ACCOUNTING INFORMATION SYSTEMS IN SMEs

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The research questions concern the possible link between Accounting Information Systems (AIS) and profitability in small and medium-sized firms (SMEs). "Instrumental" functions of AIS are compared with profitability for 24 SMEs in the Swedish prefabricated housing industry. Data were collected by extensive, structured interviews with firm CEOs and CFOs. Results are interpreted in the context of the "sense-making process". AIS parts include: budgets, cash management, calculations, accounting and reports. The instrumental functions are evaluated in terms of completeness, complexity, logic, consistency and timeliness.

The findings indicate that instrumental features of calculations and reporting do matter and are related to profitability in the business. Well designed features of these parts of an AIS seemed to be necessary but not sufficient prerequisites for profitability. It is suggested that the relationships can be better understood in the light of sense-making aspects.

On the basis of the findings a framework of decision models is proposed. The framework is based on two dimensions of a problematic situation: degree of structure and complexity.

RESEARCH QUESTIONS IN THE STUDY

This study addresses the relationship between management control and company performance. Drawing upon Boland's (1979) two-aspect framework for information requirement analysis, the model-based aspect encapsulating "instrumental" functions of accounting information systems (AIS) is compared with profitability for mid-sized firms in the Swedish prefabricated housing industry. An instrumentally functioning AIS is characterized by its usefulness for decision making purposes in the firm.

The "sense-making aspect" of AIS is then studied. The sense-making aspect of AIS is concerned with the psycho-social context in which the system operates. Two research questions are focused in this article. 1) Is it possible to link instrumental aspects of AIS to profitability in small and medium-sized firms (SMEs)? 2) Can the existence or lack of such relationships be better understood in the light of sense-making aspects? Specifically it was hypothesized that an instrumentally functioning AIS is a necessary, but not sufficient, prerequisite for profitability. There are three unique features to this study. First, the instrumental impact of AIS is placed and interpreted in the context of a sense-making process. With this approach, it is possible to link the instrumental and the sense-making aspects and evaluate the importance of both. Second, we focus on SMEs in a turbulent environment. For such companies it can be assumed that management control is particularly important for profitability with respect to their limited capacity to meet environmental changes. Third, the results are based on a 100% response rate from a sample including 2/3 of the SMEs in the Swedish prefabricated housing industry.

BACKGROUND AND FRAME OF REFERENCE

This paper is based on an actor and action-oriented perspective (Burrell and Morgan, 1979; Silverman, 1970; Giddens, 1979). The frame of reference is related to a symbolic interactionist view (Mead, 1934; Tomkins and Groves, 1983, 1983a; Wilmott, 1983). Reality is seen as a symbolic discourse, focusing on people creating meaning (sense-making) and forming their concepts through interaction, negotiation and discourse. The forming of concepts and sense-making create a basis for action. This process can be understood and interpreted in a gradually and slowly developing social context (Sheridan, 1980). The approach allows for socially created interpretations of reality; everything is relative to its context and the frame of reference of the actor/observer in accordance with a "naturalistic" paradigm.

The frame of reference is based on the premise that it is worthwhile to study naturalistic-qualitative and rational-quantitative systems at the same time (Boland and Pondy, 1983). One point of departure is the assumption that different methods can be used for different research objectives. Some parts of reality, such as the "instrumental" functions of an AIS (see section 3.1), are supposed to be better understood, described and analyzed using scientific-oriented methods. For other parts of reality, such as "the sense-

making aspect" of an AIS, naturalistic approaches are more fruitful for understanding. By combining these two approaches we can reach a more thorough understanding of AIS in business organizations.

The instrumental features concerning design and use of AIS have been regarded as important for a long time. Research findings supporting its importance were made already by Woodruff and Alexander (1958). Their classic study of American mid-sized companies compared a group of successful firms to companies going into bankruptcy. There were two corresponding characteristics of companies in the latter group: poor management and defective control systems. In SMEs it is common that formal systems or techniques are missing, underdeveloped or that they go unused (Raymond and Magnenat-Thalmann, 1982; Pleitner, 1989; Bergström and Lumsden, 1993).

The value of AIS in small firms is still an open question. The nature of small firm management, where the actors are involved in work ranging from the strategic to the operative level, tends to impede the use of analytical, quantitative methods (Rice and Hamilton, 1979). The most frequently used information sources of small business managers are family and friends, and accessibility plays a key role in determining the choice of information sources (Fann and Smeltzer, 1989). The present study purports to contribute to knowledge about AIS in SMEs by focusing on both the instrumental functioning of the systems and the psycho-social context in which they are put to use.

ACCOUNTING INFORMATION SYSTEMS

Instrumental Parts and Functions of AIS

An accounting information system can be regarded as a number of interrelated decision models. Expanding on a framework proposed by Mason and Mitroff (1973), Boland (1979) develops a two-aspect framework of information requirement analysis building on:

The distinctions between an active versus a passive view of the user of a system, an action versus a model-based view of organizations, and a mutually causal control "with" versus sequentially causal control "over" understanding of the social process. (p. 265)

Starting out from the classical model-based view, characterized by a passive user and "control over" in accordance with a rational actor-

paradigm, our initial concern will be the instrumental functions of AIS, and their relevance from a profitability point of view. From an instrumental perspective, a decision model refers to a specific kind of problematic situation. One central aspect of the decision model is its capacity to depict relevant parts of the problematic situation in order to achieve visibility of consequences (Becker and Neuhauser, 1975). For the present study the following dimensions are assumed to be crucial.

- Completeness. All aspects of the problematic situation that are important for decision outcome should be represented by the model.
- Complexity. The complexity of the model should match the variety of the problematic situation (Ashby, 1956).
- Logic. Order provided by the model, rules and algorithms should be logical with respect to the problematic situation.
- Consistency. Interrelated parts of the model should be consistent as well as different models related to each other.
- Timeliness. Information produced by the AIS should be made available to the user in due time with respect to "deadlines" for the problematic situation.

The above dimensions should be contained in the decision models in order for them to function instrumentally. Typically the models are designed to have a good capacity for the processing of "hard information" (Häckner, 1988), which is primarily quantified. When using a symbolic interactionist view, it is desirable to focus on how the actors describe their AIS and its instrumental functions. In this study empirical data was collected to define the concept of an AIS in the frame of reference (see section 4). The actors' descriptions are given below. It was found that these descriptions relate well to the functions attributed in management accounting theory (Samuelsson, 1990; Johansson and Östman, 1992).

A *budget* can include different parts, such as the one year profit/loss budget, budgeted capital expenditures and budgeted statements for assets and liabilities. Actors in operations may be more or less involved in the budget process when providing basic information and feed-back. A budget can encompass a number of decision models for such problematic

situations as the allocation of resources and responsibility; planning for operations, profits, investments, funding etc. in monetary terms; and the creation of basic information for other decision models e.g. calculations. A budget for financing and/or liquidity planning can be used for cash management.

Cash management procedures include planning, material and inventory management, making claims and disposal measures. Cash and accounts receivables can be managed parallel to accounting. As regards financing of fixed assets, stocks and work in progress, cash management is also linked to *calculations*. Pricing, product mix and investments are examples of problematic situations that can be addressed with calculations. The calculations can be made before ("ex ante") and after ("ex post") the fact. Results of the former (ex ante) can be used for comparisons with the latter (ex post), relating calculations also to accounting.

Accounting is the center of the AIS, providing input to and getting input from the other instrumental parts of the AIS. Partly on the basis of the structure of the chart of accounts, accounting can embrace a wide variety of decision models to be used in such problematic situations as what action to take when discrepancies between budgets/plans and actual outcome are at hand. Important output from accounting are final accounts and profit/loss reports throughout the year. These can be performed with or without stock-taking, representing different levels of accuracy. Development of the annual report is a main financial accounting task.

A *report system* (profit reports excluded) is the last part of an AIS mentioned by the actors. The reports can be of different kinds. Frequently mentioned were reports on sales/deliveries, order flow and order stock, and statistics on production, employees, sales offices or salesmen's performance. Implicit in the reporting procedure there are assumptions about different kinds of problematic situations where information in the reports can be used as input.

The actors' descriptions of their AIS were compared with descriptive and normative theory (Samuelsson, 1990; Bergström and Lumsden, 1993). On this basis we distinguish between the following five parts of an AIS:

- A. Budgets
- B. Cash Management
- C. Calculations
- D. Accounting - Final Accounts - Profit Reports

E. Reports (profit reports excluded)

The Sense-Making Aspect of AIS

For a more complete understanding of the AIS requirements the model-based aspect should be viewed in its psycho-social context, which Boland (1979) refers to as the sense-making process. When focusing on the context in which AIS operate we also change our way of looking at the organization. With an action-based view of the organization where the user of the system is active and control is achieved "with" instead of "over", we can address the issue of contextual implications of the usefulness of AIS. While the two aspects are intimately related, it will be useful to consider the sense-making aspect as logically prior to and serving as the context for the problematic situation. Decision models are designed with problematic situations in mind. These situations develop within the wider framework of the sense-making process (Boland 1979; Weick, 1979, 1995).

The sense-making aspect implies a broadening of the scope of accounting (Hayes, 1983, Mellemvik, et al, 1988) and focusing on the social context (Macintosh, 1985). Feldman and March (1981) demonstrate that collecting and using information (for example by means of an AIS) also have symbolic functions. Information is gathered to exercise social values, display authority and to demonstrate that decisions are made on rational grounds. When symbolic functions such as these are taken into account, the design of AIS becomes more complex. Designs that emphasize experimentation and the challenging of current procedures are encouraged (Hedberg and Jönsson, 1978).

The sense-making process is a natural result of active persons in a social world, thus it can hardly be designed. Nevertheless, the AIS influences the shaping of situations by providing a context for social interaction. Data requirements derived from a model-based view of AIS design may therefore be insufficient with respect to the sense-making process (Boland, 1979). It has been argued that the notion that a model-based AIS accurately measures and influences behavior may be an illusion of control (Dermer and Lucas, 1986).

METHODOLOGICAL ISSUES

Sample Selection and Data Collection

Industry and company size were kept constant in the study. As the industry should be turbulent and with high demands on strategic actions, the Swedish prefabricated housing industry was chosen (Brodén, 1976). Due to governmental rules and heavy regulations for the building and costs of houses, companies in this business operate in a turbulent and complex environment. One would expect the AIS to be most important in periods leading up to a decline and during the process of decline in general economic activity. Therefore, a period that included also some years with the opposite characteristics was studied. During the years 1980-1986, a dramatic decrease in the number of constructed, small prefabricated houses took place, leading to bankruptcies and mergers. This period was followed by a general upswing in the economy, also influencing the prefabricated housing industry. The study focuses on the years 1984 to 1988. All companies in the industry are mid-sized or small, i.e. they have less than 500 employees. Out of a population of 36 Swedish prefabricated firms with 20 employees or more, a sample of 24 firms was selected, all of which are located in the southern part of Sweden. These firms were subject to small case studies. Companies with less than 20 employees were not included in the sample since the level of development of their AIS was assumed to be rather poor.

Data were collected by extensive, structured interviews with two key actors in each company: the CEO and the chief financial officer. The questionnaire was pre-tested and adjusted using pilot test interviews¹. An excerpt from the questionnaire and the data collection procedures manual is given in Appendix 1. The same kind of questions was posed concerning each of the five instrumental parts of the AIS. The instrumental functions of the AIS were evaluated by assigning points to different instrumental dimensions of the parts of the AIS (also illustrated in Appendix 1). The respondents were asked to give their subjective opinion on the use/usefulness of each part of the AIS and their ratings were "checked" by comparison to their verbal descriptions. The respondents were asked to describe the parts included in their AIS as well as the principles and processes involved in using the systems. System changes were taken into account by retrospective questions covering the last five years.

¹ For a complete questionnaire please contact the authors

A stepwise, multiple regression analysis was made in order to examine the possibility that a combination of well developed system parts contributes more to profitability than any system part by itself. The points given to each of the system parts were used as regressors, with profitability as the dependent variable. Despite the low measures of correlation often found in business administration research, a significance level of 1% was chosen.

After analyzing the interview results from all 24 firms, we concentrated on the companies with poorly developed AIS but profitability exceeding average for the firms studied. Eight firms, representing one third of the sample, were relatively profitable despite the fact that their AIS were instrumentally underdeveloped. These firms were included in a supplementary analysis concerned with the sense-making aspect of AIS.

Profitability as a Performance Measure

Return On Investment (ROI) for the five years between 1984 - 1988 was measured on the basis of annual reports adjusted with regard to accounting principles (Buzzel and Gale, 1987; Häckner, 1990). All of the companies had not been in business for the entire five years. The dramatic changes in market conditions (turbulence) during the period gave considerable variations in industry profitability potential. Mean profitability (ROI) for the companies studied increased from 6.0% for 1984 to 30.1% for 1988, making it impossible to compare profitability for part of the period with the profitability of the whole period.

Since the (changing) market conditions were approximately the same for all the companies, a measure of the difference between a company's profitability (ROI) for a specific year and the mean profitability for all the companies studied was used. This measure indicated to what degree the company in question had performed better or worse than average for the firms studied (Grinyer and Norburn, 1975). This centered measure is more comparable between different years than a raw measure of ROI (Wood and Howell, 1991).

System Changes and Directions of Causality

Most companies had made changes in their AIS during the five-year period. It was assumed that a change in an AIS could influence profitability the year after the change had been realized. To take such

changes into account each company was treated as two observations (cases) when analyzing the relationships between different parts of the AIS and profitability, thereby making the number of cases 48. Two periods were determined with respect to when AIS changes had occurred. For most companies 1984-1986 was treated as one period and 1987-1988 as another.

The direction of causality concerning the AIS and profitability is problematic. According to conventional logic, the degree of AIS sophistication affects profitability in a way that is possible to measure by analysis of the (adjusted) accounts. The actors are able and willing to give fair descriptions of their AIS and its use. Alternatively, the influence of the degree of AIS sophistication on profitability is unclear or non-existent. Key actors use their knowledge of profitability to make conclusions about causality. They rationalize good or bad profitability as consequences of the sophistication level of AIS. Accordingly, actors in companies with high profitability tend to exaggerate the usefulness of the systems in their descriptions. These assumptions of causality produce the co-variations measured. It is for instance likely that an actor involved in the design and use of a system might show a propensity to see things (systems etc.) improving, rather than deteriorating, as outcomes can be attributed to the actor concerned. The profitability measure used in the study may however partially offset this effect. Where there have been changes of actors, it is possible that the actors involved relate the improvement of systems and system use to "their" period.

To explore these risks, we decided to take a closer look at the system and actor changes in the companies. To a considerable extent changes in the systems were made during the five-year period, with budgeting being subject to most changes and cash management and calculations as the most enduring parts of the systems. Changes "for the better", meaning a higher measure for the second part of the period studied, were far more frequent than the opposite, which could be expected from a "rationalization" point of view. In 11 of the 24 companies there were changes of CFO during the period studied. There were more "new" actors changing the systems for the better than for the worse. There were however also examples of the opposite. In one company, which was subject to change for the worse, there had been another change of CFO after the system changes. Since there were actor changes in 11 companies, a number of them were not involved in any system changes. All in all, a

thorough analysis of the respondents answers indicate that they tried to give fair ratings of the structure and use of their AIS.

RESULTS

Relationships Between AIS Parts and Profitability

In this section we present our results concerning the instrumental functions of AIS. We focus on those findings showing tendencies to relationships. See Figure 1 for the corresponding plots. Correlations are provided in Appendix 2.

Calculations were correlated with profitability. Capital budgeting, however, was not. Capital budgeting is far more long-term oriented than price and profit calculations and based on another theoretical foundation (the present value of future payments) than accounting and budgeting. The level of uncertainty about the accuracy of capital budgeting often is high, and assessments ex post are rather rare. Hence, the calculation systems (capital budgeting excluded) was plotted in relation to profitability (Figure 1.a). The plot indicates a weak tendency towards a relationship.

As can be seen from Figure 1.b, it is doubtful whether a weak tendency towards a positive co-variance can be argued between accounting system levels and profitability. As the profit/loss reports throughout the year normally include budget variances, the relations between budgets and accounting were examined. The measures for these system levels did co-vary.

Figure 1.c, picturing the report system level and profitability, gives some support to a positive co-variance. Company A had a very well developed reporting system during the period 1984 - 1986, when market conditions were poor. However, with changes of key personnel the system "disintegrated", showing a bottom position for the period 1987-1988, which represented a rise in demand and other market conditions. The relationship with profitability goes in the expected direction.

Figure 1. Calculations, Accounting Systems, Report Systems and Profitability.

1.a Calculations; Capital Budgeting Excluded (points)

1.b Accounting System Level (points)

1.c Report System Level (points)

We will now return to our first research question: Is it possible to link instrumental aspects of AIS to profitability in SMEs? According to our data the answer is yes, but only for some parts of an AIS. The clearest result is the finding suggesting that some instrumental features of an AIS in this business do matter, and are related to profitability. At least this seems to be the case for two parts of an AIS; calculations (except capital budgeting) and reporting. The measures for these system parts are correlated. Nevertheless these measures represent different phenomena, raising the question as to whether there are factors other than their relation to profitability explaining the fact that they go together.

We hypothesized that an instrumentally functioning AIS is a necessary, but not sufficient, prerequisite for profitability. The first part of our hypothesis was supported with respect to calculations and reporting, partially supporting the long-standing proposition that instrumental features referring to design and use of these parts of an AIS do count and are necessary prerequisites for profitability. For a company in the prefabricated housing business it seems very likely that calculations and reporting of high quality are important for profitability. These results are especially interesting if the upswing in the economy during the study period is taken into consideration. It could have been expected that the AIS be most important in periods leading up to a decline and during the process of decline in general economic activity. Our results indicate that calculations and reporting are relevant also during a period with the opposite characteristics.

However, our cases included unprofitable companies despite the fact that they had instrumentally functioning AIS. Accordingly the second part of our hypothesis was supported as expected. An instrumentally functioning AIS is not a sufficient prerequisite for profitability.

The research hypothesis was confirmed with respect to some problematic situations, but not concerning others. Calculations address some of the most crucial problematic situations; decisions on prices and product mix. Reporting on sales, deliveries, production etc. refers to different central areas for control. Whereas sales reports also can be used for pricing and product mix decisions, delivery and production reports are more closely related to problematic situations concerning operational production control.

Since calculations (except capital budgeting) and reporting were correlated, a suitable combination of well developed system parts might contribute more to profitability than any system part by itself. The results

from a stepwise, multiple regression analysis concerning the combination of calculations (capital budgeting excluded) and reporting are shown in appendix 3. R^2_{adj} is approximately 30% and the F-ratio, the t-values for reporting and the constant are all significant at the 1%-level. The t-value for calculations is significant at the 10%-level (0.09).

These results suggest that the combination of well-developed systems for calculations and reporting are the most important formal control devices for profitability. Next, we turn to the context within which the AIS are designed to operate.

Results from Interviews

The interviews suggest that several problematic situations are handled in a much less formalized manner than the procedures associated with information from the AIS. Other problematic situations are handled by complementing information from the AIS with other, less formal, sources of information. The actors use their own (or others) experience from similar previous situations when making decisions on what measures to take. Problematic situations are tackled on the basis of the actors' impressions and interpretations of "what was done" in similar previous situations and "how things turned out then".

Situations approached in this manner include (but are not limited to) human resource-issues (hiring new employees, setting salaries, making task and responsibility changes) and non-strategic investments. For example, the actors in one firm consider themselves as having "a good grasp" of their business even though formal budgets are not used. When trying to enter the Norwegian and Danish markets, the company hired new staff and made certain smaller investments. These decisions were made with the support from other firms, more experienced in those particular markets. Similarly, when engaging in contracting, firm A proceeded by trial and error. Starting on a small scale and slowly progressing, the actors received continuous feed-back on their actions and gradually acquired more experience. This pattern emerges also in the results from several other firms.

Judgments based on the actors' experience also include tenders and pricing decisions, where the actors generally refer to their knowledge of how customers have reacted to previous offers and prices. As to decisions on price and product mix, the actors tend to combine using the AIS with judgments based on experience. In one of the firms, calculations *ex post*

are made if the actors perceive something to be "going wrong". The CFO in this firm states:

We are dealing with people with bounded rationality. Rough measures ... are enough to see where we stand. We use full costing, and then we compare our prices with those of our competitors.

In some cases the actors seem to compensate an underdeveloped part of the AIS with significant use of some other, more sophisticated, system part. Weak budgets are compensated with well-developed accounting. Weak system parts are to some extent compensated for by using informal systems (the corporate sales staff, conferences, exhibitions and the like) and intensively making use of the formal information actually available. The CEO of one company stresses that the reports produced are heavily utilized and frequently discussed in the management team. This way, the actors contend that they "get a feeling for how the business is running" although the general level of development of their AIS is low.

The actors in another firm also heavily emphasize the importance of using the information produced. Reports on sales and production are used intensively by both the management team and the board of directors. Reporting turned out to be correlated with profitability. However, to the extent that system output (reports) can be regarded as a kind of experience storage, reporting can also be related to using experience. As we have seen earlier, no correlation could be argued between cash management and profitability. Accordingly, the interview results demonstrate that when liquidity is strained (which often coincides with profitability problems) the actors normally feel that they need to devote more attention to cash management.

Our second research question addressed the issue whether a relationship between the instrumental aspects of AIS and profitability in small firms can be better understood in the light of sense-making aspects (Boland, 1979; Weick, 1995). Our findings support an affirmative answer. Clearly the context was important for understanding actors' use of information from an AIS and how they made sense of it. Specifically two contextual dimensions seemed to be crucial for understanding: 1) actors' bounded rationality and symbolic use of information, and 2) type of problematic situation. The first dimension has to do with social aspects (Macintosh, 1985) and the use of formalized information and models for legitimating, power and justification purposes. This has been widely recognized in the literature (Feldman and March, 1981; Hayes, 1983; Mellemvik, et al, 1988). Regarding the second dimension the findings

indicate that the actors emphasize and use certain kinds of decision models to a greater extent for certain types of problematic situations. Information from the different parts of the AIS seemed to be specially useful in clear-cut and analyzable situations, for example when taking decisions on production plans or product mix. In "fuzzy" types of situations the actors tended to rely less on formal models from the AIS and more on the actors' visions and experience. Visions and ideologies seemed to have special significance when working with strategic issues and problems with long-term consequences. Actors' experience was used widely in situations concerning the acquisition of human resources, non-strategic investments, and submissions of offers. A combination of decision models (related to the AIS and to experience respectively) was used for decisions on prices. We discuss this second dimension of context further in the next section.

DISCUSSION

On the basis of the findings reported in this paper we propose a typology of decision models for different problematic situations. The proposed typology is based on two dimensions of a problematic situation: degree of structure and complexity. Several authors have made a distinction between structured and unstructured problems (Thompson, 1967; Mason and Mitroff, 1973; Nutt, 1986, 1989; Iselin, 1989; Taylor III, 1988). We relate the degree of structure concerning a certain problematic situation to knowledge about cause/effect-relationships and access to an established procedure, i.e. a model or a "tool" for problem solving.

In situations where a certain problem can be systematically evaluated, tools are developed for this purpose. The decision models included in AIS are often designed with highly structured problematic situations in mind (Rice and Hamilton, 1979). When problems encountered in organizations are poorly structured they can be interpreted in different ways, giving birth to ambiguity. Different interpretations of causal relationships in the environment or between the organization and its environment may result in different preferences for solutions to problems among the actors. Supplementary data might be confusing and contribute to uncertainty (Weick, 1979, 1995; Daft and Lengel, 1987).

We refer to these retrospective interpretations of reality as the sense making process (Boland, 1979). Actors help each other to understand and make sense of such situations through interaction. Our results indicate that important underlying factors in this respect are the actors' experiences

from similar situations (Bergström and Lumsden, 1993). The presence of an experienced actor in a particular problematic situation can have a considerable impact on the problem solving approach of the management team (Nilsson and Nilsson, 1992). Experience seems to be more important in situations being unstructured with few guidelines (Perkins and Rao, 1990).

Another important and frequently discussed variable is complexity. The number of factors to consider and their inter-relationships influence the approach to a given problem. Complexity is high when reality consists of several different and mutually dependent variables (Hedberg and Jönsson, 1978). Complexity is also dependent on the environmental change rate. When reality is changing rapidly it is perceived as more complex. Thus, complexity has a subjective element or dimension. Clarity of preferences is also related to complexity. When preferences are unclear or disputed it can be more difficult to assess which factors are relevant and need to be taken into consideration. Therefore the situation is perceived as complex.

Having introduced the two dimensions on which our proposed typology is based, it is time to take a closer look at what kind of decision models seem to be most useful in situations of varying degrees of structure and complexity. The variables are continuous rather than discrete and we can comment on the ideal types only. See Figure 2.

Figure 2. Decision Models for Problematic Situations with Varying Degrees of Structure and Complexity.

Problem Structure	High	Algorithm	Analysis
	Low	Analogy	Vision
		Low	High
		Problem Complexity	

Vision is used when the problem is unstructured and highly complex. Entrepreneurial research can provide numerous examples of managers acting solely on the basis of an inner conviction that a certain alternative will give the desired result. This phenomenon can also be illustrated using

examples from politics, e.g. Martin Luther King's famous: "I have a dream". This has a clear relationship to Weber's (1947) substantive rationality. Actions are guided by a strong belief (an "ideology") in some absolute value (Klein and Hirschheim, 1991).

The opposite situation, with well-structured problems of low complexity, calls for *algorithms*. Among numerous examples we find calculations of tariffs and premiums in the insurance industry, where the values of some variables are the inputs from simple, mechanical and often computerized calculations. Parts (decision models) of an AIS such as some calculations can also possibly be treated in this way.

As complexity increases *analysis* is used. The number of factors and connections becomes so large that the solution is not computable without support from sophisticated techniques. Classical decision theory is focused on this kind of problem, e. g. game theory and statistical models. These kinds of problematic situations are often dealt with in operations analysis. Brownell and Hirst (1991) have suggested that the developments of CAD/CAM in production technology should influence management accounting research along these lines.

Our results suggest that the main concern for those involved in managerial problem solving is not always complexity. Although the number of relevant factors may be limited and the preferences may be reasonably clear, the situation can be challenging for the actors involved. If there is no "tool" that can be used, the problem can be solved only on the basis of judgment. This is particularly true when their knowledge of how the environment affects their business is limited, which is often the case in small and medium-sized enterprises (Rice and Hamilton, 1979).

In pricing decisions or when making an offer for example, a mutual interpretation of the situation can only be reached through discussions and exchange of opinions. Social interaction leads to shared values and co-ordination of actions within the organization. The present study demonstrates that the actors' previous experience is an important underlying factors in the process. A comparison can be made with the way chess players affront different problematic situations that come up during a game of chess. With increasing experience, the players acquire a "vocabulary" of a very large number of configurations or patterns that are used in problem solving. Successful players can relate the various problematic situations that come up during a game of chess to patterns and clusters of patterns with which they are already familiar. Therefore, they need not analyze the situation in detail (Newell and Simon, 1972; Simon,

1987). The situation is interpreted using concepts based on theoretical knowledge and experience, providing the actor with an "inner picture". Action follows if this inner picture makes sense in relation to the perceived problematic situation (Göranzon, 1990). We refer also to the *analogy* as a decision model.

Let us now summarize the two dimensions whereupon our discussion is based. Degree of problem structure means whether we are knowledgeable of cause/effect relationships and have access to a model or a "tool" for problem solving. Degree of complexity regards the number of factors to consider and their interrelationships, environmental change rate and clarity of preferences. Our two dimensions cannot be entirely isolated from each other. Structured/unstructured problems are related to complexity. Through complexity a confused situation can arise where a mutual interpretation of the situation at hand may be necessary to solve a certain problem. When the situation is complex it may however be less fruitful to work with analogies and experiences for problem solving, since the reality of today is different from that of yesterday. Attempts have been made at capturing the two dimensions (related concepts) in a single construct (Van de Ven, Delbecq and Koenig, 1976; Gresov, Drazin, and Van de Ven, 1989), but more recent research advocates treating them as two dimensions with differing theoretical implications (Brownell and Dunk, 1991; Brownell and Hirst, 1986).

In focusing on unstructured problems of low complexity, analogies, we argue that classical decision theory is insufficient and even misleading since it does not take into consideration the ambiguity associated with unstructured problems (Boland and Pondy, 1983; March, 1987). There is a tendency in the literature to approach unstructured problems analytically. Analytical methods have very few practical implications for solving unstructured problems. In such situations actors use their experiences and analogies instead. To be tackled efficiently, unstructured problems require an approach based upon discussions between participating actors, so called discourse (Klein and Hirschheim, 1991). The application of analytical methods on unstructured problems may lead to the actors solving the wrong problem (Mitroff and Featheringham, 1974).

THE ANALOGY AS A RESEARCH PROBLEM

Returning to Figure 2, it can be concluded that algorithms are reasonably unproblematic from a research perspective. The decision models here referred to as vision and analysis are already vivid fields of research. We suggest that one important task for AIS researchers is the development of information systems comprising decision models better adapted to the problematic situations for which they are intended. We also suggest that one interesting starting-point in this work is to explore the importance of analogies at the expense of, or as a supplement to, analysis for decision-making.

The specific situations where managers use analogies as decision models could be described and analyzed further, as well as their possible implications for the design and use of AIS. The suggested linkage between unstructured problems of low complexity and the analogy as a decision model put forth in the present study requires corroboration. Several factors could possibly relate to such a research agenda.

Turbulent and stable environments have different implications for organizations (e.g. Burns and Stalker, 1961). The capacity of enacting (Weick, 1979) the environment is often limited concerning small and medium-sized firms. Rather, such firms need to adapt to environmental circumstances. In a turbulent environment it should be possible to rapidly change the way of acting in different situations (Hedberg and Jönsson, 1978). Fast and frequent decisions must be made in order to handle unexpected or complex situations (Huber and McDaniel, 1986; Eisenhardt, 1990). In stable environments, organizations can benefit from more complex decision models (Hedberg and Jönsson, 1978).

Factors on the group-level can also have implications for design and use of AIS. Looking at decision making as a result of negotiations, conflicts and as a political game within organizations (Allison, 1971), the relative power of the actors becomes an important aspect to consider. Powerful actors integrate their individual objectives in decisions that are made within the organization (Hickson, 1986; Dermer and Lucas, 1986). It is conceivable that the factors most immediately related to using the analogy as a decision model are related to the characteristics of the problematic situation and to the individual characteristics of the decision makers. Descriptive decision research suggests that information use and decision making are highly contingent on the characteristics of the

decision problem as well as on individual differences (Payne, Bettman and Johnson, 1992).

In small & medium-sized enterprises, the individual characteristics of managers are considered particularly important (Bohman and Boter, 1984). One important factor in the psycho-social context of AIS is the psychological style of the users, their "decision styles". Several empirical studies discuss the presence of "fingerspitzgefühl", i.e. some kind of experience-based feeling for what is the most suitable alternative in a particular situation. It has for example been shown that intuitive managers prefer making judgments based on experience rather than using their AIS (Bergström and Lumsden, 1993). In situations where the problem is poorly defined, experience with the operation and with similar problems in the past is often used. A vague problem is quickly given a concrete form if a similar situation has been experienced previously (Berger, Ferguson and Woods, 1987).

One widely acclaimed personality typology is that of Jung (1923). Using this typology we can distinguish between four fundamental differences in personality: We prefer to perceive the world in either a sensing or an intuitive fashion. We prefer to pass judgments either in a feeling or a thinking way. A preference for perception or judgment can also be discerned. Some of us (the extroverted) focus the outer world, i.e. people and events, while others (the introverted) prefer the inner world of abstract ideas and concepts. Links between the Jungian personality traits and information management are suggested by several authors (Mason and Mitroff, 1973; Henderson & Nutt, 1980; Macintosh, 1985, 1992).

The Jungian (1923) typology can be used in order to address the question of a possible linkage between the analogy as a decision model and the decision makers' individual characteristics. The decision style of the actors can be captured readily with the Myers-Briggs Type Indicator, MBTI (Myers, 1980) the reliability and validity of which have been proven (Tzeng, Outcault, Boyer, Wayfare and Landis, 1984). Age, sex, education and present position also function as filters in relation to the stream of stimuli that actors face (Hambrick and Mason, 1984).

Small case studies are most likely a suitable approach for studying the sense making aspect of AIS as it has been presented here. Actors' thoughts and actions can probably best be studied by analyzing situations they have been involved in themselves. Extensive interviews on such situations could therefore be performed with the actors. The interviews could also be supplemented with simulated "problematic situations" or cases.

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Appendix 1

Excerpt from Questionnaire and Procedure of Analysis

Budgets

- 6.1. Were budgets formatted for 1988/1989?
Yes, since __ (year) No
If "yes", please answer the following questions.
- 6.2. What budgets did you establish? For what periods? Enclose example, please.
- 6.3. Who makes these budgets (basic information and consolidation)? Please specify positions, persons or org levels.
- 6.4. For which of these budgets are comparisons to actual results made? How often? By whom? Please specify positions, persons or org levels. Comment on their use and usefulness, please.
- 6.5. Have there been any changes with respect to budgeting or use of budgets since 1979? If so, please specify what changes, when they were made, the reasons for them and their consequences.

Profit and loss-budget - budget for one year: Level of development

0	No budget is made
1	Poorly developed (linear trend from previous year, no basic documentation)
2	Average (no or limited period cutoffs, some basic documentation, linear trend to some extent adjusted for known major changes of conditions)
3	Comprehensive (periodic, comprehensive basic documentation based on forecasts, expected environm. and operat. changes taken into considerat.)

Budget for statement of assets and liabilities

0	No budget is made	1	Budget is made

Fixed capital expenditure budget

0	No budget is made	1	Budget is made

Financing budget

0	No budget is made	1	Budget is made

Budget process participation

0	No budget is made
1	Budget is by and large made by the CFO
2	One or a few significant actors participate and contribute basic information (e.g. CEO, Marketing Manager or Production Manager)
3	Several actors on different organizational levels participate and contribute basic information. A budget review process is performed

Follow-up frequency

0	Never
1	Once a year
2	Two - four times a year
3	Five times a year or more

System use, usefulness

0	Poor
1	Average
2	Good

Appendix 2

AIS in the Swedish prefab housing industry
 Data summary
 Correlations

	Profitability	Budgets	Cash	Calculations	Accounting	Reports	
	Y*)	B	Mgmt	C1**)	C2**)	A	R
Average	0.1	7.6	6.6	10.0	8.3	6.5	12.4
Std deviation	13.0	4.1	2.9	4.7	4.1	2.3	3.4
Max value	39.0	14.0	11.0	19.0	15.0	11.0	18.0
Min value	-36.1	0.0	1.0	2.0	2.0	2.0	5.0
Max points possible		14.0	11.0	19.0	15.0	19.0	18.0

Correlation matrix. Pearson's product moment correlation coefficient

	Budgets	Cash	Calculations	Accounting	Reports		
	Y*)	"B"	Mgmt "CM"	C1**	C2**	"A"	"R"
Y*	1.00						
B	0.15	1.00					
CM	0.01	0.20	1.00				
C1**	0.41	0.48	0.29*	1.00			
C2**	0.48	0.45	0.21	0.95	1.00		
A	0.39	0.57	0.48	0.36*	0.38	1.00	
R	0.54	0.47	0.10	0.42	0.48	0.51	1.00

*) Y = Relative Profitability

**) C1 = Calculations (Capital Budgeting included), C2 = Calculations (Capital Budgeting excluded)

Numbers in bold style represent values that are significant on the 1%-level.

Numbers followed by a bold style asterisk represent values that are significant on the 5%-level.

Appendix 3

Accounting Information Systems and Profitability Multiple Regression Analysis $Y = f(C2, R)$

48 observations (2 for each company). $48 - 3 = 45$ degrees of freedom

Dependent variable: Y Relative Profitability

Independent variables: C2 Calculations (capital budgeting excluded)
R Reporting

Determination Coefficient

(Multiple Regression Coefficient) R:

0,58

R^2 : 0,33

R^2 (adjusted): 0,30

Standard error: 10,83

Analysis of Variance

Source	Degrees of Freedom	Sum of Squares	Mean Squares	Square
Model	2	2 612,08	1 306,04	
Residual	45	5 275,10	117,22	
F-ratio:	11,14	Significance for F-ratio: 0,0001		

Variables in the equation:

Variable	B	Std Error of Coeff.	Beta	T	Sig. T
C2	0,77	0,45	0,25	1,73	0,0910
R	1,57	0,55	0,41	2,86	0,0064
Constant	- 25,69	6,04		- 4,25	0,0001

Equation $Y = f(C2, R)$ $Y = - 25,7 + 0,8(C2) + 1,6R$