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The Role of Decision Heuristics in Organizational Management

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Selart, M., Boe, O., & Lindström, I. The role of decision heuristics in organizational management. Göteborg Psychological Reports, 2000, 30, No. 3. In the present study, interviews were made with IT managers of larger companies in Sweden. The results revealed that the managers differed with regard to performance on a couple of heuristics tasks based on the logic of consequences (Tversky & Kahneman, 1974). It was suggested that the performances on these tasks were able to explain to some extent the managers' reasoning in the interviews about how information technology was used in their organizations. However, it was also stated that the managers' responses also most probably were influenced by another kind of heuristics that are built on rule following (Lipshitz, 1995; March, 1994).

Key words: Decision making, organizational management, IT

It is generally believed that the term heuristics became a common part of the English language some decades ago due to the efforts of the Hungarian mathematician Georg Ploya. The term is often used in order to describe a certain method of self-centered thinking and reasoning as a response to real world problems. A heuristic method could be defined as a provisory reasoning about the sensibility of a solution for a problem. According to Schoenfeld (1985) good problem solving is often at least partly characterized by the usage of a general heuristic. Problem solvers may be defined as "good thinkers" in the sense that they are supervising their own thinking during the problem solving process. A positive feature of this supervising is that strategies, which are not working, may quite easily be abandoned in favor of others that may lead to a solution. Characteristic to this way of thinking is also the ability to generalize and conclude.

Consequently, we use heuristic thinking in everyday life to facilitate the decisions we have to make (see Baron, 1994, for a review). In decision research, it is commonly assumed that the use of different decision heuristics is an adaptive response of an information processor. This processor has been characterized as limited in its capacity to meet the demands of the decision problem (Payne, Bettman, & Johnson, 1993). Such demands may include how complex the problem is and whether or not uncertainty is involved. One reason for using decision heuristics in everyday life is that optimal strategies are often unknown.

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or unknowable (Simon, 1987). However, the term heuristics may not only be understood as equivalent to rule of thumb. For instance, Baron (1998) argues that the term intuitions may in many cases be as relevant here since the principles in question are not always used as rules of thumb.

Although the use of heuristics may often be successful, sometimes they may lead to characteristic errors or biases (Kahneman, Slovic, & Tversky, 1982; Tversky & Kahneman, 1974). It has therefore been argued that the focus of the researcher must be on the features of the decision heuristics that may lead to judgmental or perceptual biases (Kahneman & Tversky, 1996).

Still, other researchers argue that much of human reasoning and decision making can be modeled by minimalist heuristics that make inferences with limited time and knowledge (Gigerenzer & Todd, 1999). These heuristics are based on the constraints set by bounded rationality and do not involve much computation with regard to probabilities and utilities. They are also extremely successful. Lipshitz (1995) has recently pointed out some limitations tied to the traditional paradigm. He states that the uncertainty that affects real-world decisions is not limited to the nature, likelihood, or value of future consequences. It also affects real-world decisions by interrupting ongoing action, delaying intended action, and guiding the development of new alternatives.

The influence of decision heuristics on information technology strategies in companies

In the present study, we examine how the use of decision heuristics may influence IT (information technology) managers’ reasoning in their organizations. The value of information lies largely in how it affects the choices that are made. From this perspective, it may be argued that the value of IT affects organizational choices. For instance, the results from Feldman and March (1981) indicate that the efforts in managing information are largely driven by an ambition to improve decisions. This is important since displaying information and being able to explain decisions in terms of information indicate an ability to use information easily and appropriately. Information is thus used as a symbol of competence and as a symbol of social efficiency which help to justify a decision. A similar argumentation has been presented by Levitt and March (1988). They suggest that certain properties of interpreting an experience stem from features of individual inference and judgment. People in general are not perfect statisticians and they make systematic errors in recording the events of history and in making inferences from them.

The design of the study

In the present study, IT managers at larger companies in the county of Skaraborg, Sweden, were interviewed about the treatment of information technology in their companies. The questions mainly concerned visions, current
strategies, evaluations etc. related to the management of information systems and were based on the results obtained from previous research (Allwood & Hedelin, 1996; Hirschheim, 1989; Mayo, 1991). In connection with the interviews, participants also completed a couple of tasks measuring biases related to the use of the representativeness, availability, and anchoring & adjustment heuristics (Tversky & Kahneman, 1974). In addition, tasks measuring attribution biases were also used, since it has been argued that attribution may also be treated as a decision heuristic (Plous, 1993). It was hypothesized that high-performing participants on the heuristic tasks would reveal a greater variety of answers to the interview questions than low-performing participants. It was also hypothesized that they would act more consistently. Furthermore, it was hypothesized that the outcome from the high performing participants would not differ depending on whether frequencies or relative frequencies were used in the analyses.

Method

Participants

Twenty-seven IT-managers (24 men and 3 women) in organizations with over 150 employees participated in the survey. On prior occasions, these participants had indicated that they were willing to take part in the investigation. The participants' mean age was 42.8 years (SD=10.2) within a range of 21 to 60 years. The participants differed with regard to their background, level of education, and their position in the organization. They also differed with regard to the type of organization they worked in, how long they had been working with IT, and for how many years they had been working in the organization. Table 1 gives an overview of what type of organization participants were employed in, their position in the organization, as well as their level of education.

Position

Eighteen participants were found to be in charge of their company's respective division for information technology and computer matters. Ten participants were also responsible for the economy and the administration in addition to being responsible for IT and computers, or they were responsible for the whole business. Dividing the participants into different categories of decision levels in the organization, four participants were on the group executive board, eleven participants formed part of a managerial group, and twelve participants had positions below the managerial group level.
Table 1.
Participants Position in the Organization, Level of Education, and Type of Organization.

<table>
<thead>
<tr>
<th>Position</th>
<th>Level of education</th>
<th>Type of organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT manager</td>
<td>2 years computer science</td>
<td>Public sector</td>
</tr>
<tr>
<td>IT manager</td>
<td>3 years senior high school.</td>
<td>Manufacturing industry</td>
</tr>
<tr>
<td>IT manager</td>
<td>MBA</td>
<td>Laboratory company</td>
</tr>
<tr>
<td>IT manager</td>
<td>Secondary-school teacher, 2 years college ADP</td>
<td>Public sector</td>
</tr>
<tr>
<td>IT manager</td>
<td>MBA</td>
<td>Manufacturing industry</td>
</tr>
<tr>
<td>IT manager</td>
<td>2 years senior high school (economics)</td>
<td>Production company</td>
</tr>
<tr>
<td>IT manager</td>
<td>Systems analysis at college</td>
<td>Manufacturing industry</td>
</tr>
<tr>
<td>President IT</td>
<td>Computer engineer</td>
<td>Manufacturing industry</td>
</tr>
<tr>
<td>Computer manager</td>
<td>Computer engineer</td>
<td>Manufacturing industry</td>
</tr>
<tr>
<td>Computer manager</td>
<td>Systems engineer</td>
<td>Manufacturing industry</td>
</tr>
<tr>
<td>IT manager</td>
<td>3 years senior high school</td>
<td>Manufacturing industry</td>
</tr>
<tr>
<td>IT manager</td>
<td>3 years senior high school</td>
<td>Manufacturing industry</td>
</tr>
<tr>
<td>IT manager</td>
<td>Bachelor of Science in systems analysis</td>
<td>Service company</td>
</tr>
<tr>
<td>IT coordinator</td>
<td>Technical</td>
<td>Manufacturing industry</td>
</tr>
<tr>
<td>Local IT manager</td>
<td>Academic, mathematics, information processing</td>
<td>Manufacturing industry</td>
</tr>
<tr>
<td>IT coordinator</td>
<td>Elementary school, agriculture education.</td>
<td>Public sector</td>
</tr>
<tr>
<td>Computer manager</td>
<td>Secondary engineering course</td>
<td>Service company</td>
</tr>
<tr>
<td>ADP coordinator</td>
<td>Senior high school</td>
<td>Manufacturing industry</td>
</tr>
<tr>
<td>ADP manager</td>
<td>College</td>
<td>Manufacturing industry</td>
</tr>
<tr>
<td>Administrative manager</td>
<td>Senior high school</td>
<td>Manufacturing industry</td>
</tr>
<tr>
<td>Administrative manager</td>
<td>Business economist</td>
<td>Manufacturing industry</td>
</tr>
<tr>
<td>Administrative manager</td>
<td>School of social studies</td>
<td>Manufacturing industry</td>
</tr>
<tr>
<td>Administrative manager</td>
<td>MBA</td>
<td>Manufacturing industry</td>
</tr>
<tr>
<td>Financial manager</td>
<td>School of social studies</td>
<td>Car dealer</td>
</tr>
<tr>
<td>Group leader and responsible for IT</td>
<td>Police training course, various other courses</td>
<td>Public sector</td>
</tr>
<tr>
<td>President</td>
<td>Economist</td>
<td>Transportation company</td>
</tr>
<tr>
<td>Local manager</td>
<td>Systems engineer</td>
<td>Manufacturing industry</td>
</tr>
</tbody>
</table>
Level of education

Eight participants had completed their secondary school exams as their highest level of education, and the remaining participants had completed some level of college or university education.

Organization

Most of the organizations were rather large and included subsidiary companies. The mean number of employees was 4567 (the size of the organizations varied between 130 to 55 000 employees). The majority of the organizations were dealing with manufacturing and service (both public and private).

Materials

A brief questionnaire was distributed to the participants prior to the interviews. The questionnaire contained some general questions about background variables, such as age, gender, level of education, and previous employment. Additional questions about how many years participants had been working in their profession and in their organization, the type of organization they worked in, as well as their position in the organization were also asked. In the interview, the participants were given semi-structured questions, which can be found in Table 2. These questions were aimed at investigating the use and development of IT in the organizations. After having completed the interview, participants were requested to fulfil a series of tasks that measured the degree of biases in connection to the use of different decision heuristics. The test booklet developed by Selart, Boe and Takemura (2000) consisted of 24 questions. These questions were adopted from earlier research on heuristics and biases (Kahneman & Tversky, 1973; Tversky & Kahneman, 1973, 1974, 1982). The 24 questions were divided into four different decision heuristic categories dependent upon which decision heuristic they measured. Each of the four decision heuristic categories consisted of six questions, and the four decision heuristic categories included in the booklet were representativeness, availability, attribution, and anchoring and adjustment. Each question always had a correct answer and a wrong answer. After having given an answer, participants were also requested to give a confidence rating on a scale ranging from 50 (making a guess) to 100 (absolutely sure) to indicate how sure they were that they had given the correct answer.
Table 2.
The Questions that Were Used in the Interview.
What kind of visions do you have regarding the use of IT in your organization?
What is your perspective on issues like responsibility, distribution, availability, and the communication climate?
How will your visions affect the processing of information in the decision making process?
How sure are you that these visions are the correct ones?
What kind of solutions can you think of?

Which are your existing IT-strategies?
How do you regard the issues of responsibility and development?
How do your existing IT-strategies affect the processing of information in the decision making process?
How sure are you that the existing IT-strategies are the correct ones?
What kind of solutions can you think of?

What are your motives for the IT-development?
What can you gain from IT-development in the future?
What kind of advantages do you see now and in the future?
How do your motives affect the processing of information in the decision making process?
How sure are you that there are not any other important motives?
What kind of solutions can you think of?

Which are the effects of the IT-venture in the organization as you see it?
How do you evaluate the effects of IT in your company?
Are you able to predict any future effects of it?
How do these effects affect the processing of information in your decision making process?
How sure are you that there are not any other important effects?
What kind of solutions can you think of?

What are the opportunities and obstructions for effective use of IT in your organization?
Which advantages and disadvantages can you perceive?
How do the opportunities and obstructions affect the processing of information in your decision making process?
How sure are you that there are not any other advantages and disadvantages?
What kind of solutions can you think of?
Procedure

Participants were contacted by telephone and were asked to participate in an investigation that consisted of an interview and a second part where they would have to choose between and rate different statements. They were told that the aim of the investigation was to collect data for a longitudinal study. The interviews were in most cases performed at the participants’ work place. They were conducted in a semi-structured form. Each participant received all the questions. All participants were first requested to give some background data. The interview was then conducted and recorded. In connection with the interview each participant received the tasks that measured the degree of biases in connection to the use of different decision heuristics. After having completed these tasks, participants were informed about the full purpose of the study. A session including the interview and the decision heuristics tasks lasted between 1 and 1.5 hours.

Results

The data from the interviews were coded into different categories according to content and the question asked. The performance measure was constructed by summing the number of times the respondents answered correctly across the 24 different heuristic questions. A correct answer was always coded as 1, and an incorrect one as 0. If participants chose the correct answer, the corresponding confidence rating was given a positive value, otherwise it was given a negative value. An index measure of confidence was obtained by taking the mean values of the confidence ratings of the same 24 questions. All participants that performed above the mean value on the choices ($M_v = 10.77, S_d = 1.77$) and on the confidence ratings ($M_v = 77.14, S_d = 7.50$) were coded as high achievers, and those performing below or equal to the mean values were coded as low achievers. In this way, it was possible to create four groups of participants; one group consisting of high achievers with high accuracy and calibration (Group HH), and a second group of low achievers with low accuracy and calibration (Group LL). Furthermore a third group was constructed consisting of those participants that performed below or equal to the mean value on the choices but above the mean value of the confidence ratings (Group LH). Finally, the fourth group (Group HL) consisted of those participants that had performed above the mean value on the choices but below the mean value of the confidence ratings.
Results from the interviews
Participants' descriptions of visions regarding IT in the organization

Participants were first asked about what kind of visions they had regarding IT in their respective organizations. All participants described at least one vision in the organization. The answers were coded into three categories (see Figure 1). Category 1 (n=4) represents answers where participants expressed an IT-vision where IT was developed in a deeper sense and changed the organization structure, as well as answers which stated attitudes and an approach to using the technology. Category 2 (n=17) represents answers where participants expressed an IT-vision where they viewed IT as an innovative resource for the company's field of activities. Accounts were also presented where managers modernized their own organizations' routines with the help of the new technology. However, in some cases they didn't see any changes or developments of the organization's existing structures. Category 3 (n=5) represents answers where participants expressed an IT-vision where IT was seen only as a form of substitute technology that rationalized and facilitated the systems of production and administration in the organization's own field of activities. The majority of participants (21) attached great importance to IT for their company's expansion and competitiveness in the market, partially through the technology's practical possibilities but also through its structural possibilities. Several participants emphasized that the development of IT was moving extremely fast. The most frequent descriptions were tied to the technical advancements.

Figure 1.
Number of Participants in Respective Groups and Distribution of Answers Regarding IT Visions

<table>
<thead>
<tr>
<th>Category 1</th>
<th>Category 2</th>
<th>Category 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development of organizational structures and routines</td>
<td>Innovative resource for company activities</td>
<td>Substitute technology</td>
</tr>
</tbody>
</table>

Number of participants

```

   7  6  5  4  3  2  1  0

Category 1  Category 2  Category 3
```

HH  LL  LH  HL
Chi-square tests performed on each of the four decision heuristic groups revealed that for the HH group no significant difference was obtained between the answer categories, $\chi^2 = .00$, n.s. A significant effect was yielded for the LL group, $\chi^2 = 10.02, p < .01$, indicating that participants in this group produced substantially more answers belonging to Category 2 than to Category 1 and 3. For the LH group no effect appeared, $\chi^2 = 2.01$, n.s. Testing the HL group revealed a clear difference between the answer categories, revealing that participants in this group gave significantly more Category 2 answers, $\chi^2 = 15.23, p < .001$. By summing the answers that all four groups gave, it became possible to further investigate whether there existed any differences. A difference was found indicating that most answers tended to be Category 2 answers. This difference was statistically significant, $\chi^2 = 12.08, p < .01$.

Participants' descriptions of strategies regarding IT in the organization

Participants thereafter described how they viewed the IT strategies in their own organizations. Their descriptions were divided into three categories (see Figure 2). Category 1 (n=4) represents answers where participants described strategies that aimed to use IT to achieve growth in the organization as well as using IT to develop and change the organization's structures and routines. Here participants expressed strategies that were more thorough and that had more content and where IT affected productivity, the field of activities and the organization in some way. Category 2 (n=13) represents answers where participants described strategies that facilitated adaptation and that created opportunities for continued growth. Participants revealed the opinion that their own organization had to follow technological development in order to create opportunities for growth in the future. Category 3 (n=9) represents answers where participants described IT strategies that facilitated the inner work of the organization and where one tried to follow technological development, but where the company's field of activities did not have the opportunity to grow because of the organization's line of direction. The majority of participants described IT strategies that lead to a rich access and versatility of IT within their organizations.
Chi-square tests were again performed for each of the four decision heuristic groups. The tests revealed that no significant differences were obtained between the answer categories for any of the four groups. Group HH, $\chi^2_s = .66$, n.s., Group LL, $\chi^2_s = .40$, n.s., Group LH, $\chi^2_s = 3.52$, n.s., and Group HL $\chi^2_s = 3.26$, n.s. A chi-square test was also performed for the combined four groups, also revealing a non-significant difference, $\chi^2_s = 4.00$, n.s.

Participants' descriptions of motives for IT-development

Participants’ descriptions of the motives for the development of IT were divided into two categories (see Figure 3). Category 1 (n=21) describes the answers where participants thought that external factors governed the development of IT within their own organization to a very high degree and where the organization would have to follow this development in order to remain in the market. The most common external factor mentioned was the technical standard that clients and suppliers implicitly demand for daily communication. Participants described a movement towards closer relations between their own organization and the client- and supplier organizations. Category 2 (n=5) describes the answers where participants considered that internal factors governed the development of IT within their own organization. In this category participants described that their own organization was still in a construction phase regarding IT. The majority (13) of the participants mentioned external IT-related factors (such as communication with clients and suppliers) as deciding factors for the company’s survival and for promoting competition. Being able to
keep up with technological development was considered essential to development and growth. Participants also described how their companies had become more dependent upon each others technological standards for common communication and in order to gain access to certain information from databases. The availability of information from databases that was considered important for the company, was described as an important future motive.

Figure 3.
Number of Participants in Respective Groups and Distribution of Answers Related to Motives for the Development of IT

Additional chi-square tests performed on each of the four decision heuristic groups revealed that for the HH and LL groups, no significant differences were revealed between the answer categories, $\chi^2 = 2.00$, n.s., and $\chi^2 = 2.00$, n.s., respectively. For the LH group a significant difference was observed, as yielded by $\chi^2 = 4.00$, $p<.05$, indicating that these participants stated reliably more Category 1 answers than Category 2 answers. For the HL group a significant difference between the answer categories was also sustained, $\chi^2 = 4.50$, $p<.05$, again revealing that participants in this group gave significantly more answers belonging to Category 1 than to Category 2. A chi-square test performed on the combined four groups yielded a significant difference between the answer categories, as sustained by $\chi^2 = 9.85$, $p<.01$. This effect again indicated that significantly more Category 1 than Category 2 answers were stated.
Participants' descriptions of opportunities and obstacles to the development of IT

Participants' answers were divided into two categories, namely opportunities for development and obstacles to the development of IT in their own organization. Most of the answers that participants gave could be assigned to these categories. All participants except one (96%) stated that there were opportunities for the development of IT in their own organization. Participants expressed thoughts about how IT would become an important factor for innovation and growth within the company. Twenty-three participants (88%) described different obstacles to the development of IT in their own organization. The causes of obstruction are described in Figure 4. Category 1 (n=15) represents answers where participants expressed that the greatest obstacle to development was believed to be inadequate IT-competence in their own organization. The inadequate competence was described as being related to a lack of personal interest and commitment to using IT-technology. Category 2 (n=8) represents answers where companies and organizations were considered part of an industrial group where the ownership culture was different. These cultural aspects were generally not specified. Still, these organizations were experienced as being more centralized and less dynamic than the others. Categories 3, 4 and 5 (n=5, n=3 and n=3, respectively) represents answers where other factors were mentioned as obstructing IT development. These factors were: general costs, the management's lack of ability to perceive opportunities for technological development, and lack of infrastructures such as developed data networks.

Figure 4.
Number of Participants in Respective Groups and Distribution of Answers Related to Factors Obstructing the Development of IT

Number of participants

<table>
<thead>
<tr>
<th>Category 1</th>
<th>Category 2</th>
<th>Category 3</th>
<th>Category 4</th>
<th>Category 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inadequate competence</td>
<td>Centralization</td>
<td>Costs</td>
<td>Inadequate management</td>
<td>Infrastructure</td>
</tr>
</tbody>
</table>
The results of the chi-square tests performed on each of the four decision heuristic groups revealed that for the HH group no significant difference was obtained between the answer categories, $\chi^2 = 7.80$, n.s. A significant effect was yielded for the LL group, $\chi^2 = 10.86$, $p<.05$, indicating that participants in this group to a higher extent produced answers belonging to Category 1 and 2. No significant effects were obtained between the answer categories for the LH group, $\chi^2 = 3.50$, n.s., or for the HL group, $\chi^2 = 8.21$, n.s. An effect revealing a difference between the answers in each category was observed for the combined groups, indicating that participants gave reliably more Category 1 and 2 answers, $\chi^2 = 14.76$, $p<.01$.

*Participants' descriptions of how one measures the effects of IT*

Participants' answers were presented according to three categories (see Figure 5). Category 1 ($n=17$) represents the majority of participants, who did not value either the use of IT or the investments made in it with regard to their own organization. Participants experienced this as a deficiency in the organization and they described it as very difficult to measure the effects of IT. Category 2 ($n=7$) represents those participants whose evaluations reflected whether users and clients were satisfied or whether they complained. Participants' evaluations were based on some kind of knowledge or experience of IT. In Category 3 ($n=2$), evaluations were based on whether or not the organization achieved the stated project goals. Most participants attached great importance to evaluation, but stated remarkably few means of evaluation. The majority of companies and organizations did not evaluate the effects of IT in their organizations.

Figure 5.
Number of Participants in Respective Groups and Distribution of Answers Related to the Evaluation of IT-Effects

![Bar chart showing the number of participants in each category for evaluation of IT-Effects](image-url)
The following non-significant differences between the answer categories were yielded after performing chi-square tests on each of the four decision heuristic groups. For the groups HH, LL, and LH, $\chi^2 = 4.77$, n.s., $\chi^2 = 1.00$, n.s., and $\chi^2 = .50$, n.s., respectively. However for the HL group, a significant difference between the answer categories was revealed, $\chi^2 = 11.06$, $p<.01$. A significant effect was also observed between the answer categories for the combined four groups, $\chi^2 = 12.54$, $p<.01$, revealing that most answers belonged to Category 1.

**Participants’ descriptions of the decision making processes in relation to IT**

Participants’ answers were presented according to three categories (see Figure 6). Category 1 (n=7) represents answers where participants described IT as an all-embracing aspect. Participants gave a picture of IT as the medium through which daily questions were communicated and they also stated that IT influenced all strategic decisions. This category also covered notions of IT technology as having great potential for changing the organizational structure. Category 2 (n=16) represents answers where participants expressed the opinion that IT was a managerial responsibility in the sense that IT decisions should not be delegated beyond the board of directors. IT did not permeate the field of activities but was instead treated as a separate matter when dealing with daily questions. Category 3 (n=3) represents the view of IT as a technological question that the management considered uninteresting or irrelevant to the decision making process. Here, IT was only discussed in relation to costs, the costs being the major concern.

No significant differences between the answer categories were found for any of the decision heuristic groups when performing a chi-square test for each group separately. For the HH, the LL, the LH, and the HL groups, $\chi^2 = 1.41$, n.s., $\chi^2 = 5.21$, n.s., $\chi^2 = 3.71$, n.s., and $\chi^2 = 3.72$, n.s., respectively. However, a significant difference between answers in each category became apparent for the combined groups, as yielded by $\chi^2 = 10.23$, $p<.01$ revealing that participants significantly more often gave Category 2 answers.
Figure 6.
Number of Participants in Respective Groups and Distribution of Answers Related to the Decision Making Process

Participants' descriptions of how IT affects the decision making process

Participants' answers were presented according to three categories (see Figure 7). Category 1 (n=8) represents those who described IT as something that developed and changed the decision making process in the long run, but also as something that would continue to be an important aspect in the future and would permeate all decisions made by the board of directors. Category 2 (n=14) represents those who viewed IT as a technological tool that was helpful in accessing relevant information in order to form a basis for making decisions. Category 2 also includes answers stating that IT affected the decision making process. Here, emphasis was put on the communicative potential of IT within the organization. Participants of Categories 1 and 2 stated two possible changes of direction, namely a decentralization of the decision making process and a strengthening of the decision hierarchies. Category 3 (n=4) represents those who perceived IT as a tool to get access to databases to make a decision but where the decision making process itself was not affected. Here the emphasis was on information and not on the communicative aspects of IT.
Figure 7.
Number of Participants in Respective Groups and Distribution of Answers Related to How IT Affects the Decision Making Process

Again no significant differences between the answer categories were found for any of the single groups. For the HH, the LL, the LH, and the HL groups, $\chi^2 = 0.66$, n.s., $\chi^2 = 5.22$, n.s, $\chi^2 = 2.01$, n.s., and $\chi^2 = 1.76$, n.s respectively. Finally, for the combined groups, a strong tendency was observed between the answer categories indicating that participants tended to give more Category 2 answers than Category 1 and 3 answers. However, this tendency did not quite reach significance, $\chi^2 = 5.85$, $p=.054$.

Analyses of order structures in the decision heuristic performance variable and in the answer category variables

To further investigate whether there were any ordered structures between the categories as well as between the four decision heuristics performance groups, a test for trend in contingency table was performed. The underlying assumption for this test is that there exists an ordered structure for the two variables included in the test. It was expected that the ordered structure for the performance groups would be that the HH group produced the most answers followed in a declining order by the LH group, the HL group, and finally by the LL group which were expected to produce the fewest answers. For the variable answer categories the assumption was that there would be an ordered structure as indicated by the numbers of the categories, so that Category 1 would have more answers than Category 2 and so on. The test for trend in contingency table were performed on the four questions that are depicted in Table 3. As can clearly be seen by observing the p-values, no significant order effects were revealed in any of the two variables, independently of which question the test was performed on.
Table 3.
Results of test for trend in contingency table for the following questions

<table>
<thead>
<tr>
<th>Questions</th>
<th>P-values</th>
</tr>
</thead>
<tbody>
<tr>
<td>What kind of visions participants had regarding</td>
<td>$p=0.81$</td>
</tr>
<tr>
<td>IT in their respective organizations</td>
<td></td>
</tr>
<tr>
<td>What kind of motives participants had for IT development</td>
<td>$p=0.96$</td>
</tr>
<tr>
<td>Participant's descriptions of the decision making processes</td>
<td>$p=0.23$</td>
</tr>
<tr>
<td>in relation to IT</td>
<td></td>
</tr>
<tr>
<td>Participant's descriptions of how IT affected the decision making processes</td>
<td>$p=0.43$</td>
</tr>
</tbody>
</table>

A test for semi-trend was performed on the remaining three questions, the participants' descriptions of strategies regarding IT in the organization, their descriptions of opportunities and obstacles for the development of IT, and their descriptions of how one measures the effects of IT. The assumption underlying this test was that there only existed an ordered structure for the variable consisting of the four decision heuristic performance groups. The results revealed that the p-values did not reach significance for any of the three questions mentioned above. This indicated that no significant order differences existed for the variable decision heuristic performance group. The p-values for each tested trend were $p=0.90$, $p=0.42$, and $p=0.85$ respectively and the dfs were 2, 4, and 2 respectively.

In order to investigate whether the high and low achiever groups on the decision heuristic test differed with regard to certain aspects, analyses of variance (ANOVA) were performed. As shown in Table 4, a significant difference was found between the high achievers and the low achievers regarding the representativeness heuristic, contributing to the established difference on the entire decision heuristic test.

Table 4.
Mean Values for High and Low Achievers on the Different Heuristics Contributing to the Difference on the Entire Decision Heuristic Test.

<table>
<thead>
<tr>
<th></th>
<th>High achievers</th>
<th>Low achievers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n=9)</td>
<td>(n=5)</td>
</tr>
<tr>
<td>Representativeness</td>
<td>4.00*</td>
<td>2.00</td>
</tr>
<tr>
<td>Availability</td>
<td>3.44</td>
<td>2.60</td>
</tr>
<tr>
<td>Attribution</td>
<td>3.11</td>
<td>2.80</td>
</tr>
<tr>
<td>Anchoring and Adjustment</td>
<td>.89</td>
<td>1.20</td>
</tr>
<tr>
<td>Total</td>
<td>11.44**</td>
<td>8.60</td>
</tr>
</tbody>
</table>

*p<.01, **p<.001

Participants' answers were coded into six different categories. These categories reflected different aspects of how IT was utilized in each organization.
Each answer or statement that a participant gave was coded into one of the six categories presented in Table 5. A mean value of the statements produced for each category was constructed for each of the six categories. Another mean value based on the frequencies of the produced statements in each category was also constructed. In this way it was possible to investigate how IT was utilized in each organization.

Table 5.  
The Six Different Categories that Describe How IT Was Utilized in the Organizations

<table>
<thead>
<tr>
<th>Access and use of IT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distribution of IT</td>
</tr>
<tr>
<td>Development of services to employees with the help of IT</td>
</tr>
<tr>
<td>Development of dialogue forms with the help of IT</td>
</tr>
<tr>
<td>Development of forms of decision making with the help of IT</td>
</tr>
<tr>
<td>Adaptation related to IT</td>
</tr>
</tbody>
</table>

Analyzes of frequencies compared with relative frequencies

Separate one-way analyses of variance (ANOVAs) were performed for each of the six categories with high- and low achievers. These were carried out on the part of the decision heuristics test that measured representativeness as the independent variable and with the occurrence of the percentages of produced statements as answers to each category as the dependent variable. Furthermore, additional separate one-way analyses of variance (ANOVAs) were performed for each of the six categories with high- and low achievers on the part of the decision heuristics test that measured representativeness as the independent variable. Here, the frequency of produced statements for each category was used as the dependent variable. Further additional separate one-way analyses of variance (ANOVAs) were likewise performed first including the percentages and then with the frequency of produced statements for each category as the dependent variable for each of the six categories. Here, parts of the decision heuristics test that measured availability, anchoring and adjustment, and finally attribution, were applied as the independent variables. In accordance with the hypothesis no significant differences were revealed between high- and low achievers for any of the four heuristics when the percentages of produced statements were used as the dependent variables. The same result was obtained when using the frequencies of produced statements as the dependent variables. Further separate one-way analyses of variance (ANOVAs) were performed for each of the six categories with high- and low achievers on the decision heuristics test (all 24 questions) as the independent variables and with the percentages of produced statements as the dependent variables. Moreover, additional one-way analyses of variance (ANOVAs) were conducted for each of the six categories with high- and low achievers on the decision heuristics test as the independent variable and
with the frequency of produced statements as the dependent variables. Again in accordance with the hypothesis no significant differences were revealed between high- and low achievers for any of the six categories, independently of whether the percentages or the frequencies of produced statements were used as the dependent variables.

Discussion

The results from the present study suggest that managers' performance on decision heuristic tasks may have a predictive value concerning their reasoning about information technology issues. For instance, it was revealed that of performance on the heuristic tasks tended to have an impact on the nature of the responses to the interview questions. High performers on the tasks generally tended to produce a greater variety of answers to the questions, and they also acted more consistently. Furthermore, it was found that the outcome from the high performing participants was the same regardless of whether frequencies or relative frequencies were used in the analyses.

However, the results also indicated that much of the behavior that was revealed in the interviews also seemed to be related to other forms of heuristics that may not be included in a discussion of limited rationality (March, 1994). These other forms of heuristics reflect rule-following behavior, which follows a logic quite different from the logic of consequence. Here, decision making is seen as resulting from rule following and the fulfillment of an identity. Rule following is, according to March, grounded in a logic of appropriateness. Decision makers are imagined to ask (explicitly or implicitly) three questions: 1. The question of recognition: What kind of situation is this? 2. The question of identity: What kind of person am I, or what kind of organization is this? 3. The question of rules: What should a person such as I, or an organization such as this, do in a situation like this? In trying to answer these kinds of questions managers are establishing identities and matching rules to recognized situations (see also Lipshitz, 1995).

Reasoning processes based on rule-based heuristics

It was found that almost all IT managers reported that they were aware of the opportunities that information technology could provide for their organization. Most participants also reported ideas about how the technology could facilitate development and economic growth in the organization. Despite the fact that almost all participants could see opportunities with the technology, several forms of hindrance were also mentioned. For instance, in many cases a lack of competence in the organization was reported. Moreover, few of the participants spoke of visions and strategies from a long-term perspective. This may be a sign that the IT managers were to some extent governed by short-term plans for which the ability to adapt quickly to the demands of the environment is essential.
Another interesting finding is that the reports indicate that there is a great lack of evaluation of information technology investments in the organizations. Most of the IT managers indicated that they considered the task of evaluating and measuring effects of information technology extremely difficult. These results corroborate previous findings obtained by Ward, Taylor, & Bond (1996). A plausible interpretation is that the deficiencies may be found in the planning and implementation phases (Hirschheim, 1989; Mayo, 1991) and that the investments have not been subject to a thorough analysis beforehand. Also, it seems reasonable to assume that there is a lack of specification of the investments' goals. Only two IT managers in the present study reported that they were carrying out projects involving a follow-up of intended goals.

Considering the status of information technology, most participants indicated that IT today is gradually becoming more of a managerial issue, and that is not longer regarded as a technical matter. The use of information technology is highly regarding as integrated part of most issues and decisions. At this point, our results differ from the findings obtained by Allwood & Hedelin (1996) which state that management is often perceived to be obstructing the development of information technology. The findings of the present study instead show that the decision process is as much influenced as changed by the use of IT.

The question is often raised as to whether the use of technology has any influence on power relations in organizational structures. Participants reported two trends here: on the one hand, technology seems to strengthen hierarchies in larger industrial groups, whereas on the other hand it may stimulate the development of self-governed groups in more independent organizations.

Another tendency reported is that many of the managers feel that they do not have control over the strategic decisions that have to be made regarding information technology. The general opinion is rather that managers feel obliged to follow development for competitive reasons, otherwise, there is a risk of losing market shares. Hence, many of the strategies that are described by the managers rely quite heavily on short-term adjustments to the requirements of the market. These types of strategies clearly dominate in number over the long-term strategic initiatives for survival. An explanation of this finding may perhaps be traced to the general idea that efficiency and adaptation can be regarded as signs of an organizations ability to communicate effectively with the surrounding world (Mott, 1972). In line with this, many participants feel that they must upgrade technical standards in order to communicate effectively with customers and suppliers. Also, technological improvements may facilitate communication with other organizations in the sense that common databases may be developed and shared.

Conclusion

In the present study, interviews were conducted with IT managers of larger companies in Sweden. The results revealed that the managers differed with regard to performance on a couple of heuristics tasks (Tversky & Kahneman,
1974). It was suggested that the performance on these tasks partially explained their reasoning in the interviews about how information technology is used in their organizations. However, it was also stated that participants were probably also influenced by another kind of heuristics that are built on rule following.

References


Selart, M., Boe, O., & Takemura, K. (2000). What matters the most in the building of preferences: Decision heuristics or social value orientation? Unpublished manuscript.


Notes

The representativeness heuristic: Several studies show that people have a tendency to judge probabilities on the basis of representativeness and similarity. The degree to which A is representative of B is dependent on the degree to which A resembles B. The conjunction, or co-occurrence of information leads us to think of it as more valid and more probable. As the amount of detail increases, the probability of there being a connection between A and B decreases. This increment of details easily results in an incorrect order of rank of probability and thereby results in systematic biases.

Anchoring and Adjustment: There is a tendency for individuals to experience difficulty in adjusting our understanding enough from a known or fixed value. It has been shown that fixed values lead us to systematically make wrong judgments. We tend to underestimate because we haven’t adjusted enough from a reference point, but rather have been led by a fixed value to govern our cognitive decision processes. Fixed values are often ignored and seldom evaluated and especially low or high fixed values result in the largest shortcomings of adjustment and thus result in substantial risks when carrying out judgments and making decisions.

The availability heuristic: Another well known risk factor arises where some events are more available to us than other events. This is because they occur more often, and we more often think about these events, they have occurred more recently, or they are more emotionally charged and therefore more intensive and more easily available to us. This type of heuristic sometimes exceeds other important facts and thus leads to systematic biases.

Attribution: This term indicates the rules that we use when seeking to explain causal connections and when we seek information regarding important factors or areas. We want to know something about whether the actual situation is in accordance with other similar situations. We also want to know something about the situation’s distinctive character in relation to other situations and if they are known. We procure some of the different imaginable causes and emphasize these to different degrees. In certain situations we make exceptions to a rule and this leads us to ignore fundamental information from some of these factors. A fundamental attribution error is that we ignore situational facts and put greater emphasis onto facts related to persons and behavior. These latter facts are given the most salient meaning and therefore a dominant basis for our explanations and judgments. We tend to underestimate consensual facts and overestimate facts that are related to behavior, which leads to incorrect judgments and decisions.