation for IS decision-making is an important incentive for this study: there is remarkably little empirical research focusing on the process used by managers to decide to buy, develop and/or implement IS applications. Different views exist on this process, including those that consider it a 'rational' process, a 'political' process, or an 'incremental' process (Sabherwal and King, 1995). This paper builds on these views and aims to contribute to the development of a theoretical foundation for IS decision-making, also by relating it to other types of decision-making. One can question is whether IS decisions are similar or different from other types of decision-making in organisations: IS decision-making can be perceived as just one category of decisions about business activities or as a distinguishable field with an own logic on decision-making (Smith, 1995). In order to address this question, this paper uses theories about and approaches to decision-making in the MIS field as well as from the literature on decision-making in organisations.

Within this research project, an IS decision is defined as a decision to invest (or not to invest (McCalla-Chen, 2000)) in new information systems. Normal maintenance of IS facilities and slight modifications to existing facilities are outside the scope of this research. Examples of IS decisions included in this research project are the development of transactional web sites to facilitate e-commerce, the decision to implement a workflow management system, the implementation of an ERP system, the implementation of a groupware system, and the development of a management information system.

Before a decision to invest in IS is made, a decision-making process is followed. That process begins with the identification of what is referred to here as an 'IS-related problem', and ends with the final IS investment decision - the formal authorization and the specific commitment to action. An IS-related problem is defined here as a gap between the existing IS facilities and the perceived optimum with regard to IS facilities. Such a problem can be experienced as negative (a crisis), neutral (a problem) or positive (an opportunity or a challenge). This is illustrated in figure 1.

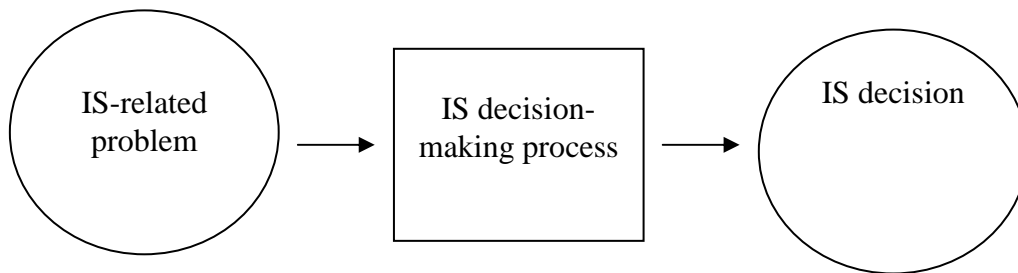


Figure 1. The IS decision-making process

An IS decision-making process is a set of actions that begins with the identification of a stimulus (the IS-related problem) and ends with the IS decision. This paper describes and analyses how such processes occur in practice and –by doing so– identifies the key variables of IS-related problems that may determine the organisation of the decision-making process concerned.

Theoretical background

Different schools of thought

Most IS decisions are taken within an organisational context; there is a strong body of knowledge on decision-making in organisations. The empirical literature on decision-making is from different disciplines, such as cognitive psychology, social psychology, management theory, political science, sociology and economics.

A school of thought that is rooted in economics includes rational models of decision-making, such as classical models of strategic planning. Analysis of information and the objective assessment of alternatives incorporate such models (Brunsson, 1982; Goll et al., 1997; Langley, 1989; Porter, 1985, 2001). A logical assessment of the business strategy, organisational goals, existing IS applications, future trends in industry, and technology are part of logical and rational IS decision-making processes. Rational models assume that there is some form of agreement among stakeholders about organisational means and ends as well as room to design or search alternatives. Hitt and Tyler

described rational decision-making as 'as series of .. analytical processes whereby a set of objective criteria are used to evaluate strategic alternatives (1991:329).

The school of thought rooted in psychology emphasizes bounded rationality, interruptions during the decision-making process and incrementalism. Political science and sociology view decisions as outcomes of political and social processes among groups with diverse and conflicting interests and unequal power (Delquié, 2003). Examples of some influential scholars within these traditions are Brunsson (1982), Cyert and March (1963), Cohen et al. (1972), Janis (1989), Lindblom (1959), March (1994), Mintzberg et al. (1976), Pettigrew (1973), Quinn (1985) and Simon (1960). These authors emphasize, from different perspectives and in different ways, the fact that decision-making processes in organisations are often influenced by:

- the limited ability of people to process information;
- disagreement among stakeholders;
- change, uncertainty and indistinct objectives;
- psychological barriers of individuals and groups to adapt information and act in a rational way;
- the tendency towards incrementalism and arbitrariness in decision-making.

A variety of terms illustrate this thinking including: *bounded rationality* (Simon, 1960), *garbage-can model* (March and Olsen, 1972), *politics* (Pettigrew, 1973), *incrementalism* (Quinn, 1985; Eisenhardt et al., 1995), *groupthink* (Janis, 1989) and *irrationalities* (Brunsson, 1982).

In the MIS field, many current approaches seem to ignore the body of knowledge rooted in psychology and sociology, and suggest using prescriptive rational models to organise the IS decision-making process. Bacon (1992), Barua et al. (2001), Clemons (1991), DCE (1999), Hogbin et al. (1994), Lederer and Sethi (1996), Lee (1998), Parker et al. (1990), Quaddus (1997), Santhanam (1995), Schwartz et al. (2003), and Sebus (1991) suggest such approaches, which can be financial (including return on investment and payback) and non-financial (e.g. the information economics) methods. These approaches often advocate extensive analysis and formal planning methodologies (Allison, 1971). They assume that there is clarity and agreement about the objectives of the organisation and about the degree to which different IS investment alternatives contribute to the achievement of these objectives (Bacon, 1992). As Boynton and Zmud (1987) have noted: 'many of the assumptions and premises that underlie the current IS planning literature reflect a rational model of organisational decision processes'. However, rational models have been criticized for their overt optimism (Galliers, 1991) and for the inadequate representation of organisational realities (Cohen et al. 1972; Hickson et al., 1986; Waema and Walsham, 1991).

These contrasting approaches should lead to a debate on how investments in IS are actually made in organisations. A complicating factor is that IS investments can vary from quite simple (in technical

and organisational terms) to very complicated. Despite these differences, many authors suggest that we can identify general patterns and a basic logic in decision-making, although the processes are not always predetermined, linear and explicit (e.g. Eisenhardt et al. 1999; Mintzberg et al., 1976; March, 1994; Simon, 1960; Willemain, 1995).

Phase-based approach

In their classic study *The Structure of “Unstructured” Decision Processes*, Mintzberg et al. (1976) provide a useful contribution to addressing the diversity of decision-making by suggesting that there are different types of decision-making, using Simon’s ‘intelligence, design, and choice’ trichotomy (Simon, 1960), which can be placed in a general model of a decision-making process (see figure 2).

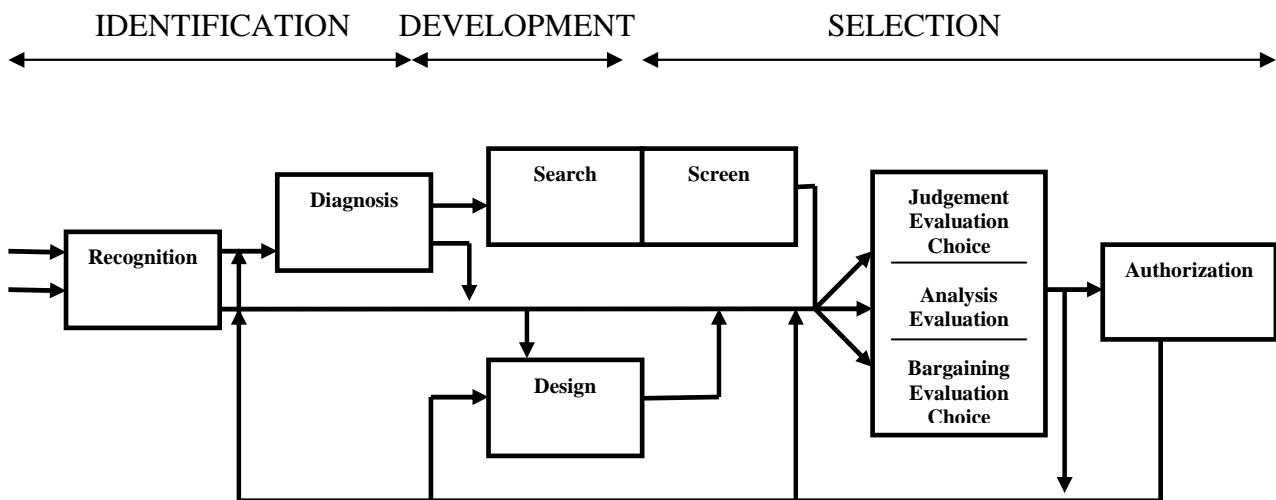


Figure 2. General model of a decision-making process (Mintzberg et al., 1976)

The authors suggest that there are different decision-making patterns or path configurations. They distinguish between:

- 1) *simple impasse* (a ready-made solution is available);
- 2) *political design* (design, analysis and negotiations are conducted in a repetitive way);
- 3) *basic search* (search for the best available ready-made solutions);
- 4) *modified search* (a search for the best available solutions that also have to be modified).
- 5) *basic design* (intensive design activities that lead to complex and innovative customized solutions);
- 6) *blocked design* (as for basic design, but also involves repetitive political activities including negotiations, also after authorization);
- 7) *dynamic design* (complicated decision-making processes involving repetitive design, search, evaluation, and negotiation).

In section 4, these path configurations will be further explained and illustrated with an example of an IS decision.

Attribute approach

Another approach is to study IS decision-making by focusing on key attributes of the overall decision-making process. Some scholars have concentrated on a few dominant attributes, such as politics and rationality (Bourgeois et al., 1988; Pettigrew, 1973), while others have used a larger number of attributes to categorize decision-making processes. In addition to these typologies and taxonomies, several overall models of the decision process have been proposed in the literature. Good reviews are presented by Eisenhardt et al. (1992) and Rajagopalan et al. (1993).

Sabherwal and King (1995) have undertaken one of the few studies of decision processes underlying IS applications. They have developed a taxonomy of IS decision processes and identified five process clusters: planned, provincial, incremental, fluid and political. *Planned IS decisions* involve planning methods and a dominant top management during the decision-making process. Top management addresses major problems, relates this to business goals and tries to control the process. In *provincial IS decisions*, the IS department has greater influence since they regard it as their territory. This process is more shortsighted and makes little use of formal IS planning methodologies. *Incremental IS decisions* encounter greater delays and take longer. They are more driven by short-term goals and internal forces, and are interrupted for various reasons. *Fluid IS decisions* are made more quickly, without much delay. Incrementalism due to reconsideration, problem search, information search and waiting for an opportune time is less than in other processes. Internal forces to a lesser extent than the other processes influence the process. *Political IS decisions* involve more politics and internal resistance than the other processes and face considerable internal influence. Top management often plays the role of project champion in this process, helping to overcome internal resistance encountered along the way.

These findings by Sabherwal and King (ibid.) on IS decisions complement the comprehensive study by Hickson et al. (1986), further elaborated in Cray et al. (1991) on strategic decision processes in organisations, known as the Bradford Studies. They examined 150 strategic decisions from 30 organisations. Based on a number of attributes, three kinds of decision processes were identified: constricted (familiar), fluid (tractable) and sporadic (vortex). *Constricted processes* tend to be the least complex, are not novel, have limited consequences and are less political. They are close to the 'provincial decisions' of Sabherwal and King (1995.). *Fluid processes* are relatively steady and facilitated by formal interactions. They tend to be less complex, less diversely involving, less serious but have diffuse consequences and are the least political. *Sporadic processes* tend to be complex,

diverse, to have serious though non-precursive consequences and are political. Our research adopts these clusters as possible attributes for IS decisions.

The following attributes are used in this study to characterize IS decisions: duration, type of organisation, stimulus, mode of design, and style, process-related and stakeholders. These attributes are based on the work of Sahberwal et al.(1995.), Hickson et al. (1986.) and Cray et al. (1991.) as discussed in the previous paragraph. We have also characterized the IS decisions according to the model shown in figure 3. This model is based on early findings from case studies and interviews. The dimensions of the model are partly inspired by the work of Burell and Morgan (1979). It shows four competing forces that may influence IS decision-making in varying intensities: ‘innovation’, ‘rationale’, ‘politics’ and ‘necessity’. These forces can influence IS decision-making processes to varying degrees, and can be mapped in a two-dimensional figure (see Figure 3). The attributes used in this study will be further explained in the next section.

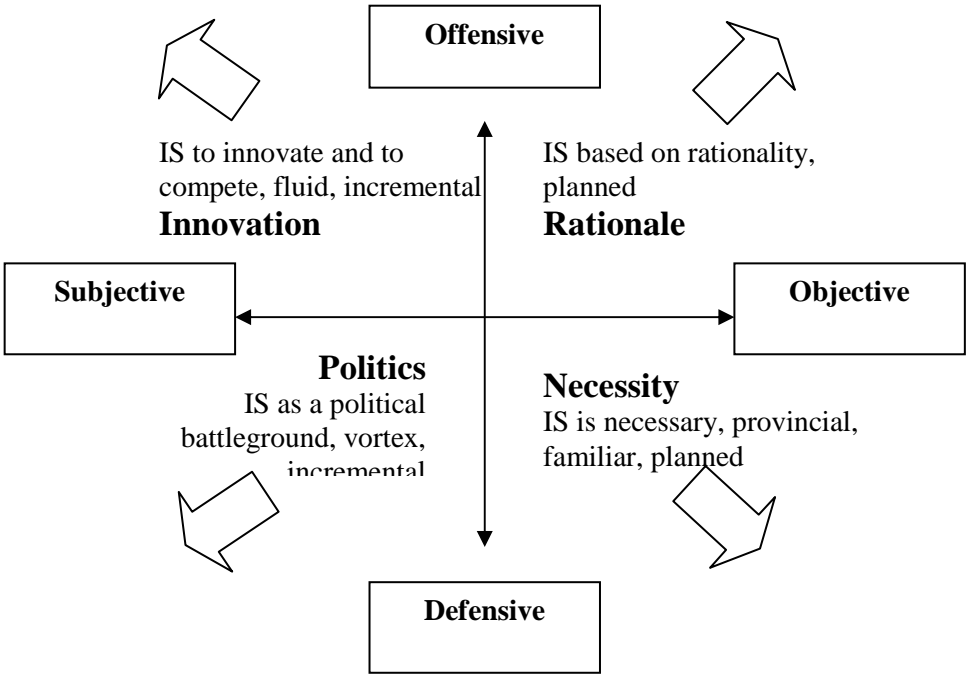


Figure 3. Four competing forces within two dimensions which influence IS decision-making

This paper follows both approaches, viewing decision processes as a number of phases, within the tradition of Simon and Mintzberg, and categorizing them on the basis of attributes, using the work of Sabherwal and King (ibid.), Hickson et al. (ibid.), and Cray et al. (ibid.).

Research design

The initial research objective of this project is to study how organisations manage their decision-making processes that lead to IS investments. This question is a 'how' question about a contemporary set of events over which the researcher has no control. It has open and explorative characteristics. This means that the case-study approach is the most appropriate (Yin, 1991). We decided to conduct a multiple case study in order to be able to compare different IS decision-making processes, to identify common patterns and to categorize them into certain groups.

This paper reports on 20 case studies conducted by different teams of managers (with 5-10 years' experience), who were studying for a degree in management. Each research team studied an IS decision in order to explore the relevant decision-making issues. During an instruction meeting, the research teams were provided with a list of guiding questions (see appendix 1), which had to be used to obtain a comprehensive view of the decision process and to promote internal consistency. This list functioned as a part of the research protocol; all the items had to be addressed by each team. During six feedback sessions, the initial findings were compared and discussed, which often led to new points of attention. These feedback sessions also improved the comparability and the internal consistency of the findings.

Typical questions of the protocol were: What was the initial stimulus? Were the stimuli frequent or intense? Were there many or few alternatives available? What was the duration of the decision-making process? Were there differences in insight and opinion? How diverse and intense were these differences and how were they expressed? Was the decision based on hard facts, such as a cost-benefit analysis, or on subjective and rough estimates? Was it necessary to make this decision? Did any external forces influence decision-making? Will the decision affect the competitive position of the company? (See also appendix 1).

At every case site, semi-structured and unstructured interviews were conducted with different people who were involved in the decision-making process prior to the IS investment. By interviewing different participants, including managers, members of the project team, IS staff, external consultants and prospective users, the research teams collected a broad perspective on the decision-making process under study. An average of six interviews per case site were conducted, of which the duration varied from 30 minutes to 1,5 hour. Sometimes interviewees expressed opposing views on certain events, but there is no reason to suspect any systematic distortion in this study, and we feel that multiple interviewing reduced the possibility of random distortion. In addition, meetings were attended and observations made. In some cases it was possible to access relevant documents. Thus, the IS

decision processes were researched by conducting interviews, by observation, and by studying organisational records. These methods produced a detailed and rich picture of the processes involved. Most of the decision processes selected for study were either recently completed or nearing completion. The case studies were conducted between 1999 and 2001.

We looked for coverage of different kinds of organisations and different kinds of IS, within the limits of the time and funds allowed. This was to reflect the diversity of organisations and IS systems. Each was approached by a formal letter after a selection based on available information from the researchers. Of the management approached, 70% joined the study.

We selected the firms for the study from a variety of industries, including financial services, government, retail, health care, education, and transport. These industries were selected to ensure substantial variance, and they included companies in both consumer and industrial markets. We first contacted the top manager of each business to secure participation, first by letter, followed up by telephone calls. Executives were assured of the confidentiality of their data. Participating firms had annual sales ranging from € 1 million to over € 10 billion and numbers of employees ranging from 5 to 40,000. The middle (or median) size was 600 employees.

The unit of analysis is the IS decision. We used decisions rather than organisations as the unit because previous research (e.g. Hickson et al., 1986.) has demonstrated that decision processes within a given organisation vary substantially. We selected the decisions to study in each firm according to the following criteria. First, the decisions had to be defined by the firm and by the researchers as an IS decision. Second, decisions had to be recently completed or near the termination of the process; they were selected because they were interesting to the managers involved and the later parts, at least, remained fresh in the participants' minds. A consequence of this timing was that participants could not always provide evidence of the final effectiveness of the decisions (Dean and Sharfman, 1996).

The decisions studied here have been categorized according to (a) the stimuli that gave rise to them, (b) the solutions, (c) the style, (d) the major forces influencing them and (e) the process used to arrive at them.

a) Stimuli: IS decisions can be categorized according to stimuli along a continuum. At the one extreme are *opportunity* IS decisions, initiated on a voluntary basis to improve a secure situation, e.g. for entrepreneurial or innovative purposes. At the other extreme are *crisis* situations, where organisations respond to strong pressures and where immediate action is required; the Y2K IS problems are examples of necessary interventions. *Problem* decisions fall in between.

b) Solutions: IS solutions can be classified in three ways. A solution can be *ready-made* as an off-the-shelf package. Second, it can combine given and customized features, in which case given features can

be *modified* in order to make them fit specific business conditions. Third, *customized* solutions have to be developed especially for the decision.

c) *Style*: The style can be categorized as *planned* or *incremental* (Sabherwall and King, 1995.). A planned decision is made right from the start and will be rolled out accordingly. Incremental decisions are series of decisions that can be made similarly and consecutively.

d) *Dominant force and mode*: Agreement among stakeholders about objectives and means implies that the process can take place in a *rational* way. Rational decisions are based on objectives, perceived or not, and undisputed facts, and are taken only after a thorough analysis as a well-orchestrated and coordinated series of actions. Disagreement about means, ends, and underlying information implies that the decision process has *political* characteristics that may lead to resistance, bargaining, negotiations and interruptions. *Innovative* decisions are aimed at gaining competitive advantage, launching new activities or process innovation. These decisions are often based on subjective assessments of the external environment, intuition and expectations. *Necessary* decisions are perceived as inevitable, and are based on hard objective facts from the perspective of the decision-makers.

e) *Participants*: Shows which group of stakeholders was dominant in this particular decision-making process and whether there were many or few stakeholders or stakeholder groups involved in this process.

f) *Process*: To describe the process for arriving at the decisions, we applied the path configurations identified by Mintzberg et al. (1976) as discussed in the theoretical background.

Results

Table 1 shows the decisions categorized in various ways. Three IS decisions were made in manufacturing firms, three in service firms, one at a publisher, two in governmental institutions, four in financial service firms, two in educational institutions, two in retailing firms, two in transport firms and one in a medical practice.

Typically, the IS decision-making processes covered a long period of time: 5 lasted less than one year, 8 lasted one to two years, 5 lasted two to four years, and 2 lasted more than four years. In some cases the duration had to be estimated.

The stimuli underlying these 20 decisions were: problems (12 cases), opportunities (6 cases), and crises (2 cases). In cases 2 and 5, it was difficult to address this aspect because most of the interviewees perceived the possible information system as a solution without a problem. They said that there was not a definite stimulus. In these cases we have categorized the stimulus as ‘opportunity’, because the ‘solution’ was seen as an improvement compared with the existing situation.

Table 1 IS decision-making processes: 20 case studies

Decision	Duration in years	Type of organization	Type of decision process						
			Stimulus	Design	Style	Dominant force	Participants	No. of search/screen options	Process
1 Online data entry insurer	1-2	Insurer	Opportunity	Customized	Planned	Innovative	Top dominant	-	Basic design
2 Intranet at advertisement agency	1-2	Service	Opportunity	Customized	Incremental	Innovative	Top dominant	-	Modified search
3 Imaging technology	2-4	Service	Problem	Modified	Incremental	Political	Many involved	4	Political design
4 Web site newspaper	>4	Publisher	Opportunity	Customized	Incremental	Innovative Political	Many involved	-	Dynamic design
5 Transactional web site for municipality	>4	Government	Opportunity	Customized	Incremental	Political Innovative	Many involved	-	Dynamic design
6 Planning system	1-2	Transport	Problem	Modified	Planned	Rational	Top dominant	3	Basic design
7 Board Computers	1-2	Transport	Problem	Modified	Planned	Rational	Top dominant	4	Basic search
8 ERP cheese manufacturer	1-2	Manufacturer	Problem	Modified	Planned	Rational	IS dept dominant	4	Modified search
9 Communication system	2-4	Education	Problem	Modified	Incremental	Political Innovative	Many involved	3	Political design
10 Maintenance system	1-2	Manufacturer	Problem	Modified	Incremental	Political Rational	Top, Many involved	3	Blocked design
11 Conversion to euro	<1	Retailer	Crisis	Customized	Planned	Necessary	IS dept dominant	-	Basic search
12 Adaptation Y2K	<1	Bank	Crisis	Customized	Planned	Necessary	IS dept dominant	-	Basic search
13 Introduction of MS Office	<1	Government	Problem	Ready made	Planned	Necessary	IS dept dominant	2	Simple impasse
14 Scheduling system	<1	Education	Problem	Ready made	Planned	Rational	IS dept dominant	5	Simple impasse
15 Lotus Notes for consultancy firm	2-4	Service	Problem	Modified	Incremental	Innovative Political	Many involved	3	Modified search
16 Workflow management system	1-2	Bank/ Insurer	Problem	Customized	Incremental	Political	Many involved	-	Blocked design
17 E-commerce for direct writer	2-4	Insurer	Opportunity	Customized	Incremental	Innovative Political	Many involved	-	Dynamic design
18 E-commerce retailer	2-4	Retailer	Opportunity	Customized	Incremental	Political Innovative	Many involved	-	Blocked design
19 Electronic prescription system	<1	Health care, practice of GPs	Problem	Ready made	Planned	Rational/	Few participants	4	Basic search
20 Management information system	1-2	Manufacturer of dairy foods	Problem	Customized	Planned	Political	Many involved	2	Blocked design

There were 10 processes that could be characterized as ‘planned’ and 10 as ‘incremental’. A typical example of a planned decision is case number 11, where a retailer decides to convert his systems to the euro. This is one main decision that can be executed according to an initial plan. A typical example of an incremental decision is case number 5: the development of transactional web sites for a municipality. In this case, series of small decisions are taken without a master plan.

In many cases, (IS) decision-making processes have nested activities and move from the evaluation and choice routines back to the development phase to initiate another search or design cycle. As a result of this, modified processes may follow one or more search cycles to find a possible solution and then a series of design cycles to modify this solution.

Figures 4 to 10 show the flow of activities for each decision type within Mintzberg’s path configuration model, and illustrate each path configuration with a typical IS example derived from the research data (presented in Section 4). With regard to the process, there were 2 simple impasses, 2 political designs, 4 basic searches, 3 modified searches, 2 basic designs, 4 blocked designs and 3 dynamic designs.

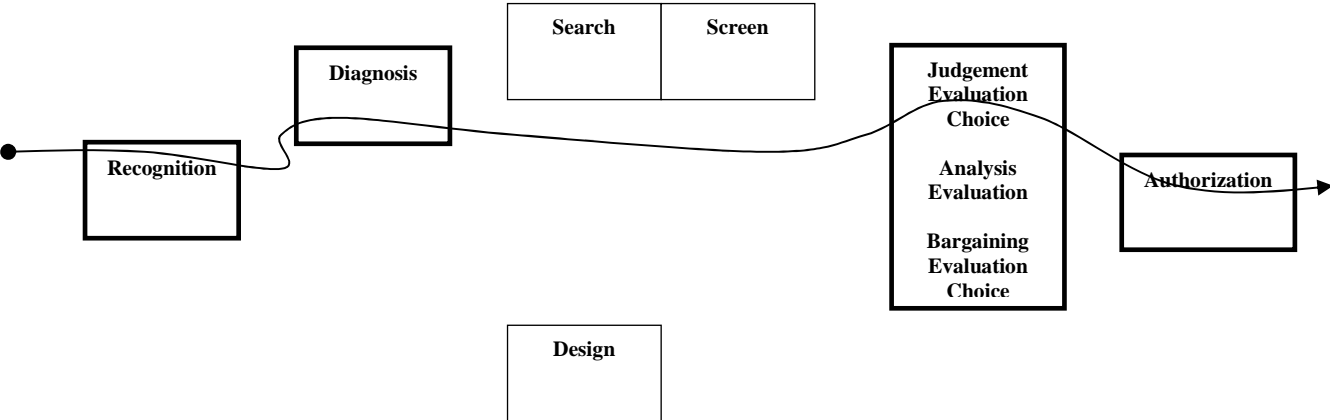


Figure 4. Simple impasse

The decision to introduce Microsoft Office software at a government agency did not require search or screen activities. It was perceived as a necessary step without real alternatives, which is typical of a ‘simple impasse decision’ (case number 13, see figure 4).

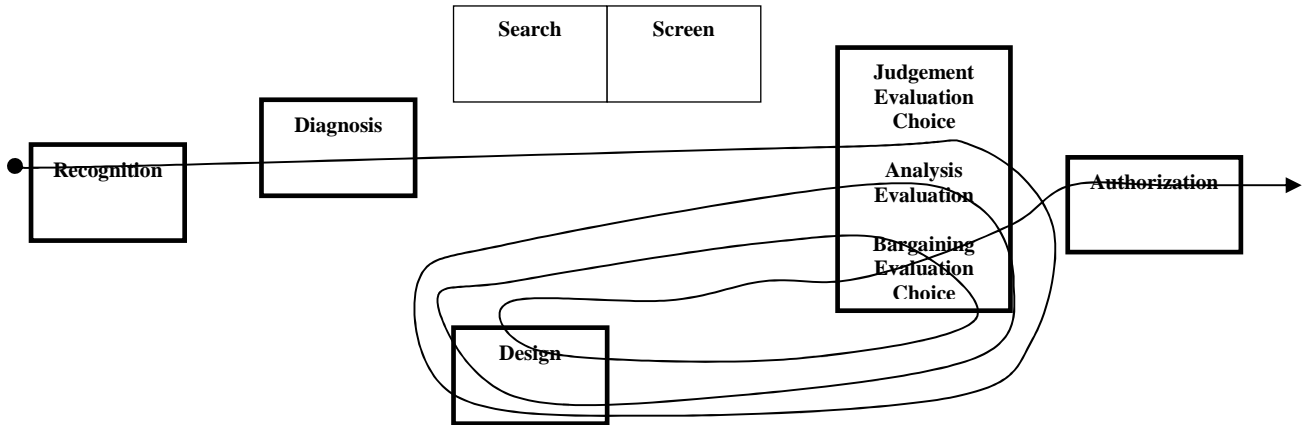


Figure 5. Political design

The decision to implement imaging technology at a cash collection agency was a drastic decision that affected many vested interests. Work processes and structures had to change and it was only after following different designs, evaluations and negotiations that implementation could begin. This is an example of a typical ‘political design decision’ (case number 3, see figure 5).

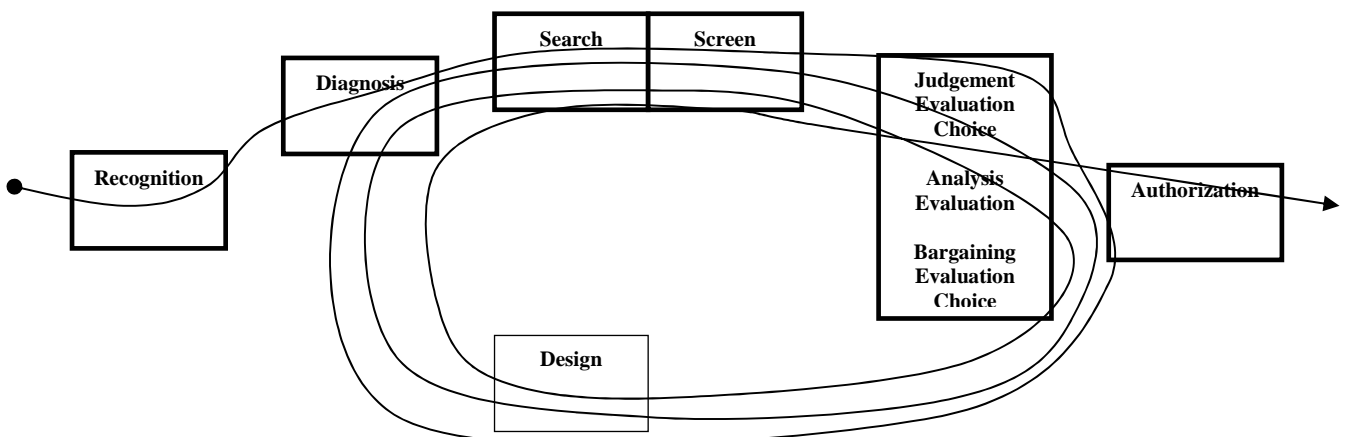


Figure 6. Basic Search

The decision to implement an electronic prescription system at a doctors' practice required a number of search and screen activities. It was not possible to design a system but a variety of ready-made packages were available to choose from. The general practitioners' association urged the practice to implement the system as a consequence of an agreement with the Ministry of Health. The choice was not 'whether', but 'which'. This is an example of a typical 'basic search decision' (case number 19, see figure 6).

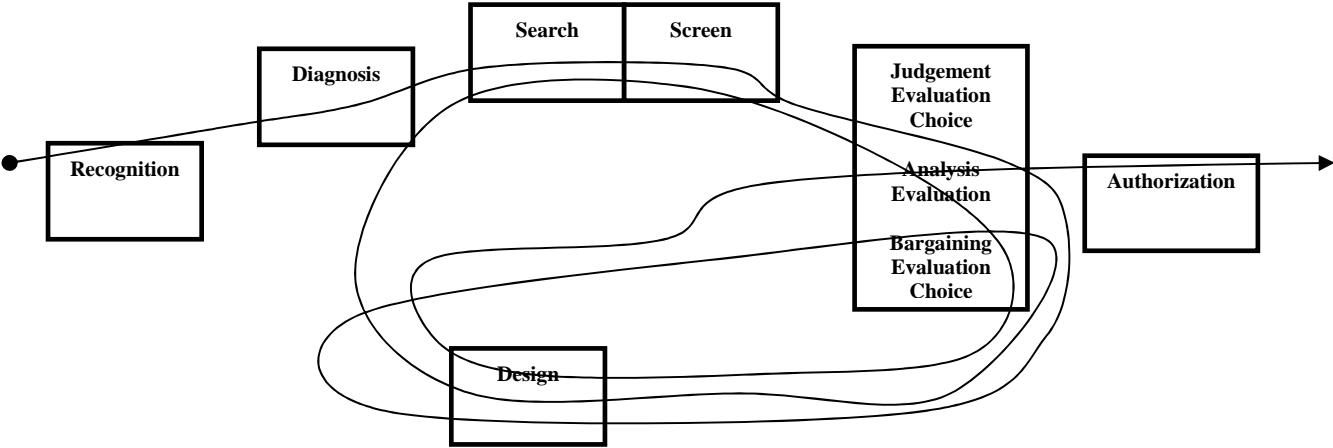


Figure 7. Modified Search

Implementation of an ERP system can often be characterized as 'modified search'. The ERP system has to be selected, and this involves search and screen activities. After that decision has been made, the chosen package has to be modified in order to make it work. The ERP implementation at a cheese manufacturer's site included different search/screen and design activities (case number 8, see figure 7).

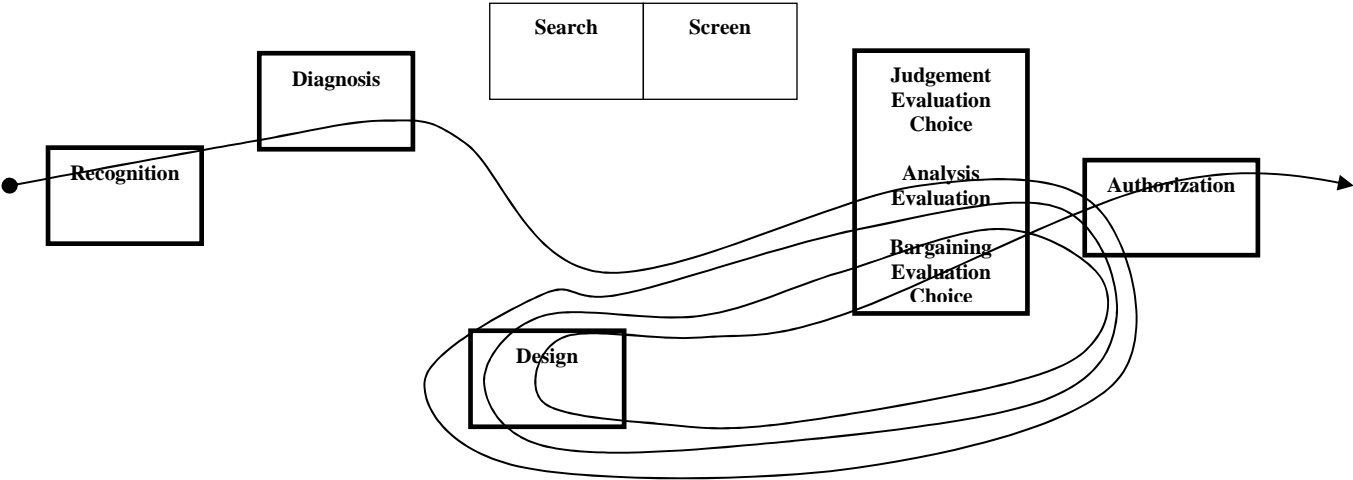


Figure 8. Basic Design

'Basic design' refers to the development of a working system. The online data-entry system for an insurance company involved many design and evaluation steps before the final decision could be made to implement the system (case number 17, see figure 8).

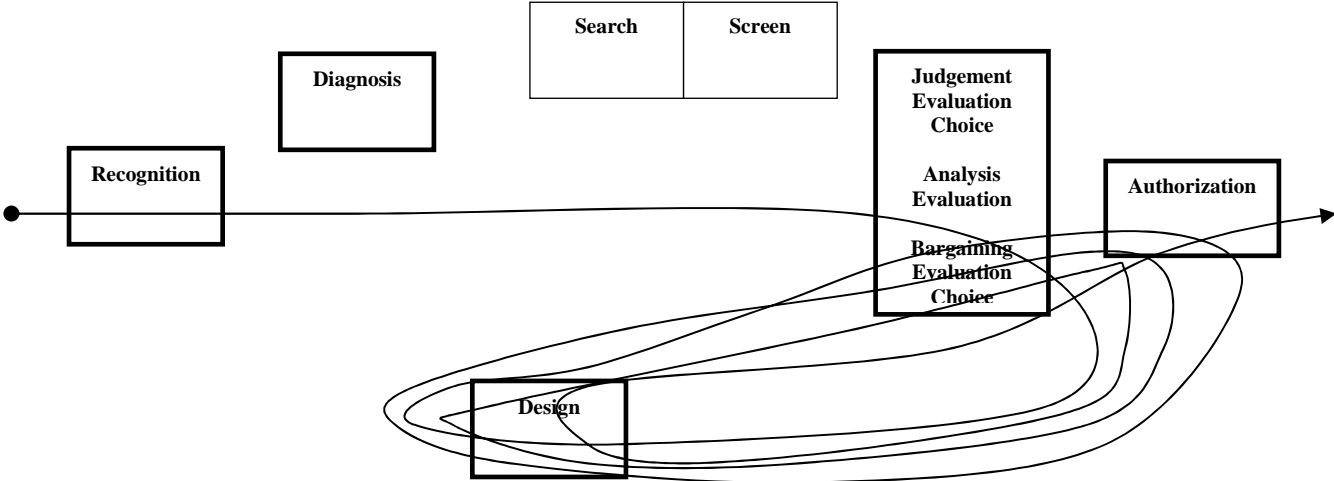


Figure 9. Blocked design

When systems have to be developed in an environment of contrasting interests, 'blocked design' can be observed. The development of a workflow management system at a financial services institution involved a customized system in which many parties (department managers, directors, IS experts, and users) attempted to promote their conflicting interests (case number 16, see figure 9).

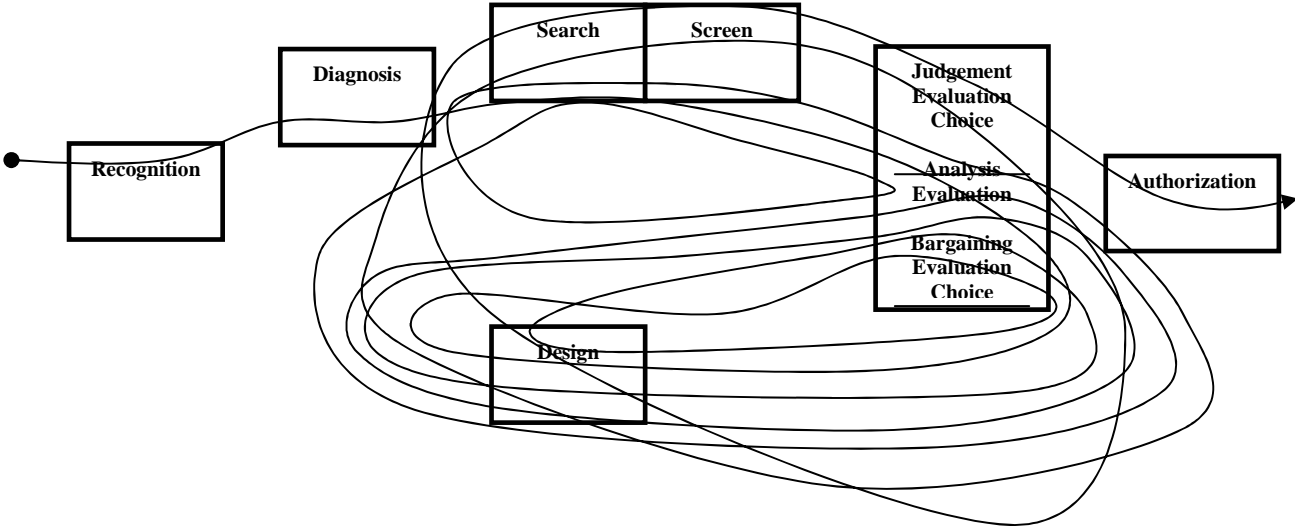


Figure 10. Dynamic Design

The development of a web site for a municipality, that had to facilitate information provision and transactions, involved many search-screen and design steps in a highly political environment. The process has taken many years and is still on going. This is a typical example of a ‘dynamic design decision’ (case number 5, see figure 10).

It was not always possible to characterize the decision unequivocally according to the competing forces model (see figure 3). In those cases, the two most dominant forces are mentioned, with the strongest force first.

The 20 decisions illustrate that IS decisions can be extremely diverse and have many perspectives. The attributes used in this study proved useful for describing some of the characteristics of these IS decisions. In the following table, we give three examples of quotations from interviewees, which illustrate each force:

Table 2 Typical quotations illustrating each force

Major force	Characteristic quotation	Case #
Innovative	<i>‘Now our customers can use the Internet as well as the traditional channels. By doing so we will forge ahead of our competitors’</i>	Case 2
	<i>‘We can improve our competitive position by coming closer to our customers’</i>	Case 3
	<i>‘We cannot quantify the benefits, but our consultants will save time and will be more effective for our customers’</i>	Case 15
Rational	<i>‘Our planners will save time and route planning will be optimized for our drivers’</i>	Case 6
	<i>‘Our drivers will spend less time reporting information to the office, and the information will be of a higher quality’</i>	Case 7
	<i>‘The computer allocates the work among the available workers, according to their specific competencies. This will save management time and improve quality’</i>	Case 16
Political	<i>‘The different autonomous departments have to cooperate in order to realize a coherent web site. That is a mammoth task’</i>	Case 5
	<i>‘It will not be easy to convince teaching staff to use such a system. Administrators and program leaders look for consistency in courses, while individual lecturers want to design courses on their own terms’</i>	Case 9
	<i>‘It is difficult to involve local shops because some of them think e-commerce is a threat rather than an opportunity’</i>	Case 18
Necessary	<i>‘We simply had to adapt our systems. We had no choice’</i>	Case 11
	<i>‘We tend to follow the mainstream and when the situation has become quite clear and the moment calls for a decision, we make up our minds and make that decision’</i>	Case 13
	<i>‘The Ministry of Health, healthcare insurers and the National Association of General Practitioners urged us to implement this system. It was not primarily our own decision’</i>	Case 19

Data analysis and discussion

The 20 cases show that IS decision-processes can be very diverse. They can be of a relatively short duration, but also very long. They can take place in a planned way, but also incrementally. It is the task of management to manage and supervise these processes. In order to do this in a balanced way, it is necessary to understand and analyze the IS problem and the context in which it arises. This research project makes a contribution to such analyses. For this purpose we have categorized the different decision processes according to the competing forces model (see figure 11).

Offensive

	<i>Innovative</i>		<i>Rationale</i>	
	(case no.1) Basic design		Basic design (case no. 6)	
	(case nos. 2,15) Modified search		Modified search (case nos. 8,15)	
	(case nos. 4,5,17) (case no. 9)		(case no. 14) (case nos. 7,19)	
Subjective	Dynamic design	Political design	Simple impasse	Basic search
	Dynamic design (case nos. 4,5,17)	Political design (case nos. 3,9)	Simple impasse (case no. 13)	Basic search (case nos. 11,12,19)
	Blocked design (case nos. 10,16,18,20)			
	<i>Political</i>		<i>Necessary</i>	
				Objective
				Defensive

Figure 11. Mintzberg’s seven types of placed into the competing forces model of IS decision-making

Rationale

In some cases the IS decision can be characterized as 'rational'. In these cases there is a clear and recognizable problem, and influential interest groups perceive the problem quite similarly in terms of means and ends. The information available is relatively unequivocal and undisputed. The decision must lead to a definite improvement in the view of the main stakeholders. The improvement must be measurable, preferably also in financial terms. Simple impasses, basic searches, basic designs and modified searches are typical rational decision-making processes (see case number 6, 7, 8, 14 and 19). The process chosen in the case of a rational decision depends on the possible solution that can be customized, ready-made or modified. Rational decisions are often planned decisions because there is enough reliable information and agreement among stakeholders for a planned approach. Within these 20 cases, the stimulus for 'rational' decisions in each case is a problem, but this is not necessarily the case. An 'opportunity decision' can also be taken in a rational way. Within this research project, we speak of a strong rational force when there is undisputed and unambiguous information available, when there is some sort of agreement among the main stakeholders and when the main parties involved believe that the decision leads to a clear improvement (Bacon, 1992; DCE, 1999; Hogbin et al. 1994; Lee, 1998; Ranganathan et al, 2002).

Necessity

When the stimulus for a decision is a crisis, rather than an opportunity or problem, the dominant force will often be 'necessity'. We studied two decisions for which the stimulus was a crisis (cases 11 and 12) and in both cases the dominant force is 'necessity'. In two other cases with 'necessity' as the dominant force, the decision was stimulated by a problem (cases 13 and 20). 'Necessary' decisions are also rational in the sense that hard and undisputed information is available. However, necessary decisions are strongly defensive, vigilant (Hirokawa et al, 1992), reactive and sometimes inevitable. We observed that 'simple impasse' and 'basic search' are the main processes when the dominant force is necessity. This seems to be logical because defensive and reactive decision-makers have a preference for proven solutions.

Politics

There is strong evidence that political activities play an important role in many IS decision-making processes. Political activities show that individuals and groups within and outside the organisations do not all share the same goals, and try to influence the IS decision process in order to obtain outcomes which advance their particular interests (Markus, 1983; McLoughlin, 1999; Noble et al. 1992). In our study we found ten cases involving intense political activity. This study suggests that when political influences are involved, the duration of the process tends to be relatively long. In all cases with a duration of more than two years there was a strong political force. When an IS decision process leads to political activities, managers can plan bargaining processes explicitly in order to allow for open

negotiations. In cases 3, 5 and 20, this was so. But political activities can also take place when the decision has almost been taken. Political activity can come from inside as well as outside the organisation. In particular when decisions concern links with customers or suppliers, these external parties may become part of the process. Political design, blocked design and dynamic design are typical path configurations in cases where the dominant force is political. In cases of political design, political activities take place during the design stage, with blocked design at a later stage, and with dynamic design on a continuous basis.

Innovation

The stimulus for decisions that are characterized as 'innovative' is often an opportunity. IS can be an opportunity for reaching new customers, introducing new products, providing better service, and gaining competitive advantage in other ways. During this research project, the Internet was often used to innovate through the introduction of on-line services.

Innovative IS decisions are often based on expectations and projections of the future without hard evidence. Sometimes calculations of returns on investments are used, but these are often based on very subjective expectations. We observed that some innovative decisions tend to have political characteristics as well (cases 4, 5, 9, 17 and 18); these are categorized as 'innovative-political decisions'. Other innovative decisions also have more rational characteristics (cases 1, 2 and 15); these are 'innovative-rational' decisions. When innovative decisions are political, the innovations tend to affect the interests of influential stakeholders. In those cases, the path configurations were dynamic design or political design. When innovative decisions are rational, the process is often basic design or modified search. In some cases (cases 2 and 5) an IS decision was seen as a proposed solution without a clear problem; an IS opportunity 'came along' and was taken without clear and rational consideration of means and ends. March and Olson (1972) call this a typical 'garbage can decision'.

Forces and organisational culture

While conducting the case studies, we received the impression that the most dominant force (i.e. rationale, innovation, politics or necessity) influencing the decisions is determined not only by the characteristics of the IS problem, but also by the culture of the organisation taking the decision (Bate, 1984; Butler, 1991). Some organisations have a more innovative attitude towards IS, while other organisations have a more rational or political IS culture, or perceive IS more as a necessity. The 'innovative' culture can be characterized by a strong market orientation that can be enforced or enabled by information systems. Such organisations believe, for instance, in the first-mover advantage of IS, and are prepared to develop new and innovative IS applications.

The 'rational' culture of organisations is also pro-active and offensive, but more directed to certainty and value for money. The 'necessity' attitude of some organisations can be characterized by caution,

vigilance and a wait-and-see approach. They do not expect too much from IS and sometimes perceive it as negative and troublesome, taking the necessary decisions as a reaction. Other organisations are strongly political. Individuals, departments and business units have different objectives, and IS proposals are assessed by asking how the new systems affect the various interests. These observations agree with the findings of Cooper (1994), who tested the idea of the cultural fit of information systems. He developed a framework that specified which IS applications would be likely to support, and so be accepted by, each of the cultural types within his framework. To test this, he presented the model to members of the IS community by asking them to rank the extent to which particular systems were likely to support the focus of each cultural type. Their conclusions agreed with the author's prediction. The forces innovation', 'rationale', 'necessity' and 'politics' may also influence or determine an organisation's IS strategy, and can be used as a model for analyzing IS strategies.

Forces and external factors

During an economic downturn, many organisations adopt a wait-and-see approach towards investments in general, and IS investments in particular. In such periods, businesses are careful about investing in new and innovative IS. IS decisions move from 'innovative' to 'necessary'. This illustrates that the dominant forces that influence IS decisions are determined not only by the IS or specific organisational features, but also by sentiments and general economic conditions. Other relevant external factors are the degree of turbulence in the industry and IS-related initiatives of competitors. In some cases, organisations felt competitive pressure to make certain IS decisions (Goll et al., 1997).

Designs

We found three design modes for information systems: ready-made, modified and customized. In the case of ready-made systems, the decision-makers can identify one or more available solutions. In the figure below we show these design modes and their relationship to the related decision configuration, and a typical example from the 20 cases studied.

Table 3 Design modes and related decision processes

Mode of design	Rational		Political	
	<i>Decision configuration</i>	<i>Typical example</i>	<i>Decision configuration</i>	<i>Typical example</i>
One solution ready-made	Simple impasse	Case 13. MS Office implementation		
Search activities ready-made	Basic search	Case 11. Conversion to euro	Political design	Case 3. Imaging technology
Modified	Modified search	Case 15. Lotus Notes for consultancy firm	Blocked design	Case 10. Maintenance system
Customized	Basic design	Case 1. Online data-entry for insurance firm	Dynamic design	Case 5. Interactive web site for municipality

The 20 cases contain no examples of ready-made solutions with political characteristics. However, this can be the case if the (ready-made) solution affects the interests of powerful parties. Table 3 shows that the design mode and the presence of political aspects are determining factors for the decision-making process.

Style

When we consider the decision-making style (i.e. planned versus incremental), it is striking that planned decisions often have ‘rational’ or ‘necessity’ as the dominant force (8 out of 10 cases). Incremental decisions often have innovative or political characteristics (also 8 out of 10 cases). Innovative and political decisions are often ambiguous because of the lack of familiarity with new IS applications, because of the turbulent environment, or because of the complexity in relation to the different stakeholders (politics). The ambiguity and uncertainty tends to lead to small, piecemeal decisions taken in order to gain a learning effect and to obtain greater clarity for subsequent decisions. In cases of novelty or complexity, from a political as well as from an innovation point of view, decision processes tend to be recursive and discontinuous, involving many steps and a host of dynamic factors over a considerable period of time before a final choice is made. Decision-makers want to allow for review and modification based on past experiences (Bourgeois et al. 1988).

For example, the municipality in case 5 introduced an Internet facility for the payment of dog licenses. After this relatively minor decision was taken, other related decisions followed, which led to a range of Internet facilities. This is a common strategy in innovative and political environments.

In 'rational' and 'necessary' decision processes there is often greater certainty and unequivocal information on which to base the decision. This enables planned decisions to be made, that in such cases are often more effective than a series of small decisions. When the planned decision has been made, implementation can begin.

Planned decisions are often rational or necessary. For this reason, the processes that we characterized as rational are relatively common: simple impasse (2), basic search (4), modified search (1) and basic design (2). Incremental decisions often have political or innovative characteristics. Here, the processes are political design (2), blocked design (3) and dynamic design (3). Modified search occurred in two out of ten cases in incremental decisions.

Conclusions

In this paper we have shown that IS decisions are often complex and dynamic but also amenable to analysis and structuring. By analyzing 20 decision processes, we believe that we have been able to show some of the structures and factors that can play a role in making these decisions. IS decisions seem to fall into distinct categories, depending on different factors and forces. This implies that there is not a universally applicable decision-making process for IS. Depending on a number of factors, a particular path may be followed. We have identified five relevant factors in this study, formulated in the following questions:

- the question whether there is scope to *design* a solution (ready-made, modified or customized);
- the question whether a *search* must be made to find distinct IS alternatives (one, few or many alternatives);
- the degree of *urgency* and *necessity* from the perspective of the decision-makers (crisis, problem, opportunity);
- the question whether the IS decision can be *subdivided* in order to follow a more gradual process path (planned versus incremental) if the direction is unclear;
- the number and influence of *stakeholders* involved in the process, and the extent that their interests vary and contrast.

These factors influence the actual IS decision-making process. In this study we used the seven path configurations distinguished by Mintzberg et al. (1976) to categorize the 20 IS decision-making processes: simple impasse, political design, basic search, modified search, basic design, blocked design, and dynamic design. We also found that four competing forces (innovative, rational, necessary or political) influence IS decision-making and, consequently, the path configuration. The strength of these forces depends on the IS-related problem, organisational context and features, and wider environmental factors.

This study shows that many IS decisions follow the same messy and difficult path than other (strategic) decisions follow (Hickson et al., 1986), and that, consequently, models and theories from decision-making in general, seem to be applicable in the MIS-field. This means that many findings from the general body of knowledge on decision-making can be used to support IS decision-making and, eventually, to develop IS decision-making models for practitioners. The factors and forces, as identified in this study can be used –among other things- to design a contingency model for IS decision-making.

Many current decision-making models and approaches in the MIS-field, including (Bacon (1992), Barua et al. (2001), Clemons (1991), DCE (1999), Hogbin et al. (1994), Lederer and Sethi (1996), Lee (1998), Parker et al. (1990), Quaddus (1997), Santhanam (1995), Schwartz et al. (2003), and Sebus (1991) use assumptions which are mainly based on the rational model of decision-making and ignore fundamental differences in IS decisions, organisational features and external factors. Because of this, such approaches disregard the body of knowledge about decision-making in general, which are mainly build up outside the MIS-field. The rational model assumes just one dominant force while this study illustrates that other forces and factors determine the IS decision-making process.

The relevance of these findings for executives is that it may help them to understand and diagnose IS problems right at the start in order to design an IS decision-making process that is suited to the particular problem in its context. No one process should be considered universally applicable; any of the path configurations may be used, depending on the specific circumstances. The factors and forces as mentioned earlier should help managers by integrating the various divergent views on this process as an alternative for one single model. For example, 1) IS problems that affect many powerful stakeholders need a different decision-making process (e.g. with blocked design or dynamic design features) than IS problems that will lead to a one unequivocal and undisputed decision. In such constricted situations, simple impasse or basic search is more appropriate. Example 2: IS problems where decisions have to be made about one or a few ready-made solutions also need different decision-making processes (e.g. simple impasse or basic search) than IS problems where far-reaching modifications or design activities are needed (see also table 3). These examples show that the factors and forces identified in this paper provide some insights into conditions under which each path configuration can be considered as most appropriate.

Often, IS related problems and decisions are initially perceived as rational and suitable for a planned approach. During the process this might prove to be too optimistic and inadequate; in such cases adjustments are necessary, which may easily lead to confusion, poorly managed decision-making processes and ineffective decisions. By this paper we hope to contribute to more insight in IS decision-

making processes which may lead to more appropriate IS decision-making models and better decisions.

The results of this study should be viewed in the light of some limitations. One of these is that we have not considered the relationships between IS decisions and other decisions in the same organisation taken at the same time and in the longer term. Another gap in the literature that is hardly addressed in this study is the relationship between IS decisions and the structure and culture of an organisation. Decisions flow through organisational structures and influence these also. Cultures within organisations can be receptive to certain information systems but reserved with regard to others (Cooper, 1994). Finally, the advent of interorganisational information systems has implications also for the way that decisions are made between organisations. These are just some of the issues that require further research in order to increase our understanding of IS decision-making processes.

References

ALLISON GT (1971) *Essence of Decision*. Little Brown, Boston.

BACON CJ (1992) The use of decision criteria in selecting information systems technology investments. *MIS Quarterly* **16(3)**, 335-353.

BARUA A, KONANA P, WHINSTON AB and YIN F. (2001) E-Business Operations - Driving E-Business Excellence. *Sloan Management Review* **43(1)**, 36-45.

BATE, P. (1984) The impact of organizational culture on approaches to organisational problem solving. *Organisation Studies* **5(1)**, 63-87.

BOURGEOIS LJ and EISENHARDT KM (1988) Strategic decision processes in high velocity environments: four cases in microcomputer industry. *Management Science* **34(7)**, 816-835.

BOYNTON AC and ZMUD RW (1987) Information Technology Planning in the 1990s: Directions for Practice and Research. *MIS Quarterly* **11(1)**, 59-71.

BRUNSSON N (1982) The irrationality of action and action rationality: decisions, ideologies and organizational actions. *Journal of Management Studies* **19(1)**, 29-44.

- BUTLER (1991) *Designing organization: a decision making perspective*. Routledge, London.
- BURRELL G and MORGAN G (1979) *Sociological paradigms and organisational analysis*. Heinemann, London.
- CHOU TC (1998) An Empirical Study of the Impact of Information Technology Strategic Investment Decisions. *Technology Analysis & Strategic Management* **10(3)**, 338-340.
- CLEMONS EK (1991), Evaluation of strategic investments in information technology. *Communications of the ACM* **34(1)**, 24-36.
- COHEN MD, MARCH JP and OLSEN JP (1972) A garbage-can model of organizational choice. *Administrative Science Quarterly* **17(1)**, 1-25.
- COOPER R (1994) The inertial impact of culture on IT implementation. *Information and Management* **27(1)**, 17-31.
- CRAY D, MALLORY GR, BUTLER RJ and WILSON DC (1991) *Explaining Decision Processes*. *Journal of Management Studies* **28(6)**, 227-251.
- CYERT R. and MARCH J (1963) *A behavioural theory of the firm*. Prentice Hall, Englewood Cliffs.
- DCE (1999) *IT Investments, Optimising the Decision-Making Process*. DCE, Schiphol.
- DEAN JW and SHARFMAN, MP (1996) Does the decision process matter? A study of strategic decision-making effectiveness, *Academy of Management Journal* **39(2)**, 368-396.
- DELQUIÉ P (2003) Optimal Conflict in Preference Assessment. *Management Science* **49(1)**, 102-116.
- EISENHARDT KM and ZBARACKI MJ (1992) Strategic Decision Making. *Strategic Management Journal* **13(1)**, 17-38.
- EISENHARDT KM and TABRIZI, BN (1995) Accelerating adaptive processes: Product innovation in the global computer industry. *Administrative Science Quarterly* **40(1)**, 84-111.
- EISENHARDT KM (1999) Strategy as strategic decision-making. *Sloan Management Review* **40(3)**, 65-73.

GALLIERS RD (1991) Strategic Information Systems Planning: Myths, Reality and Guidelines for Successful Implementation. *European Journal of Information Systems* **1(1)**, 55-64.

GALLIERS RD and BAETS WRJ (1998) *Information Technology and Organizational Transformation: Innovation for the 21st Century Organization*. Wiley, Chichester.

GOLL I and RASHEED, AMA (1997), Rational decision-making and firm performance: The moderating role of environment, *Strategic Management Journal* **18(7)**, 583-591.

HICKSON DJ, BUTLER RJ, CRAY D, MALLORY GR and WILSON DC (1986) *Top Decisions. Strategic Decision-Making in Organizations*. Basil Blackwell, Oxford.

HIROKAWA RY and ROST KM (1992) Effective group decision-making in organizations. Field test of the vigilant interaction theory. *Management Communication Quarterly* **5(3)**, 267-288.

HITT MA and TYLER BB (1991) Strategic decision models: integrating different perspectives. *Strategic Management Journal* **12(4)**, 327-351.

HOGBIN G and THOMAS DV (1994) *Investing in Information Technology, managing the decision-making process*. McGraw-Hill, Maidenhead.

JANIS IL (1989) *Crucial decisions: leadership in policy making and crisis management*. Free Press, New York.

KEIL T, ELORANTA E, HOLMSTRÖM J , JÄRVENPÄÄ E, AUTIO, E and HAWK D (2001) Information and communication technology driven business transformation – a call for research. *Computers in Industry* **44(3)**, 263-282.

LANGLEY A (1989) In search of rationality: The purposes behind the use of formal analysis in organization. *Administrative Science Quarterly* **34(4)**, 598-631.

LEDERER AL and SETHI V (1996) Prescriptions for Strategic Information Systems Planning. *Journal of Management Information Systems* **13(19)**, 35-63.

LEE R (1998) An enterprise decision framework for Information System Selection. *Information Systems Management* **15(4)**, 7-14.

LINDBLOM CE (1959) The science of muddling through. *Public Administration Review* **19(1)**, 79-88.

MALLOY S and SCHWENK CR (1995) The effects of information technology on strategic decision making. *Operations Research* **35(5)**, 543-546.

MARCH JG and OLSEN JP (1972) A garbage-can model of organizational choice. *Administrative Science Quarterly* **17(1)**, 1-14.

MARCH JG (1994) *A Primer on Decision-making*. Free Press, New York.

MARKUS ML (1983) Power, politics and MIS implementation. *Communications of the ACM* **26(6)**, 430-444.

McCALLA-CHEN D (2000) Towards and Understanding of the Concept of Non-Decision Making and its Manifestation in the School Sector. *British Educational Management and Administration Society* **28(1)**, 33-46.

McLOUGHLIN I (1999) *Creative Technological Change*. Routledge, London.

MINTZBERG H, RAISINGHANI D and THÉORËT A (1976) The structure of 'unstructured' decision processes. *Administrative Science Quarterly* **21(2)**, 246-275.

MURRAY RJ and TREFTS DE (2000) The IT imperative in Business Transformation. *Information Systems Management* **17(1)**, 17-34

NOBLE F and NEWMAN M (1993) Integrated system, autonomous departments: organizational invalidity and system change in a university. *Journal of Management Studies* **30(2)**, 195-218.

PARKER MM., TRAINOR HE and BENSON RJ (1990) *Information strategy and economics: linking information systems strategy to business performance*. Prentice Hall, Englewood Cliffs (NJ).

PETTIGREW AM (1973) *The politics of organizational decision-making*. Tavistock, London.

PORTER ME (1985) *Competitive Advantage: Creating and Sustaining Superior Performance*. Free Press, New York.

PORTER ME (2001) Strategy and the Internet. *Harvard Business Review* **79(2)**, 63-78.

QUADDUS MA (1997) Multiple Criteria Decision Support for the Strategic Analysis of Information System Projects. *International Journal of Management* **14(2)**, 302-314.

QUINN JB (1985) *Strategies for Change: Logical Incrementalism*. Irwin, Homewood (Ill).

RAJAGOPALAN N, RASHEED AMA and DATTA, DK (1993) Strategic Decision Processes: An Integrative Framework and Future Direction. In *Implementing Strategic Processes: Change, Learning and Cooperation*. (LORANGE P, CHAKRAVARTHY B, ROOS J and VAN DE VEN A Eds) pp 274-312, Basil Blackwell, Oxford.

RANGANATHAN C and SETHI V (2000) Assessing the Impact of Decision Process on the Effectiveness of Strategic IS Decisions: A Triangulation Approach Combining Qualitative and Quantitative Methods. In *Proceedings of the 21st International Conference on Information Systems* (ORLIKOWSKI W, ANG S, WEILL P, KRUMHOLTZ HC Eds), p 455, ACM Publications, Brisbane, Australia.

RANGANATHAN C and SETHI V (2002) Rationality in Strategic Information Technology Decisions: The Impact of Shared Domain Knowledge and IT Unit Structure. *Decision Sciences* **33(1)**, 59-86.

SABHERWAL R. and KING WR (1995) An empirical taxonomy of the decision-making processes concerning strategic applications of information systems. *Journal of Management Information Systems* **11(4)**, 177-215.

SANTHANAM R (1995) A multiple criteria decision model for information system project selection. *Computers & Operations Research* **22(8)**, 807-818.

SCHWARTZ ES and ZOZAYA-COROSTIZA C (2003) Investment Under Uncertainty in Information Technology: Acquisition and Development Projects. *Management Science* **49(1)**, 57-71.

SAUER C and YETTON PW (1997) *Steps to the future: fresh thinking on the management of IT-based organizational transformation*. Jossey Bass: San Francisco.

SEBUS GMW (1991) *Information Economics*. Kluwer, Deventer.

SIMON HA. (1960) *The new science of management decision*. Harper & Row, New York.

SMITH GF (1995) Classifying Managerial Problems: An Empirical Study of Definitional Content. *Journal of Management Studies* **32(5)**, 679-706.

VENKATRAMAN N (1994) IT-enabled business transformation: From automation to business scope redefinition. *Sloan Management Review* **35(2)**, 73-84.

WAEMA T and WALSHAM G (1990) Information Systems Strategy Formulation. *Information and Management* **18(3)**, 29-39.

WILLEMAIN TR (1995) Model Formulation: What Experts Think About and When. *Operations Research* **43(6)**, 916-932.

YATES J (2001) *Information technology and organizational transformation: history, rhetoric and practice*. Sage, Thousand Oaks.

YIN RK (1991) *Case study research, design and methods*. Sage, London.

Appendix I Research and interview questions

Stimulus

Can you describe the IS-related problem that led to a decision?

What was the initial stimulus?

Were the stimuli frequent or intense?

Alternatives

Were there one, few or many alternatives available?

Were the alternatives: 1) ready-made, 2) was modification needed or 3) was design needed?

Did the participants explicitly define alternatives before making the decision?

Process

Can you describe the chain of events that led to the final decision?

What was the duration of the decision-making process from formal identification to authorized decision?

Politics

Which individuals, parties and stakeholders were involved in this decision?

Were there differences in insight and opinion?

Did the participants have conflicting interests?

Was one party dominant due to expertise or power?

How diverse and intense were these conflicting interests and how were they expressed?

Can the process be characterised by negotiations and use of power among various participants?

Was the process of arriving at the decision delayed due to differences of interests among participants?

Rationality

Was the decision process consciously planned by management?

Did management use formal planning methods?

How extensively did the participants look for information in making this decision?

How was the correctness of the decision judged? For example, on hard criteria such as cost-benefit analyses and sales figures or on subjective and soft criteria such as image and reputation?

Was it necessary to make this decision?

Did external forces influence decision-making?

Will the decision affect the competitive position of the company?