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The role of information in strategic decision-making

Charles L. Citroen *, [1]

C&C Information Management, Zoetermeer, The Netherlands

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ABSTRACT

Aspects of the role of information in strategic decision-making by executives in industry are hardly ever mentioned in management research publications. We therefore investigate in this paper the way information is obtained, analysed, judged and applied by executives in industry that have to take strategic decisions. We interviewed executives from thirteen companies in The Netherlands and in Germany about the stages in the decision process that they followed in thirty two recent decisions they had to make.

We found that executives that follow a rational approach collect and use ample information in a structured decision-making process passing through a number of distinct phases in time. In this process, information plays a crucial role in reducing uncertainty. Over all discussions held, the aspect of the quality of the information used by the board was stressed. We could only obtain circumstantial evidence of changes in the decision making process caused by developments in new information acquisition and analysis methods such as use of the Internet becoming common practice. But we can affirm that with more relevant information available, discussions in the boardroom on issues affecting the choices and alternatives can now be better controlled and rational decision-making is thus facilitated.

1. Introduction

Information on the internal and external environment of the organisation is a crucial factor in the process of decision-making by executives in industry. Precisely there, in the availability of information, a revolution has taken place in recent years with new information acquisition and analysis methods such as the Internet becoming common practice. In a previous publication (Citroen, 2009) we have analysed the processes of strategic decision-making and the use of information thereby. In this article we concentrate on this last aspect, namely what information is required and how this information is used by company executives during their strategic decision-making processes.

1.1. Information use in strategic decision-making

Many studies in strategic management take the position that executives reach strategic decisions based on a structured process of careful consideration of circumstances, alternatives and consequences. This approach is known as a 'rational process'. Information on matters such as competition, markets, technologies and trends in the societal environment affecting the organisation is used as a basis for the judgement on the implications of feasible alternatives for the decision to be made in such a rational process. As such, the use of information contributes to the reduction of uncertainty.

However, aspects of the role of information in the decision-making process receive little attention in management research. For that reason we investigate in this study whether we can add a new viewpoint to this field, specifically that of the role and value of modern information resources and access as a prerequisite for the structuring of the strategic decision-making process. We observe in detail the use of information during the process of a number of actual recent strategic decisions taken by executives in the chemical and food industries. The emphasis is on the process, not on the substance or quality of the resulting decisions.

2. Literature review

2.1. A rational approach to decision-making

An important theme in research into strategic decision-making concerns the process or approach that is followed in making a decision and the structure of this process. In a rational decision-making process, executives reach strategic decisions without a prejudiced opinion about the eventual decision and only after a structured process of careful consideration of circumstances, alternative lines of thought and consequences of the decision made. Information on matters such as competition, markets, technologies and trends in the societal environment affecting the organisation are needed to judge the implications of the feasible alternatives for the decision

* Tel.: +31 793213167.
E-mail address: c.l.citroen@alumnus.utwente.nl
URL: http://home.hccnet.nl/c.citroen.

[1] This research was performed at the School of Management and Governance, University of Twente, Enschede, The Netherlands.

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to be made (Baum & Wally, 2003; Corner, Kinicki, & Keats, 1994; Hammond, Keeney, & Raiffa, 2006; Noorderhaven, 1995, p. 29; Nutt, 2005; Weirich, 2004, pp. 97, 211). Making rational decisions thus presupposes that information is available that enables an executive director or a board of directors to make the best possible decision under the circumstances. Rationality involves choosing which information to order and analyse and which not to (Choo, 2006, p. 104; Citroen & Hooghoff, 2003; Hussey, 1997, p. 18; Schwenk, 1986). The structured approach of the decision-making process is characterised by the fact that the decision is reached after dealing in due consideration with a number of distinct phases that are programmed in time and that can be observed and studied in a rational and objective way.

Conditions for such a rational and structured process have been formulated by several authors, e.g. Drucker (1967), Mintzberg, Raisinghani, and Théorêt (1976), Nutt (1999), Koopman and Pool (1997, pp. 7, 17) and Johnson, Scholes, and Whittington (2005, pp. 42, 385):

1. the issue or problem is properly identified and the objectives of the decision are well defined by the decision-makers,
2. the decision-makers actively search for information on potential alternatives,
3. they carefully weigh the advantages and the disadvantages of these alternatives and the chances of success for each of them,
4. even when a preliminary solution is in sight, new information or expert judgement is accepted, studied and analysed, even if it contradicts earlier ideas and preferences,
5. before a final decision is made, positive and negative consequences of all alternatives are re-examined,
6. provisions for implementation of the decision are prepared, (including a contingency plan that might be required if the implementation fails),
7. a procedure is defined for follow up of the decision to judge if the purpose has been achieved or has to be reconsidered.

In some cases that can still be considered a rational process, not all of these conditions have to apply fully, e.g. when only one valid option for a decision can be identified.

2.2. Information as a factor in strategic decision-making

In management research publications the role of information in the process of decision-making is seldom recognised, discussed or analysed as such, probably because management information is considered a production factor that is readily available and its accessibility is 'taken for granted' in many studies on company performance. Although input of information is often mentioned in order to be able to consider parameters such as the business environment, internal and external issues and changing conditions during the decision-making process, information is seldom seen as a determining factor. As a consequence, the characteristics of information in strategic management such as the quality, the sources and the actual use of available information during the process of strategic decision-making are not recognised as important issues (e.g. Drucker, 1973; Hammond et al., 2006; Mintzberg, 1973; Porter & Millar, 1985; Porter, 1985; Simon, 1960).

Examples of authors that stem from the information management field that treat the subject of information for management decisions are Allen (1990), Meadow and Yuan (1997), Choo (2002, 2006), Rowley (1998), de Alwis, Majid, and Chaudhry (2006), Aharoni et al. (2010) and Kroll and Forsman (2010). Choo (2002, p. 8) states that "*An organization behaves as an open system that takes in information, material and energy from the external environment, transforms these resources into knowledge, processes and structures that produce goods or services which are then consumed somewhere in the world. An organization uses information strategically to make sense of changes in its setting, to create new knowledge for innovation and to make decisions about its course of action*".

The subject matter of the information that is relevant to strategic decisions consists of such items as internal organisation, market structures, competitors, customers' attitudes, technologies, regulations and public affairs. For these areas, opportunities, threats and risks of the market place and the business environment, best practice, and most importantly, current developments and trends in those features are essential (Auster & Choo, 1996; Brenner, 2005; Citroen & Hooghoff, 2003; Citroen & van Loen, 1994; Eisenhardt & Martin, 2000; Li, Yatrakis, Turner, Yen, & Hsu, 2003; Mintzberg, Ahlstrand, & Lampel, 1998; Nonaka, 1991; Oppenheim, Stenson, & Wilson, 2003). Formalised routines improve the flow of information throughout the organisation, including information to strategic decision-makers and thereby speed up strategic decision-making according to Baum and Wally (2003) in their study of firm performance.

A rational approach to decision-making does not by itself imply that every titbit of information must be located, accessed, retrieved, analysed and utilised before a decision can be reached as there are limits to the amount of information that can be collected in a rational decision-making process. Founding a theory or a decision on truly complete information is impossible in principle because this would require "*infinite regress, whereby every argument makes an inference from assumptions and verifying each assumption calls for additional information*" (Popper, 1935, s.4, 1963, p. 21). Accordingly, there are always limits to the amount of information that can be collected that is relevant to an issue, limits of resources needed for the search process and limits to the time available. Utility maximisation and awareness of diminishing returns stipulate that equilibrium be reached between the cost and the time of obtaining additional information on which to base the decision-making process and the expected benefit of this additional information in order to prevent a regress about 'deciding how to decide' (Noorderhaven, 1995, p. 29; Weirich, 2004, p. 98; Winter, 1964 in Weirich, 2004, p. 221).

2.3. Information and communication technology (ICT)

As computers find applications for practically every business process in the present-day company, this evolution has had a great influence on the way company executives need to operate nowadays. If we restrict ourselves to the more strategic issues, the decision-making process has completely changed over the last decade by the way information has become available and travels over communication services that are common now. The potential influence of ICT on strategic decision-making can be summarised as (Aguila-Obra del, Padilla-Melendez, & Serarols-Tarres, 2007; Hedelin & Allwood, 2002; IBM, 2008; Kendrick, 2007; Laudon & Laudon, 2006, pp. 21, 29, 457; Li, 2002; Molloy & Schwenk, 1995; Sajor-Wood, 2000; Teng & Calhoun, 1996; Ticoll, Shuman, Twombly, Finken, & Yeo, 2001):

- accelerating the process and thus being able to use the assigned time in a more efficient manner and concluding the decision-making process before the set deadline,
- diminishing uncertainty by enabling the evaluation of more decision alternatives,
- better forecasting accuracy and decision-making time horizon,
- more unanimous decision-making processes through better internal and external communication and thus
- being able to conclude an accurate decision-making process where previously this decision had to be postponed because of lack of information.

There is little research into the use of the Internet as an information source for strategic decision-making. Sajor-Wood in her

dissertation (2000) on the use of the Internet as 'decision support information technology for managers in the public sector', concludes that "*The Internet is used in all levels of management involving a number of functional areas. Internet usage is perceived by managers as a decision-support information technology that contributes positively in improving their decisions*". Li (2002) for his dissertation, interviewed 20 strategic-level managers of multinational companies' affiliates in China on 'The relationship between Internet usage and decision-making'; Li observed that "*They all felt strongly that the Internet contributes greatly in improving managerial decision-making. It would be extremely difficult for these executives to conduct their daily business if the Internet was not available*". Yip and Dempster (2005) questioned managers from 115 multinational companies on their use of the Internet to enhance global strategy and conclude that "*Managers in all industries made sure that the Internet was taken into consideration in nearly every individual activity*". IBM Global Business Services (IBM, 2008) interviewed over 1000 CEOs worldwide on what they believe the 'Enterprise of the Future' will look like. A common theme emerged from the interviews: "*Virtually all CEOs are changing their business models. Two thirds are implementing extensive innovations. Why now? Because it's possible. The Internet is allowing them to enter niche markets and reshape their processes, delivery channels and ways of partnering*". Kroll and Forsman (2010) find that even managers in academic R&D rely exclusively on digital sources (and personal networks) for their information requirements.

3. Research strategy and fieldwork

For our research we asked a selected group of executives in industry whether they would be willing to discuss with us some recently taken strategic decisions in a personal interview (see Annex A). Sixteen executives responded positively to our request and with these executives we conducted in depth semi-structured discussions that allowed us to observe in which way they made use of information during the decision making process.

3.1. Fieldwork

The sixteen executives that we interviewed were members of the board or directors of twelve companies in the chemical and food industries in The Netherlands and two executives from two companies in Germany. These companies each had an annual revenue of over M€ 300 (M$ ~420) in 2004 and are independent, i.e. not completely dependent on directives from the head office in another country. The type of industries that agreed to take part in the research and the functions of the interviewees are shown in Tables 1 and 2. As shown, they were either chairman or member of the board/management team or were directly involved in strategic company management.

We identified and discussed in detail with these executives thirty-two issues that had recently prompted a strategic decision by them. The executives volunteered these issues or were provoked by the interviewer when necessary. For each of the decision-making processes that they reported the interviewer asked the executives by probing questions to explain step by step the process and the considerations and motivation for each step, the sources, quality and usage of the information sought and obtained, the alternatives that were considered and the eventual final decision made. At the end of the interview the executives were specifically asked whether they could point out changes in these procedures in the last couple of years, and the role of ICT, if any, responsible for those changes.

In order to supplement the data obtained from the interviews, we solicited input from two other groups that actively supply information services within their companies.

Table 1
Type and number of companies interviewed.

- 4 Food companies
- 4 Base chemicals companies
- 5 Specialty chemicals companies (in one case 2 executives)
- 1 Research institute (2 executives)

Table 2
Function of the executives that were interviewed.

- 4 CEOs
- 5 Executive Board members
- 1 Vice-President Corporate Development
- 2 Division directors
- 1 Director Technology
- 2 Directors Strategic Planning, & Development
- 1 Director Business Development, & Innovation

We asked 9 corporate information managers that provide scientific and business information services to all potentially interested employees of their company, often to affiliates worldwide, whether any of them provided information directly to the board of the company, either as a news bulletin or in answer to ad hoc questions.

We also approached 50 industrial chemical information professionals contributing to the Chemical Information Sources Discussion List, CHMINF-L, by e-mail questionnaire (see Annex B).

3.2. Model of the decision-making process

In order to facilitate the analysis of the structure of the decision-making process, we developed and then used a new model (Fig. 1) that shows the successive phases in this process and the information that is acquired in each of these phases:

4. Results and discussion

From the 32 issues discussed with the executives in our interviews, we were able to identify 102 explicitly stated decision process descriptions of distinct phases that were followed by these executives during the strategic decision-making processes. Apparently, in some cases, one or even several phases could be skipped because there was no need to follow this phase.

Almost all decision processes started with a 'preparation' phase (A) for the decision-making process by defining the issue, setting the objectives of the decision and studying an initial amount of information on relevant issues in the environment. In most cases initial preparation did not yet contain sufficient information to judge alternatives and make justified rational decisions. Therefore, in a second phase (B), additional information on internal and external parameters had to be identified, selected and studied. In a few cases, comparable developments in other organisations were analysed in order to better judge the implications of a specific solution.

In the third phase (C), based on the information gathered in the analysis phase, alternatives could be specified. In the fourth phase (D), the alternatives and options identified had now to be limited to those that have a real chance to succeed. Adequate information seemed to be present on consequences of a decision one way or another and on potential alternative courses of action to make a rational and objective choice. However, in some cases rationality required that in a fifth phase (E), preceding the final decision (F), feedback was needed from additional sources of information to be able to appreciate the consequences of each otherwise valid alternative.

4.1. The role of information in the decision process

The crucial value of information in decision-making is confirmed in our interviews when the interviewees mention that the decision-making process often started off under uncertain conditions that

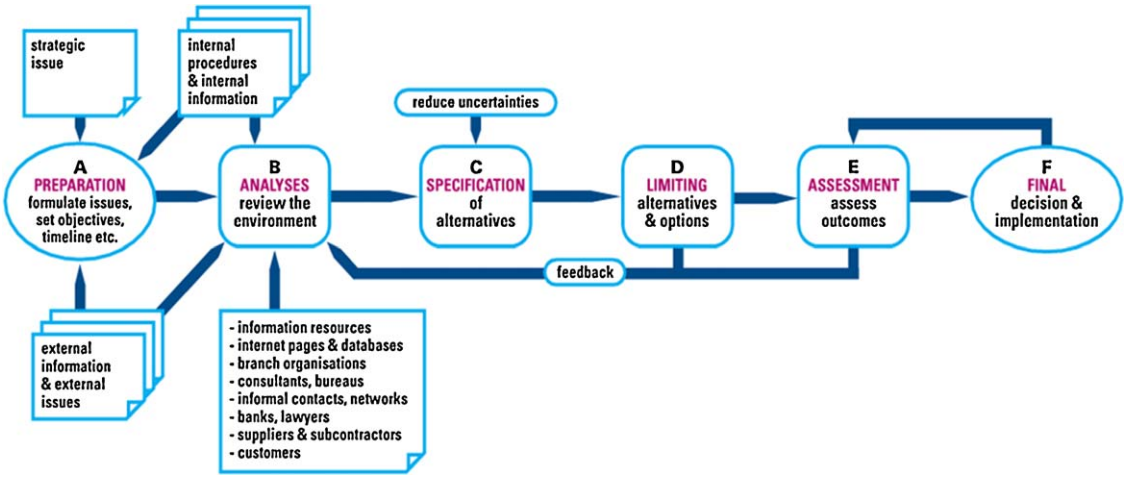

Fig. 1. Model of the phases of a rational decision-making process. Rounded boxes indicate the five phases in the decision process; square boxes contain parameters that provide input for the indicated actions. Arrows indicate the main direction of interactions.

evolved into more certainty when sufficient relevant and reliable information had been gathered. In order to get the right answers to reduce this uncertainty executives know that they have to ask the right questions and have to be aware what important information is still missing.

Examples of why information is so important are comments such as:

- European operations have to cope with high costs, small margins and fixed markets, so management has to be very alert and perform proper analyses on, e.g. market developments before decisions can be taken.
- The company as a whole is more opportunity driven now and can react faster . . .. with sufficient information.
- For each strategic issue decision the best decision structure can only be obtained when it is clear that all information is available in the proper format and is reliable and can be understood by all parties concerned.

Executives commented that after collecting additional information an effort was required for studying and analysing this additional information. First hand information mostly came from consultations with internal staff from the departments involved. Lacking this expertise or in cases where an external opinion was indicated, studies were also often commissioned to external organisations or consultancies. The resulting reports always had to be reviewed against internal expertise before they could be accepted. Comments were made that consultants generally are more positive/optimistic about peaks in market cycles and more negative/pessimistic on the slumps. Also one remark was that 'old-fashioned' consultants do not use ICT a lot, but rely on their knowledge of the industry and their networks, resulting in analytically sharp reporting; on the other hand, more 'modern' consultants sometimes supplied loads of computer output with little analysis.

In the case of mergers and acquisitions, due diligence – collecting of data followed by a thorough examination of the books and records of the target company – is a standard procedure. In those cases often a feedback loop was mentioned as new information kept coming up and consequently had to be analysed (Harvey & Lusch, 1995).

4.2. Information management

During the decision-making process, there are two phases in which information is mostly collected and analysed by the board, the preparation phase and the analysis and review phase. The titles of departments that supply this information to the board are, e.g. Corporate Development, Strategy Development, Business Development, & Innovation or the Market Intelligence Group. Furthermore, most business units collect information about their own branches and send summaries of analysed information up to the executive management.

Some companies outsource the searching for information to specialised information services companies, but a comment was that "*This is sometimes not effective when the questions and issues cannot be made explicit and unequivocal. This would result in an overload of irrelevant information*". In one case, a director mentioned that on an acquisition plan of the company, the board had to maintain more than the usual confidentiality and the CEO did not consult internal departments but collected information to prepare for this decision-making process himself.

Most companies have a department responsible for documentary information such as an 'Information Services Department', often connected to the library. These departments manage research books and journal collection and abstract services such as the Chemical Abstracts but they are often also responsible for contracts with commercial business information suppliers such as LexisNexis or Dow Jones Factiva. The information department is usually concentrated in the research location of the company. On the other hand, several executives commented that nowadays because of new access methods to information supported by communication software they do not see the need for such a service in their company anymore. They consider that employees can nowadays easily search for and find their own information: "*This involves using all the sources of knowledge that one can reach by connecting oneself internally and externally and let everyone involved be connected with the relevant parts of his own environment*". One executive formulated this by stating that "*The technical possibilities to define queries have become much easier so that no information specialists and fewer external experts are needed anymore to formulate data base searches*" and also that "*The interpretation of data and ensuring the relevancy of information for the executives is now the bottleneck, not the process of searching*".

The questionnaire that we sent out to correspondents on the discussion list for chemical information professionals, mostly in the USA, showed that of the 14 colleagues that answered our request, only one third of information departments – mostly in the smaller companies – provides information directly to the board of the company, either as a news bulletin or in answer to ad hoc questions. They indicate that input to the board level in large companies is usually organised through the marketing department, another staff

department or the R&D department. Information that is supplied through internal news bulletins also is generally screened by intermediate levels in the company before these items are presented to the board.

Only one manager of internal information departments of 13 large companies in The Netherlands, when asked whether they provided information directly to the board, stated that they did, but only in response to direct questions from the board. The others all know that their information does often reach the board, but always through intermediary staff departments. Only news bulletins, summarising external developments, in several instances are sent directly from the information department to the board.

4.3. Use of external information

Discussions with the executives on the use of information for strategic decision-making in the analysis phase mostly centred on the use of external information.

Comments that were made on sources of external information during the interviews were:

- Reports can be bought, e.g. from research companies specialised in these markets. Opinions are varied; some executives state that these are quite reliable; others comment that this information is often far from correct.
- Before the times of ICT based information resources, management was more reliant on external reports that were bought. With present expertise in the use of the Internet, it is easier and faster to find information for oneself.
- Trade organisations offer an open atmosphere where experiences are exchanged and key figures are collected and published. Data such as total investments per unit product are available. Examples are the European Brewery Convention (www.ebc-nl.com) and the Brewers of Europe (www.brewersofeurope.org) and the Association of Plastic Manufacturers (www.plasticseurope.org).
- For one branch an interviewee mentioned that there is a formal market information network maintained by a specialised trade organisation. Parties in this information network however have a tendency to play down the market size and enhance their market share. Official sources are too much dependent on such voluntarily supplied data; these only give an indication of trends, not of the true state of affairs.

All companies collect data on competitors' behaviour through 'competitive intelligence' or from specialised consultants; these data are analysed regularly for relevant issues and often stored in an internal database so that the board is at every moment prepared for an issue to arise. Selected information from this database is usually available on the company Intranet. From such a database ad hoc questions from within the company, sometimes from the board, are answered. In one company an excerpt from this database is presented company-wide on a weekly basis as a current awareness service and important new matters are sent out immediately as a news flash. In another company, a group of 5–6 gatekeepers comes together bi-monthly to analyse and compare the stored data and correct them where needed and to reach consensus on updates for this internal database.

In another company the strategic planning and decision process is supported by an up-to-date database that continuously follows developments in the international markets, international supply and demand developments and investment plans of competitors all over the world. It predicts longer term profitability and it assists in keeping up to date the strategic plan of the company continuously so that decisions need not wait when a sudden development occurs. Sources for this database are many: newspapers, internal reports, consultant reports, information from colleagues in conferences and other discussions, internet items, etc. and also the internal SAP system. Several executives stressed the importance of public affairs information, new government policies, EU developments and the interaction between the markets and the government.

In several cases supporting information for board decisions on new developments and acquisitions came in first instance from the business units/divisions involved. A risk that was mentioned was that the division that was going to benefit from an acquisition might not always be absolutely objective and realistic in its arguments and be too optimistic and eager.

4.4. Use of internal information

Monitoring reports of internal processes and parameters is common now in all companies. An executive remarked that "*The most important aspect of modern computerisation is the increased speed with which weekly and sometimes daily information becomes available on all processes and results within the company and so facilitates our decisions*". But for internal information to be effective, another mentioned, the flow of information has to be open; "*Information that is kept in a closet is worthless; lack of open information creates rumours and reduces motivation and trust*". Another positive aspect of the facilitation of communication within the company is that this leads to more multi-disciplinary projects and less duplication.

An Intranet is used in several companies to share successes of the company that appear in the news: "*It makes people more engaged, aligned. Starting the computer in the morning brings up first the Intranet*" was a comment. In one case, a reorganisation was completed reducing the number of levels in the organisation, one of the objectives being to improve the flow of information.

4.5. Quality of information for strategic decision-making

In all discussions held, executives stressed the aspect of the quality of the information required by the board. Correct strategic decisions could only be taken on correct and complete information. As one executive phrased it "*Quality of information means integrity, robustness, able to stand up for scrutiny, but very important is also a guarantee of completeness, wholeness*". Or as another CEO phrased it: "*We rely on well checked, reliable, robust and relevance rated information*".

Generally, information that arrived 'bottom up' was trusted more than information provided by external sources. If information became available from uncertain sources or was not reliable at first sight, it was thoroughly scrutinised for its credibility and robustness before being accepted by the departments responsible for supplying information to the board. But even so, executives sometimes double-check information themselves, one reason being that these departments are not always aware of the strategic plans of the board.

Some more cautionary comments that were made regarding the quality of information were that "*The value of these open (Internet) data is notoriously only moderately reliable*". And "*Information can be 'manipulated' as is seen by the example of client satisfaction reports*". Another comment was that "*Consultant reports always have to be verified internally, they are in general not more accurate than one's own predictions and often have a different content if asked again after 3 months*". These comments show that executives are well aware of the prudence with which external information has to be treated.

There were comments by executives on the manner in which companies ascertain that the information they receive is reliable:

- Information integrity is certified by a small information technology committee as watchdogs, on quality, timeliness and proper analyses of data.
- Deviations from earlier trends have to be signalled to the management.

- Each information item that is to be communicated to external parties has to be confirmed by management to be accurate. This is adhered to strictly because of the 'Right to Know' laws in the USA.
- A good way to check for credibility is to see how accurate the data on its own company are analysed and reported.

4.6. Changes in decision-making processes due to increased availability of information

We observed indications that there is a noticeable difference in the way the strategic decision-making process does proceed now that information has become available so much easier and faster in the last few years although it is hard to establish this in a valid measurable manner. Most executives commented on the fact that indeed information has become much easier to obtain. As an example a comment was that "*Marketing information is hardly searched for actively, it is continuously available*" offering the facility to follow closely and continuously the behaviour of new products in the market. A comment given by a director was that "*All information that is needed by the board seems to be available nowadays, though one never can be sure. The improvement over the last years from Internet is tremendous: Finding information before the Internet must have been horrible*". But this executive also said that not all problems are solved yet, e.g. information on Asian developments is still hard to obtain as language is a major obstacle when viewing Chinese or Japanese web pages. One executive remarked that "*The uncertainty about decision quality has decreased as sufficient information is rapidly available to all persons concerned*", demonstrating that information helps reduce uncertainty and offers better conditions for rationality than in earlier days.

Another comment was that: "*Now that information has become a 'super-commodity', searches that used to take 10 days can now be done in 10 min. In earlier days market information could only be obtained from paid marketing consultants, now three quarters of this information is available on the Internet. But at the same time this reduces the value of information, as everybody can access the same facts and thus creative analysis is needed to maintain ones' competitive advantage*". As a consequence of these developments a director remarked that the question from the board no longer was whether some required item of information was available, but the 'demand' now was: "*Get this information for us, no matter where this item can be found as long as it is reliable and complete and timely*".

Several executives remarked though that "*This does not necessarily mean that decisions can be made faster: Evaluation of this greater mass of information takes more time and not everything is yet available electronically*". And a comment also made was "*That easier information access is not always cheaper, expenses have to be made to acquire the information and each time the cost/benefit ratio has to be kept in mind*". Information overload because of too many sources or too many documents was not an issue that was mentioned. Apparently, these executives and their staff departments apply effective coping mechanisms to deal with the stream of information reaching them.

The facilitation of global knowledge exchange brings with it the fact that competition becomes fiercer as any innovation becomes public earlier than before and time to react is correspondingly shorter. Some companies are able nowadays to perform research on a worldwide 24-hour schedule, they "*forward results as a baton in a relay race*" to their affiliates anywhere in the world continuing the activity when colleagues in another time zone stop.

5. Conclusions

5.1. Value of information

Our research shows that in all cases of strategic decision-making that we discussed with executives of large industrial companies the approach taken in the process was rational, using all feasible information. Executives recognised the abundance of relevant information available and they used this information to provide a rational underpinning of the decisions made in each phase, either as a continuous preparation on events that could be anticipated, or at the spur of the moment when a new opportunity or a new issue to be decided arose.

The type of external information that was considered to be indispensable for strategic decision-making is information about market developments such as trade statistics and trends and forecasts, consumers' and customer information, information on competitors and suppliers, but also technology information and related R&D issues, patents and technical market issues; in most cases there is also a need for information on economic and political developments, environmental issues and legal issues from governments, the European Union and Non-governmental organisations.

According to these executives, having all this information available made preparation of a case for the board and the process of analysis of alternatives easier and helped giving a feeling of confidence that all options had been properly considered. Especially reliable data on the performance of competitors and market conditions gave executives assurance that they could judge more comfortably and rationally the consequences of their actions.

5.2. Quality of information

The aspect of the quality of information that was used by the board was stressed as an important condition for any type of information to be trusted as a supportive base for strategic decision-making. Correct strategic decisions could only be taken on correct and complete information. Quality of information meant integrity, clarity, robustness, stand up for scrutiny and timeliness, but very important was also an acknowledged limitation of completeness when this was indeed the case.

As information was collected from multiple sources, such information varied much in quality as defined here and depending on the origin and credibility of the source, it was taken at face value or thoroughly checked for accuracy using internal expertise or by an external consultant before it was accepted. Generally, information that arrived internally 'bottom up' was trusted more than information provided by external sources. Information from open data sources and even from consultants was considered only moderately reliable and could even have been 'manipulated'.

The trend towards disintermediation – whereby the information is searched and retrieved without a professional intermediary – is not clear yet, but a trend to self-reliance is noticeable. However, several companies still have an information services department employing information specialists. In all companies externally obtained information was controlled by experienced staff, e.g. technical information specialists, market and business intelligence searchers, strategy developers and legal people, either within the company or by outside agents such as banks, branch organisations or consultants.

5.3. Information overload

Executives agreed that increases in availability of information unavoidably led to an increased volume of information arriving on their desks. When in the literature 'information overload' is signalled, this implies that those executives would not be able to properly handle this increased flow. But information overload as a result of too many information sources or too many documents or data was not mentioned in our discussions. Having more relevant information at hand, added to the comfort factor and feeling that the ultimate decision had been supported by a more rational process than was possible before such information

sources became available. The conclusion therefore is that information overload was not an issue for these well organised executives who are protected by staff departments from receiving unnecessary information and that they can effectively cope with the increased information flow that they experience.

5.4. Changes in decision-making due to new information access developments

We could only obtain circumstantial evidence of the changes caused by developments in new information acquisition and analysis methods such as the Internet becoming common practice. Observing how the availability of the sources for the categories of information that executives consult nowadays has improved over recent years, we can draw conclusions as to the changes that must have taken place in that period. For all categories of information discussed, we know that the availability and accessibility has increased with the developments of new ICT technologies. As a consequence, executives no longer ask the question whether some required bit of information is available, but rather where this item can be found reliably and completely within the time that is available. Even so, better availability of information does not necessarily accelerate the decision-making process, as more information requires more time to analyse, judge for reliability, discuss and digest.

Our study shows irrefutably that with more relevant information available, discussions on issues affecting the choices and alternatives can now be better controlled and rational decision-making is thus facilitated.

Annex A. Invitation letter to executives

Mr. Name
Company n.v.
P.O. Box .....

Your reference		Phone	079 321 3167
Our reference	clc/2006/23new	Fax	084 2236482
Date	14 November 2006	Email	c.l.citroen@utwente.nl

Subject Research into strategic decision making

Dear Mr. Name,

At the moment I am engaged in the fieldwork for my PhD study on the subject of *'Changes in decision processes through application of new information resources and systems'*.
This research concentrates on the strategic decision process in companies in the chemical, pharmaceutical and food industries, focussing on the role that information plays in that process.
The research is part of a programme at the University of Twente, at the School of Business, Public Administration and Technology under direction of Professor Hans Roosendaal. In this research programme, the value chain of information is studied, particularly how it is influenced by technology.

I collect the data for this research through personal interviews with executives of companies in the above sectors. I have already interviewed executives of firms such as CSM, Dow Benelux, DSM, Quest International, Shell Nederland Chemie and Wavin.
As you are an executive of a company very relevant to my subject area, I should appreciate it if you or a colleague on the Board would agree to be interviewed about 2 or 3 strategic decisions that you have taken recently.

The content of our conversation of course will remain confidential. If you would prefer me to treat respondents anonymously in the final report, this will be done; if needed, I can additionally sign a non-disclosure agreement.

A synopsis of my research project and a short curriculum vitae are included.

I do hope that you are willing to make one hour available for this interview in the near future; I will contact you in the next week to see if I may make an appointment.

Yours sincerely,

Charles L. Citroen.

Annex B. E-mail questionnaire

Sent out to members of the discussion list of chemical information professionals.

Dear Donna,

I would very much like to receive some input from you on the subject of 'Information flow to the executive/Board level in (chemical) industry' - which is the topic of my doctoral research.
(I have been a member of the ACS Chemical Information Division since 1968 and have worked for many years as an information scientist for industry mostly in The Netherlands).

Some people say that nothing has changed in the way decisions are reached in the Board room with the arrival of Internet and other innovative information services, others are more optimistic and belief that executives are well aware of the kind of information resources that can be tapped nowadays.
So please help me find out how these matters are organized in the USA (or another country) and answer the 4+ questions that I have listed below, of course they will be recorded anonymously.

1. Are (some of the) information services that you supply directly delivered to the Board of your company?
--Yes --No.

1a. If so, do these mostly answer ad hoc questions from the Board, are they delivered at your own initiative or supplied on a regular basis?
--Ad hoc --Own initiative --Regularly

1b. If not so, are you aware whether your information services reach the Board of your company through an intermediate level in your company (such as the marketing department or a strategic planning department)?
--Yes --No.

1c. Or alternatively, are the information services that you supply mostly used as input for reports that are produced by e.g. the marketing department or a strategic planning department?
--Yes --No.

2. Do you have an indication whether executives in the Board are aware of information resources that have become readily available over the last few years through new mechanisms such as Internet search engines, alerting services, RSS feeds etc, covering important items such as prices, markets, competitor data, patents etc.?
--Yes --No.

If you care to, can you roughly describe your function in the company and give an indication if this is a company in base chemicals, fine chemicals, food chemicals, engineering, the pharma industry or other?

This is a request directed at you as a chemical information scientist that works in industry, I have selected addresses from the CHMINF-List of which I am a long-time member, (so this isn't spam).

Thank you very much for your help, my report is expected to be out in 2008.

e-mail: c.l.citroen@utwente.nl or c.citroen@hccnet.nl
web: home.hccnet.nl/c.citroen

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Charles L. Citroen is self-employed since he left Delft University of Technology-Library where he was senior consultant for external projects in information management from 1994–2003. He holds an MSc in organic chemistry (1966) from the University of Amsterdam. He received his PhD in business administration from Twente University in 2009. His research interests are in the value of information and the functioning of professional information intermediaries in industrial management. Citroen is a fellow of the UK Chartered Institute of Library and Information Professionals.