Chapter I

The Role of Information and Communication Technology in Competitive Intelligence

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ABSTRACT

This chapter discusses the role of ICT for competitive intelligence activities. To this end, it starts with an introduction to competitive intelligence. Next, it discusses possible uses of ICT for intelligence activities. In this discussion attention is paid to the use of the Internet, to general purpose ICT tools, to ICT tools tailored to one or more of the intelligence stages, and to business intelligence tools (data warehouses and tools to retrieve and present data in them). Finally, the chapter describes how organizations may select ICT applications to support their intelligence activities.

INTRODUCTION

Competitive Intelligence (CI) can be described as producing and processing information about the environment of an organization for strategic purposes (cf., Kahaner, 1997). To (re-) formulate their strategy, organizations need to collect and process information about their environment—about, for instance, competitors, customers, suppliers, governments, technological trends or ecological developments. Collecting and processing environmental information for strategic purposes is by no means something new. It has always been important. Without knowing what is going on in the environment, keeping the organization viable would be impossible. In fact, as Beer (1979) asserts, the "intelligence function" (scanning the environment in order to maintain the adaptability of a system) is a necessary function of *any* viable system. However, the issue of *explicitly* building and maintaining an intelligence function in an organization has only gained importance since the last few decades (cf., Hannon, 1997; Fleisher, 2001a). Due to the increasing complexity and dynamics of the environment the need to produce relevant "actionable" intelligence is increasing as well. Because of, for instance, increased global competition, (speed and impact of) political changes, and rapid technological developments (e.g., Kahaner, 1997; Cook & Cook, 2000; Fleisher & Blenkhorn, 2001) the need for information about the environment is more pressing than ever. As McDermott (in Hannon, 1997, p. 411) puts it, "Perhaps [CI] was inevitable, given the heightened competition that prevails now [...]." Or, putting it more directly: "If you are in business, you need competitor intelligence" (Fuld, 1995, p. 1). At the same time, organizations are facing a huge amount of available data about the environment. The Internet, although a very useful source of environmental data, is growing so large that finding relevant information is hard. As many authors point out (e.g., Cook & Cook, 2000; Chen et al., 2002), this leads to the problem of information overload.

Organizations are thus faced with an increased pressure to produce relevant information about the environment and, at the same time, with an extremely large, ever-increasing amount of data about the environment. To deal with this problem, many organizations are explicitly structuring their intelligence activities. Many have, for instance, implemented so-called "competitive intelligence units" (see Prescott & Fleisher, 1991; Kahaner, 1997; Fuld, 2002; or Gilad, 1996, for examples). To structure the process of competitive intelligence, several authors (cf., Kahaner, 1997; Gilad & Gilad, 1988; Herring, 1991; Bernhardt, 1994; Fuld et al., 2002) propose an "intelligence cycle," consisting of four stages:

1. **Direction.** In this stage the organization determines its "strategic information requirements." It determines about what aspects in the environment data should be collected.
2. **Collection.** Here, it is determined what sources can be used for data collection and the data are actually collected.
3. **Analysis.** In the analysis stage collected data are analyzed to assess whether they are useful for strategic purposes. In this stage, the actual "production" of intelligence (data relevant for strategy) takes place.
4. **Dissemination.** The intelligence (produced in stage 3) is forwarded to the strategic decision-makers and used to formulate their strategic plans.

To make sure that these activities can be carried out properly, an organization should implement a so-called "intelligence infrastructure" (Vriens & Philips, 1999). This infrastructure consists of three parts: (1) a technological part, comprising the ICT applications and ICT infrastructure that can be used to support the (stages in the) intelligence cycle, (2) a structural part, referring to the definition and allocation of CI tasks and responsibilities (e.g., should CI activities be centralized or decentralized? Should CI-activities be carried out by CI professionals or can others be involved?), and (3) a human resources part, which has to do with selecting, training and motivating personnel that should perform the intelligence activities. The challenge for organizations is to find a balanced "mix" of technological, structural and human resource measures to build and maintain the infrastructure (cf., Fuld, 1995; Kahaner, 1997; Gilad & Gilad, 1988; Hannon, 1997).

In this book we focus on the technological part of the infrastructure. In particular, we focus on the Information and Communication Technology (ICT) applications supporting the intelligence activities (see for instance Cook & Cook, 2000 for an overview). Examples of such ICT tools are the systematic use of the Internet for direction or collection activities (cf., McGonagle & Vella, 1999; McClurg, 2001), groupware applications for uncovering information requirements, specific applications for supporting the analysis of information (e.g., System Dynamics software), the use of an intranet for disseminating intelligence (cf., Cunningham, 2001; Teo & Choo, 2002), and data warehouses or data mining tools (cf., Zanasi, 1998; Cook & Cook, 2000; or Ringdahl, 2001).

Although many ICT tools to support intelligence activities are available, organizations face difficulties in using them. One particular difficulty is that there tends to be an overemphasis on the role of technology in obtaining intelligence.

As a result, some organizations rely too much on the use of their ICT applications for intelligence. For instance, ICT for competitive intelligence often means ‘implementing’ a data warehouse with tools for (quantitative) analysis. The software industry even seems to equate the term “business intelligence” (a “former” synonym of competitive intelligence) with data warehouses and associated tools. In other cases, organizations implemented a “CI unit,” consisting of one person monitoring the results of an online database. In these cases, the technology is viewed as the only or most important means to produce intelligence. This can be problematic for several reasons. First, the data from data warehouses (or from ERP applications) mostly have an internal focus (cf., Fuld, 2002; Li, 1999) while competitive intelligence is about environmental data. Second, the use of ICT as the main source for intelligence may lead to an “unjustified sense of control” or even overconfidence in ICT for obtaining CI. This sense of control may emerge because of the vast amount of (electronic) sources one hopes to have at one’s disposal—e.g., by means of an online database, by means of clever search engines or by means of a large data warehouse. However, the sense of control is unjustified, because one important source of intelligence—human intelligence (cf., Kahaner, 1997; Fleisher, 2001a; Fuld et al., 2002)—is not directly accessible via ICT [although the Internet may be used as a tool for tracking down and contacting primary sources (see Kassler, 1998)]. The sense of control is also unjustified because the number of electronic sources (e.g., websites) attached to the Internet is so large that no search engine covers all of them (see Chen et al., 2002). Moreover, their content is also (continuously) changing. Overconfidence in ICT for producing intelligence may also emerge because of the belief that intelligence activities can be automated. This is not true (yet) (see Fuld et al., 2002; Cook & Cook, 2000). As Cook and Cook (2000) remark: What you get from ICT-applications is data that still have to be put in a proper context to obtain intelligence. Direction and analysis remain the work of humans.

Another difficulty with using ICT in intelligence activities is that it can increase the information overload. If the collection stage is not properly directed, the Internet becomes “the intelligence-highway to hell”: without a clear focus one can go on searching and mining forever.

A last problem with employing ICT in intelligence activities we want to mention here is that ICT is sometimes implemented without paying attention to the human resource and structural parts of the infrastructure. For example, a persistent problem with the use of an intranet for intelligence gathering and dissemination is that some “refuse” to use it. The reasons are various: ranging from “lack of time,” “no part of my job-description,” to “I don’t see the point in using this system." In such cases, the importance of additional human resource measures to motivate personnel to use the intranet application is not recognized (see e.g., Bukowitz & Williams, 1999, for a treatment of this motivation issue). A way to deal with such problems is to treat ICT as a part of the whole infrastructure.

Despite such problems, however, ICT is a valuable part of the intelligence infrastructure. ICT offers many opportunities to support (and sometimes carry out parts of) intelligence activities. However, to avoid problems, organizations should be careful in selecting and implementing ICT applications for CI purposes. They should know the possibilities of ICT to deliver internal and external data and its capacity for supporting (and carrying out) CI activities, and they should treat ICT as a part of the whole infrastructure. In short, to support organizations in using ICT properly for their intelligence activities, an understanding of the role of ICT in intelligence activities is needed—both in terms of the (im)possibilities of ICT for intelligence activities and of its being a part of the whole intelligence infrastructure. This chapter intends to address this need. Its main goals are (1) to give an overview of the use of ICT for the intelligence activities, and (2) to present criteria for selecting proper ICT applications. To reach this goal, the plan for the chapter is as follows. In the next section we discuss competitive intelligence more closely. Next, we present an overview of ICT applications for CI. And finally we discuss the issue of selecting ICT for CI.

WHAT IS COMPETITIVE INTELLIGENCE?

To determine the role of ICT in competitive intelligence, it is first necessary to define CI. Many authors use the term, but their definitions differ. Consider, for instance, the following two definitions:

1. "CI is the process of ethically collecting, analyzing and disseminating accurate, relevant, specific, timely, foresighted and actionable intelligence regarding the implications of the business environment, competitors and the organization itself" (Society of Competitive Intelligence).
2. "CI is the process of obtaining vital information on your markets and competitors, analyzing the data and using this knowledge to formulate strategies to gain competitive advantage" (Yuan & Huang, 2001).

At a first glance, these definitions seem to refer to the same thing. Both refer to a process of obtaining information, analyzing it and using (or disseminating) it. Some differences may also be noted. One definition speaks of intelligence, while the other refers to information, data and knowledge. The second definition explicitly states the goal of CI—while the first leaves it more implicit.

In this section, we examine competitive intelligence by means of the following four aspects:

1. the contribution of competitive intelligence
2. competitive intelligence as a product
3. competitive intelligence as a process
4. the nature of the obtained competitive intelligence

This enables us to define CI and, at the same time, understand the differences and similarities of different definitions in the literature.

The Contribution of Competitive Intelligence

Authors mostly refer to two reasons for obtaining competitive intelligence. The first reason is that it contributes to an "overall organizational goal" such as improving its competitiveness or maintaining the viability of the organization. The second reason refers to the contribution of CI to the organizational activities needed to reach the overall goal (e.g., decision-making or strategy formulation). For instance, the second of the above definitions of CI refers to both kinds of contributions. It states: "CI is (…) to formulate strategies [second kind of contribution] to gain competitive advantage [first kind of contribution]." The first definition does not state either of the contributions. To our knowledge, most authors seem to agree about the overall contribution of CI. Some disagreement exists, however, about the organizational activities in which CI is used to reach this overall goal. Some hold the view that CI is used in decision-making at any level in the organization [e.g., the more ICT-oriented CI definitions (cf., Dresner, 1989)] while others maintain that it is mainly used in strategic decision-making (most authors seem to fall in this category: e.g., Fuld, 1995; Kahaner, 1996; Cook & Cook, 2000; Hannon, 1997). In defining CI, we will follow these authors and state that CI is tied to strategic decision-making.

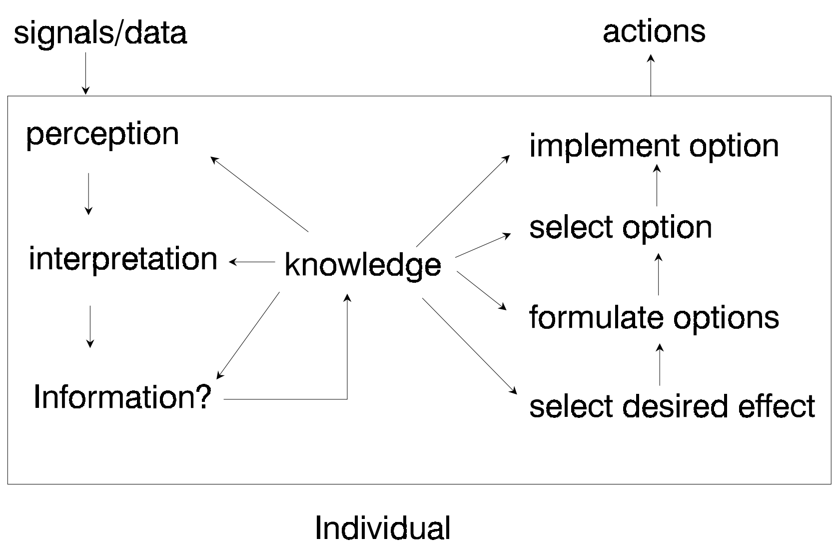
Competitive Intelligence as a Product

In the literature, it is customary make a distinction between (competitive) intelligence as a product and as a process (e.g., Gilad & Gilad, 1988; Fuld, 1995; Kahaner, 1996; Fleisher, 2001a). In treating intelligence as a product, authors refer to the "information" or "knowledge" obtained and used for strategic purposes. The process view stresses the process by means of which this information or knowledge is obtained and used. Both the above definitions stress the process aspect. The first definition also highlights intelligence as a product.

If competitive intelligence is seen as a product, it is usually compared with data, information and knowledge (cf., Fuld, 1995; Kahaner, 1997; Vriens & Philips, 1999). To define intelligence as a product (and to compare it with data, information and knowledge) we use a framework provided by Achterbergh and Vriens (2002) (see Figure 1).

For the survival of any individual, two processes are imperative: observation and the performance of actions. In the process of observation, three steps can be distinguished. First, individuals perceive signals from the environment. These signals are referred to as data. The second step is that individuals make sense of these perceived data by putting them into a context or "frame of reference." Once perceived and interpreted, individuals may evaluate whether the signal is informative (contains something new—i.e., something the individual did not know already) and whether action is required. Information is now defined as "perceived and interpreted data, containing something new to the observer." Given this description, knowledge can be seen as the background for observation (cf., Achterbergh & Vriens, 2002). The process of performing actions consists of four steps: (1) selecting a desired effect (what does the individual want to achieve by acting?), (2) formulating options for obtaining the

Figure 1. Individual Observation and Action—A Model to Clarify the Distinction Between Data, Information and Knowledge



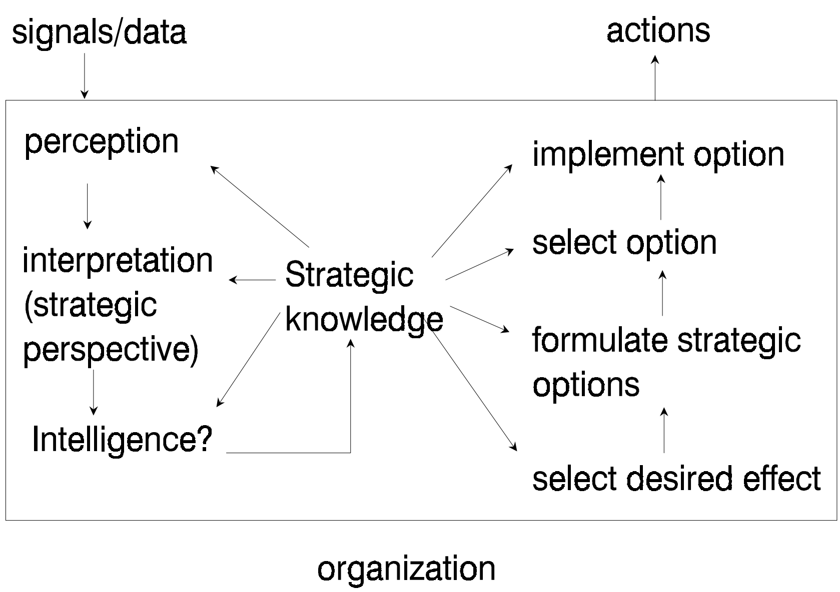
desired effect, (3) selecting an option, and (4) implementing the option. Figure 1 depicts these steps. Regarding the performance of actions, knowledge can be defined as that which serves as a background for these four steps.

In this view, knowledge has two main functions. It serves as a background for observing (or as Achterbergh & Vriens put it, the "assessment of signals") and for "performing actions." Note that knowledge is defined functionally. No attempt is made to sum up the content-elements of knowledge (see e.g., Davenport & Prusak, 1998). The reason for this is that the function of knowledge is easily pinned down, while its exact content is (still) "the subject of psychological research and philosophical debate" (Achterbergh & Vriens, 2002, p. 226).

Against the background of the definitions of data, information and knowledge, we can now define intelligence (see also Figure 2).

To do so, we transfer the above concepts from the realm of individual observing and acting to the organizational realm of strategic observing and acting. That is, we can define strategic observation as (1) "perceiving data from the environment," (2) making sense of these data—i.e., putting them in a strategic perspective, and (3) determining whether the data contain something

Figure 2. Organizational Observation and Action—A Model to Clarify the Distinction Between Data, Intelligence and Knowledge



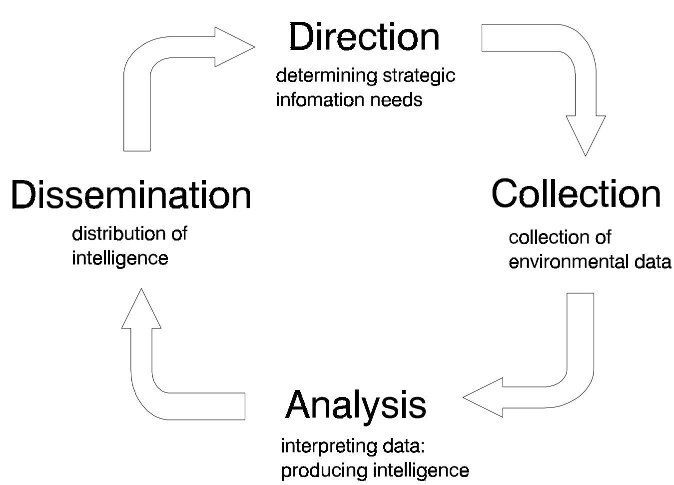
of strategic importance (something new and relevant for strategic purposes) and assessing whether strategic action is needed. In this process of "strategic observation," intelligence can be defined as the "strategic" counterpart of information. That is, if perceived and interpreted data contain something of strategic significance, and one did not already know this, the perceived and interpreted data can be defined as "intelligence." Intelligence, in turn, is evaluated in order to decide whether strategic action is needed. The four processes of (individual) action, as described above, can also be translated to strategic action. Knowledge may then refer to the background against which these strategic observations and actions occur—the "strategic knowledge" in the organization.

This view on intelligence and knowledge also makes apparent that what counts as intelligence in an organization depends on the existing strategic knowledge in the organization. This seems self-evident—but as Gilad (1996) points out, it is anything but: Incomplete or incorrect strategic knowledge often leads to the phenomenon of business blind spots.

Competitive Intelligence as a Process

Next to defining "intelligence as a product" it can also be seen as a process delivering this product. As we already stated in the introduction, authors often divide the process of competitive intelligence into four stages: (1) direction, (2) collection, (3) analysis, and (4) dissemination. The whole process (comprising these four steps) is usually called the intelligence cycle (see Figure 3).

Figure 3. The Four Stages of the Intelligence Cycle



Below, we discuss these stages and illustrate them with findings from a study conducted by Lammers and Siegmund (2001). The object of this study was to give an overview of current CI practices in (large) organizations in The Netherlands. Although we are aware of the fact that these findings only represent the "Dutch" situation, we are somewhat confident in generalizing them, because many participating organizations are large multinationals (e.g., Shell, Akzo-Nobel, or Philips).

In the direction stage, the "strategic information requirements" are stated. In this stage, one determines about what aspects of the environment data should be gathered in order to produce intelligence. A distinction can be made between a "rough" data profile (indicating certain data *classes*, e.g., "We need to know something about the logistic capacity of competitor X and Y") and an exact data profile (indicating the exact data within a certain data class, e.g., "We need to know the amount of trucks and their capacity"). These topics (both in their exact or rough version) are also known as Competitive Intelligence Needs (Fleisher, 2001), Key Intelligence Topics (Kahaner, 1996) or Essential Information Elements (Sammon, 1984).

A particularly difficult aspect is determining the relevance of certain data classes before actual data about them are collected and before they can be interpreted, i.e., before intelligence can be produced. To accomplish this, some kind of model about the "organization in its environment" is needed. The challenge in the direction stage is to build and maintain such a model and to use it to define the strategically relevant data (classes) about the environment. In the literature, one often refers to the critical success factor method (or one of its variants; see for instance Sammon, 1986; Kahaner, 1997; Herring, 1999; or Cook & Cook, 2000) to build such a model and to derive environmental information needs from it.

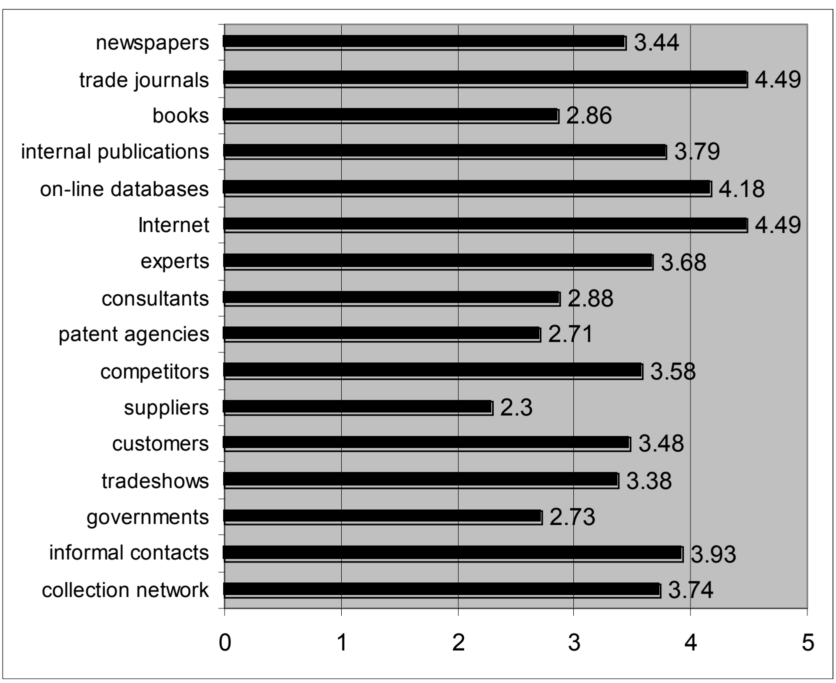
In the second stage of the intelligence cycle, the required data are collected. To this end, two main activities are needed: (1) determining what sources are available and (2) accessing these sources and retrieving data from them. Many authors distinguish between several types of sources. For instance:

- open versus closed sources (open sources are accessible by everyone, closed sources are not);
- internal versus external sources (this distinction refers to the location where sources with data about the environment can be found: inside the organization (e.g., sales-representatives) or outside the organization);
- primary versus secondary sources [Primary sources are sources that hold the data in their original, unaltered form directly from the source from

which the original data stems. Secondary sources offer altered data (cf., Kahaner, 1997)];
- sources that differ in data carrier—i.e., paper, electronic and human sources.

To collect data that may contain strategic relevant information, many possible sources can be identified. Several authors sum up lists of possible sources. Among these are: the Internet, online databases, trade shows, consultants, customers, universities, embassies, suppliers, journals, labor unions, etc. (see for instance Cook & Cook, 2000; Vriens & Philips, 1999; or Kahaner, 1997 for a more comprehensive overview). Most organizations tend to use more than one source. In a recent study, Lammers and Siegmund (2001) asked organizations in The Netherlands what data sources they employed in their intelligence gathering. Figure 4 presents the results. As can be seen in the figure, trade journals, the Internet and online databases were found to be the three most used sources.

Figure 4. Sources Used by Large Organizations in The Netherlands for Collection Activities (Scores range from 0 (never) to 5 (always); Multiple answers are possible)



Source: Lammers & Siegmund, 2001

Gilad and Gilad (1988) stress the importance of an "intelligence collection network"—a network of people involved in collection activities. Members of this network may be dispersed throughout the organization and have all kinds of functions (e.g., service, R&D, purchase, or marketing and sales). The idea behind such a network is that individuals may collect information about the part of the environment they are closely related to. To give an impression of the nature of such networks, Table 1 summarizes the findings of Lammers and Siegmund regarding their composition in large organizations in The Netherlands. As can be seen, the study reveals a high involvement of marketing and sales, R&D and management in the collection network

To collect certain data, knowledge about the available sources should be gathered and used. This entails knowing (1) what sources may contain the requested data, (2) whether these sources can be approached and accessed adequately (measured, for instance, by means of general criteria like timeliness, costs, relevance, accuracy, whether the data is up-to-date, accessibility, etc. (cf., Gilad & Gilad, 1988), and (3) who will be involved in gathering data about the sources and in the actual collection activities. Managing the CI collection stage means ensuring that this knowledge is generated, stored and applied.

In the third stage of the intelligence cycle, the data is analyzed. In terms of the model we presented earlier (see Figure 1), the third stage focuses on interpreting the data from a "strategic point of view" to determine their strategic

Table 1. Composition of the Intelligence Network Members of Organizations in the Lammers and Siegmund Study (The percentage refers to the percentage of organizations indicating that their collection network consisted of a specific member.)

Members of the Collection Network	**Percentage**
Marketing & Sales	79
Service	14
Purchase	29
R&D	50
Finance	14
Human Resources Dept.	7
Lawyers	14
Production	7
Management	57
Other	36

relevance (i.e., to determine whether the data contain intelligence). For this analysis, as with the direction stage, a model of what is relevant for the organization should be available. Many authors present both general and specific models for this purpose. Among the general models are SWOT analysis; the growth-share matrix of the Boston Consultancy Group; scenario-analysis; war-gaming; and competitor profiling (see Kahaner, 1997; Fuld, 1995; Powell & Allgaier, 1998; or Cook & Cook, 2000 for overviews of these models, and Fleisher, 2001b for a reflection on the analysis stage). More specific models are models about patent behavior (Kahaner, 1997; Poynder, 1998) or models tied to specific products. The goal of these models is to provide a context for interpreting data. For instance, an increase in R&D budget of a competitor may mean several things. A SWOT analysis may be used to put this "piece of data" in its proper context. If its R&D was analyzed to be a competitor weakness, the threat of a budget increase may be viewed as less serious than in the case where R&D was analyzed as state of the art.

In the same study we mentioned earlier, Lammers and Siegmund asked several Dutch organizations what models they used in the analysis stage. Table 2 presents the results. These results confirm the popularity of the SWOT analysis. It also turned out that organizations used models they made themselves (in the "other" category).

In the last stage of the intelligence cycle, the intelligence should be made available for strategic decision-making. That is, the intelligence should be presented clearly and distributed to relevant decision makers, using it to

Table 2. Models Used in the Analysis Stage (Lammers & Siegmund, 2001) (The percentage refers to the percentage of organizations indicating that they used a certain model for analysis.)

Models, Used in the Analysis Stage	**Percentage**
Simulation	35
War gaming	15
Scenario analysis	40
BCG-matrix	45
SWOT analysis	80
Financial analysis	65
Competitor profiles	90
Other	40

evaluate current strategic options and to generate, compare, select and implement new ones. Relevant in this stage is to make sure that the intelligence is actually used in strategic decision-making. All kinds of measures may be helpful in accomplishing this. For instance:

- paying attention to the format and clarity of the presentation of intelligence to strategic decision-makers (e.g., Fuld et al., 2002);
- using electronic means to store and distribute the intelligence to the right people;
- designing CI tasks and responsibilities in such a way that strategic management is involved in the intelligence activities (cf., Gilad & Gilad, 1988).

The Nature of the Obtained Competitive Intelligence

Some confusion exists about the difference between competitive intelligence and terms closely related or associated with competitive intelligence, e.g., competitor intelligence, market(ing) research or corporate espionage. One existing confusion is the difference between competitive intelligence and other kinds of intelligence. Data about many environmental aspects may be of strategic significance, e.g., data about competitors, about technological changes, about governments, about suppliers, etc. If the subject about which data is collected is not specified (if the scope is broad), one tends to speak about *competitive* intelligence. In this chapter, we will also refer to competitive intelligence in this broad sense. The common factor in data about these subjects is that they can all contain information of strategic importance. If, however, intelligence is produced and processed about a specific (environmental) subject, authors often use terms indicating this subject: e.g., *competitor* intelligence, *technological* intelligence, or *marketing* intelligence. Some authors even seem to equate competitive intelligence with competitor intelligence (e.g., Fuld, 1995). Of special interest is the term "business intelligence." This term was previously used to refer to the same issues as competitive intelligence (cf., Gilad & Gilad, 1988; Pawar & Sharda, 1997 who use the term business intelligence instead of competitive intelligence). However, lately, the software industry took over the term "business intelligence" to refer to a specific constellation of ICT tools used for organizational decision-making in general (cf., Cook & Cook, 2000; Fuld et al., 2002). We will adhere to this development and refer to BI as a specific set of ICT tools.

In defining CI, authors (cf., Gilad & Gilad, 1988; Cook & Cook, 2000) also stress the difference between CI and marketing research. This difference is partly a matter of scope. As Gilad and Gilad (1988, p. 8) put it: "Although the information produced by a market research department is intelligence, it is only a small part of the total intelligence required for decision making." Hannon, (1997, p. 411) states that marketing research is different because "it is usually undertaken within the marketing function and, obviously, is more limited in scope than the overall competitive intelligence process." Gilad and Gilad (1988) also emphasize that CI tends to be a more continuous activity than marketing research.

A last related term is corporate espionage. Although one may obtain intelligence by means of corporate espionage, the difference is that corporate espionage includes collection activities that are usually viewed as illegal and/or unethical: such as "dumpster diving," stealing information or illegal access to an intranet, to name a few. CI only employs legal activities to produce intelligence (cf., Hannon, 1997; Gilad & Gilad, 1988; Kahaner, 1997; Cook & Cook, 2000; Fleisher, 2001a).

Defining CI: A Summary

In our effort to define CI, we can now make the following statements about CI:

- As a product, CI is "environmental information relevant for strategic purposes."
- As a process, CI can be described by the intelligence cycle consisting of four stages: direction, collection, analysis and dissemination.
- The CI process aims to deliver CI as a product for strategic decision-making.
- CI differs from corporate espionage, business intelligence and other kinds of intelligence and from market(ing) research.

With this understanding of the concept of CI we can now look at the role of ICT for CI in the next section.

ICT FOR COMPETITIVE INTELLIGENCE

In this section, we discuss ICT tools for CI, i.e., ICT tools for supporting the activities in the intelligence cycle. To this end, we first try to position ICT tools for CI in the traditional classification of ICT applications. Next, we discuss four classes of ICT tools for CI.

Traditionally, ICT applications for management in organizations are classified along two well-known dimensions: the type of structure of the organizational task or decision the application is supposed to support (divided in structured, semi-structured and unstructured tasks or decisions) and the organizational (management) level at which these tasks or decisions reside (usually the operational, tactical and strategic management level) (see for instance Laudon & Laudon, 2000). Typically, transaction processing systems (TPS) are operational level systems supporting structured tasks; management information systems (MIS) support tactical (middle level) management by summarizing and reporting output of all kinds of TPS's—still supporting structured tasks. Decision support systems (DSS) typically add analytical tools to MIS for performing "what-if analysis." This analysis is said to be semi-structured. Executive support systems (EIS) refer to tools supporting high level management in their rather unstructured task of strategy making.

We acknowledge that this list of applications is incomplete and that it does not do justice to the research attempting to order ICT applications. The reason for the inclusion of this classification is to see where ICT for CI can be placed. ICT for CI aims at supporting strategic decision-making and thus supports—in the end—an unstructured organizational task. However, CI activities differ in structure: some CI tasks are highly structured (e.g., find experts on subject X); while others are not (e.g., "define the strategic information needs" or "analyze what it means that competitor X closes plant Y"). Moreover, CI tools may be employed at all levels in the organization: at the operational level (e.g., aiding sales representatives in asking questions to customers and storing the answers), at the tactical level (e.g., in supporting the management of CI professionals or supporting the analysis of environmental information) and at the strategic level (e.g., in presenting overviews of trends and their effects on the current or projected strategy). Therefore, ICT for CI (or Competitive Intelligence Systems—CIS) seem to defy an exact classification according to these dimensions. Instead, the dimensions can be used to state that CIS is best seen as a collection of electronic tools (see also Rouibah & Ould-ali, 2002):

- ultimately meant to support strategic decision-making;
- dispersed over different management levels; and
- supporting structured and unstructured intelligence activities.

In this section we will elaborate on the nature of these electronic tools. For this elaboration, we classify them according to (1) their contribution to one or more stages of the intelligence cycle and (2) the specificity of the tool. The latter "dimension" has two positions: a tool can be a general ICT tool used for intelligence activities (like groupware, used for direction activities or the Internet, used for collection or dissemination activities) or a tool specifically tailored to one or more intelligence activities. We will use this classification in our discussion of the tools below. We first discuss the Internet as a "general" ICT tool for all CI activities. Next, we pay attention to other ICT tools—both general and specific. And, finally, we discuss business intelligence applications as a specific set of ICT applications useful for CI activities.

The Internet as a Tool for CI

CI practitioners rely heavily on the use of the Internet for their intelligence activities. The Internet is sometimes seen as the most important information resource for competitive intelligence and, to our knowledge, the Internet as CI tool has received the most attention in the literature (e.g., Cronin et al., 1994; Graef, 1997; Teo & Choo, 2001; Chen et al., 2002; Cook & Cook, 2000; McCurgle, 2001). Chen et al. (2002, p. 1) state that a 1997 Futures group report identifies the Internet as one of the top five sources. Lammers and Sigmund (2001) found that, in organizations they approached, the Internet was the most preferred source for acquiring information.

The Internet can be used in numerous ways to produce intelligence. Examples are: searching certain information by using search engines (Graef, 1997; Chen et al., 2002; Cook & Cook, 2000); obtaining knowledge about costumers through interactive websites and agents (Teo & Choo, 2001); receiving feedback from customers about competitors or one's own products and services (Teo & Choo, 2001); monitoring discussion groups on competitors (Cronin et al., 1994; Graef, 1997); conducting patent search (Poynder, 1998); improving stock decisions by monitoring online stock data available from retailers (Yuan & Huang, 2001); accessing the latest news through a wire service (Cook & Cook, 2000); learning about competitors and partners by visiting their websites (Cronin et al., 1994; Graef, 1997; Chen et al., 2002; Cook & Cook, 2000), searching and contacting experts (Kassler, 1998); accessing governmental files (Kahaner, 1997; Cook & Cook, 2000); monitoring the "e-behavior" of visitors to your website (Tan & Kumar, 2002); gaining easy access to expertise through discussion groups (Teo & Choo, 2001; Cook & Cook); or "outsourcing" collection activities by using commercial online databases (Cronin et al., 1994; Graef, 1997; Gieskes, 2000; Cook & Cook, 2000; Kahaner, 1997).

To discuss the use of the Internet for one or more stages in the intelligence cycle, Teo and Choo (2001) propose to make a distinction between its internal use (Intranet), its external use (Extranet) and its use for "primary and secondary research." However, this seems to confuse two distinctions: one regarding a division of the Internet (into Intranet, Extranet and "beyond") and one regarding the stages in the intelligence cycle (of which Teo and Choo highlight the collection stage). To avoid this confusion, we would like to propose to use both distinctions. Below, we first discuss Internet tools for direction, analysis and dissemination and next devote a section to Internet tools for the collection stage.

Internet for Direction, Analysis and Dissemination

Few studies mention the use of the Internet for the direction, analysis and dissemination stages. To support the direction stage, an Intranet application may enhance communication of and collaboration regarding results of this stage [e.g., an internal discussion site may be used to define and monitor intelligence needs (see Vriens & Hendriks, 2000)]. The same sort of Internet applications may be used to support the analysis stage. Teo and Choo (2001) discuss the relevance of the Internet (Intranet and Extranet) for all CI activities: they hold the view that it (especially e-mail, Intranets, Extranets and databases) enhances internal and external collaboration in CI activities (e.g., multi-departmental analysis of intelligence and the exchange of intelligence between departments as well as the exchange of CI data with suppliers, external consultants and customers). The Internet can also be used to enhance internal and external dissemination of CI data (Teo & Choo, 2001, p. 70, 73; Graef, 1996; Cunningham, 2001). Furthermore, Teo and Choo expect an increase in external collaboration and dissemination (i.e., with relevant stakeholders for mutual benefit) through Extranets.

The Use of the Internet for Collection Activities

The Internet is mainly used for collection purposes and many different tools and uses are reported. A difference can be made between using the Internet for searching and accessing electronic data available on the Internet versus searching and accessing other sources by means of the Internet (like people, trade shows, conferences, etc.—cf., Cook & Cook, 2000; Kassler, 1997). In the first case, the Internet contains the requested data, while in the second case, the Internet is viewed as a means for referring to other sources (like a knowledge map—cf., Davenport & Prusak, 1998). To this end, Kassler (1997) explains that the Internet is invaluable as a means for locating people and contacting them. Cook and Cook (2000) give several sites where information about other sources (experts, trade shows, conferences, etc.) can be found and state their usefulness for CI.

Most attention, though, seems to be on searching and accessing directly available data. However, due to the extremely large number of sites, (and hence) the amount of information and due to the changes in this information, finding the right data is not easy. Chen et al. (2002) state that to deal with a possible information overload a number of tools are available that "analyze, categorize and visualize large collections of Web pages" and "assist in searching, monitoring and analyzing information on the Internet" (Chen et al., p. 3). Below, we discuss some of these tools.

Search Engines

Many CI authors discuss the usefulness of Web search engines for collecting data on the Internet. Typically, they refer to the difference between "common" search engines that can approach websites with some user defined information based on their own indexes (examples are Altavista.com or Yahoo.com) and "meta" search engines, using other ("common") search engines to conduct the search and integrate the results (cf., Chen et al., 2002). Among the search engines a difference is made between general and specific engines (cf., Chen et al., 2002; Cook & Cook, 2000). The specific engines cover a part of the Internet (qua content) e.g., governmental information or patents. Chen et al. (2002) also distinguish between (commercial) engines available through a browser and engines residing on user machines.

Tools for "Outsourcing" Collection Activities

A part of the collection activities can be outsourced to some (automated) service or tool offered via the Web. One way of "outsourcing" collection activities is making use of commercial online databases such as Lexis-Nexis, Dow Jones or Dialog (see Gieskes, 2000; Kahaner, 1997; Cook & Cook, 2000). As Chen et al. (2002) assert and Lammers and Siegmund (2001) found, these online databases are among the main sources for CI professionals. Another way of "outsourcing" collection activities is to employ "Web robots or agents." As Tan and Kumar (2002, p. 9) put it, "Web robots are software programs that automatically traverse the hyperlink structure of the WWW to locate and retrieve information." Cook and Cook (2000, p. 112) add, that "there are many valuable types of bots that can speed up the information gathering process including stock bots, spider bots, shopping bots, news bots [...]."

Tools for Text-Analysis

To support the collection of valuable data in (large) text files, Chen et al. (2002) mention tools for text-analysis—i.e., "automatic indexing algorithms to extract key concepts from textual data." Because of the time spent on reading textual material, these tools may greatly enhance the collection of relevant textual data.

Tools for Monitoring Changes on the Web

Another useful set of tools for collecting relevant data on the Internet are tools that help in monitoring changes in particular parts of the Internet. Among the tools monitoring the Internet are "alerting services" (see Kassler), an online service that alerts you whenever a change to a given topic in a relevant part of the Internet [like a collection of Web pages, bulletin boards, or mailing lists (cf., Kassler, 1997; Vriens & Hendriks, 2000; Chen et al., 2002)] occurs. The previously mentioned Web robots can be used for these alerting functions.

Tools for Collecting Data about the "Electronic" Behavior of Internet Users

One particular use of the Internet for analysis purposes also receiving little attention in the CI literature is monitoring the (electronic) behavior of users of the Internet [e.g., by identifying their navigational patterns or clickstreams (cf., Tan & Kumar, 2002)]. Of course, software is available to keep track of several statistics of visitors to websites, but tools to further analyze this behavior for CI purposes seem to be less available. Reid (in this volume) presents an example of such a tool.

Internet Tools for Collaboration in Search Activities

As has been put forward, the network of intelligence collectors plays an important role in collection activities (Gilad & Gilad, 1988). Internet applications can be used to facilitate the (self) management of and collaboration in these networks. As an example, one may consider an Intranet application through which a "competitor profile" is available to the members of the network, so that each member can fill in his or her part of that profile. Such applications enable monitoring the collection behavior of the members of the network and discussing and "correcting" each other's contribution (see Chapter X, for such an application).

Moving Beyond the Internet: General and Specific ICT tools for CI

Above, we discussed how the Internet (or tools exploring or mining the Internet) can be used for CI activities. We thus discussed how a general set of Internet-oriented tools can be made available for CI purposes. In this section we discuss (1) other general ICT tools that can be used for supporting CI activities and (2) specific ICT applications designed for one or more CI activities (among them are "CI-software" packages as Fuld et al. (2002) call them, and CI applications developed in-house). ICT tools from both classes may or may not use specific Internet applications as discussed above.

General ICT Tools for CI

General tools for the direction stage should aid in formulating strategic information requirements and in storing and disseminating (sub) results of this process. Among these are tools:

- supporting specific methods for identifying, storing and disseminating strategic information needs; for instance, tools that visualize the variables and their causal relations relevant for specifying the information needs. Examples are software supporting system dynamics (e.g., Vensim or Powersim—see Vennix, 1996), or software supporting, identifying or visualizing CSF's or Key Intelligence Topics (e.g., Mindmap).
- supporting the process of identifying strategic information needs—such as different types of groupware (cf., Coleman, 1997) or software supporting group model building (e.g., Vennix, 1996). An example of a suitable groupware application is GroupSystems (Nunamaker et al., 1991). This application enables different users to anonymously discuss, brainstorm about, categorize, and vote on relevant intelligence topics. Rouwette and Vennix (this volume) discuss groupware for direction purposes.

General tools for the analysis stage are comparable to those in the direction stage. They should:

- support specific methods used in analysis—e.g., SD software that enables CI professionals to run "simulations" with certain data and thus helps to establish their relevance. Other examples are applications supporting war-gaming or scenario analysis.
- support (management of and collaboration in) the process of analysis. Again, specific groupware applications may serve this purpose. In this

category one may also include applications supporting the storage and dissemination of the analysis results (for use during analysis). Many general databases with Intranet access can be used. Specific Intranet applications for dissemination and collaboration were discussed in the previous section.

For disseminating intelligence, one may identify all kinds of applications that support (1) the presentation of the intelligence in a suitable format and/or (2) transmitting reports throughout the organization. Many applications are available, including standard drawing packages or Microsoft Office, for sending and receiving documents.

Specific ICT Applications for CI

Fuld et al. (2002) produced several "intelligence software reports." In these reports they analyzed a number of software packages said to be designed specifically for (supporting) one or more CI activities. For each stage in the intelligence cycle (Fuld et al. identify five stages: they split up collection into collection of primary and of secondary sources) they derived criteria to score the applications. For the most part, these criteria link up with what has been said in this chapter. For instance, for the direction stage, Fuld et al. (2002, pp. 12-13) state that the fulfillment of the following functions acts as criteria in judging CI applications:

- Providing a framework to input Key Intelligence Topics and Key Intelligence Questions
- Receiving CI requests
- Managing a CI work process and project flow that allows collaboration among members of the CI team as well as with the rest of the company

Criteria for other stages refer to the:

- Ability to search effectively and efficiently internal or external sources
- Ability to deal with qualitative information
- Ability to support ordering, visualizing and mining information
- Ability to support several methods for analyzing data
- Ability to report and deliver reports

(For the exact criteria, the reader is referred to Fuld et al., 2002.)

Based on their analysis, Fuld et al. (2002) arrive at several conclusions. Among these are:

1. The "CI-software cannot drive the CI-process" (p. 2), but it can help in collecting data, in reporting and communicating intelligence and in supporting the workflow and collaboration.
2. No application can deal with all the intelligence stages adequately.
3. No application can "truly conduct qualitative analysis" (p. 10)—but some tools seem promising in assisting CI analysts to see novel linkages (p. 2). This conclusion seems to fit comments of other authors about the possibility of ICT applications in replacing human intelligence activities. As Cook and Cook (2000) point out: "innovative applications for analyzing competitive factors and forecasting the outcomes of strategic decisions may seem like the unrealistic dreams of CEOs and CIOs alike" (p. 165). However, they expect changes in the future. It is our conjecture that CI activities remain the work of humans. ICT can facilitate them—but it can never replace them.

Fuld et al. (2002) analyzed commercially available CI applications and concluded that there exists no "one-size-fits-all" solution. They add that the technology needs of organizations differ depending on their specific CI requirements. This may be the reason for organizations to build and maintain CI applications themselves.

Business Intelligence Applications

For some time, the terms competitive intelligence and business intelligence have been used as synonyms (e.g., Gilad & Gilad, 1988; Vriens & Philips, 1999; Pawar & Sharda, to name a few authors). However, the software industry has taken over the term business intelligence (BI) to indicate a specific set of ICT tools. These BI tools refer to ICT tools enabling (top) management to produce overviews of and analyze relevant organizational data needed for their (strategic) decision-making. As a BI vendor defines it: "Business intelligence (BI) takes the volume of data your organization collects and stores, and turns it into meaningful information that people can easily use. With this information in accessible reports, people can make better and timelier business decisions in their everyday activities" (www.cognos.com). As early as 1989 the Gartner group specified the nature of BI tools: "Today's [BI] technology categories include EISs, DSSs, query and reporting tools and online analytical processing (OLAP)." These categories currently include data warehouses (cf., Mahony, 1998) and new tools for analysis (e.g., data mining, cf., Zanasi, 1998) and reporting.

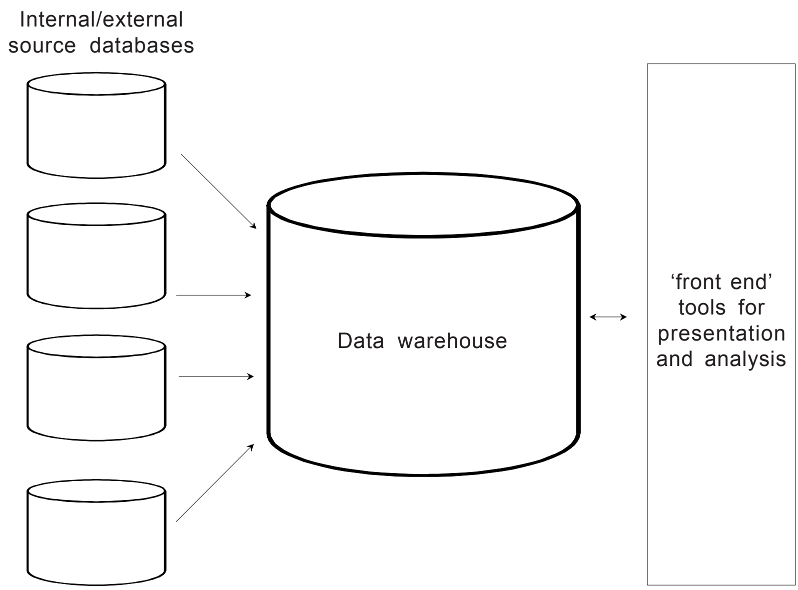
Data warehouses seem to have gained a central position in BI. Moreover, most vendors seem to equate BI with the use of data warehouse and tools for access and analysis of the data in it. Inmon (1993) defines a data warehouse as "a subject oriented, integrated, nonvolatile, and time variant collection of data in support of management's decisions." In an organization, possible relevant data for strategic decision-making is scattered in many databases (e.g., transactional databases, financial databases, personnel databases, etc.). Long and Long (2002, p. 425) point out that such data, which are not integrated and may contain redundancies, are hard to access. To cope with these problems, these data are collected and copied to a data warehouse and 'reorganized into a format that gives decision-makers ready access to valuable, time-sensitive information' (ibid). To keep the data in the data warehouse up to date, data from the source databases should be copied to it on a regular (weekly or sometimes daily) basis.

To gain access to a data warehouse and analyze its data, three types of tools are usually identified: queries, OLAP and data mining. For queries, query languages (like SQL) can be used. However, most of these are cumbersome for easy end-user access and not really suited for analysis. Online analytical processing (OLAP) is a tool for online analysis and manipulation of data. A user does not specify a query, but specifies so-called "dimensions" (like customer, product, region, time) and is able to relate these dimensions to each other in a very user-friendly way. The results can be shown directly in several formats (graphs, tables, numbers) and manipulated.

Data mining refers to a set of (statistical or artificial intelligence) tools to detect (new) relations in data (cf., Zanasi, 1998). Through data mining, for instance, elusive patterns in customer behavior may be detected. For example, a large retailer in The Netherlands discovered that buying a certain brand of diapers was positively correlated to buying a certain brand of beer. Such discoveries may be used for all kinds of purposes—ranging from identifying cross-selling opportunities or specifying marketing campaigns to improving shop layouts (cf., Long & Long, 2000). The basic architecture of a data warehouse (and tools for its use) is given in Figure 5.

The figure makes apparent that the source databases can be internal (transactional databases, financial databases, CRM data, or data from ERP systems, etc.) and external (e.g., databases from business partners, (commercially available) databases containing economic statistics, patent information, etc., or even online databases). However, most data warehouses only cover internal data—i.e., data generated in the transactions of the organization. As Fuld et al. (2002) put it: "BI software [...] typically deals with data warehouses

Figure 5. Basic Architecture of a Data Warehouse



and quantitative analysis, almost exclusively of a company's internal data" (p. 7). This, of course, is a major drawback when treating BI tools as CI tools. However, we feel that once data warehouses are used for storing (and updating) relevant *external* data, they may become valuable CI tools as well.

Next to their internal focus, other drawbacks with BI software can be mentioned. In the previous quotation of Fuld, a second problem arises: BI software primarily deals with quantitative analysis, while CI relies heavily on qualitative data. Other problems have to do with costs and implementation: data warehouses require large budgets and much implementation time and effort. Cook and Cook (2000, Chapter IX) also refer to the "high expectations" organizations have regarding BI software. In particular, one cannot expect BI software to produce intelligence. In their view, the results from analyzing data in a warehouse produce data that should "be analyzed and directly applied to a specific problem" to become intelligence. Therefore, "human intervention" is still needed.

HOW TO SELECT ICT FOR CI?

Now that an overview of ICT tools for CI has been presented, the question can be raised of what ICT tools are appropriate, given specific organizational

CI needs. In this section we discuss three classes of criteria organizations can use to select ICT tools for CI. These classes are: (1) criteria regarding the contribution of ICT applications to one or more stages of the intelligence cycle, (2) criteria regarding the CI infrastructure and (3) criteria pertaining to costs. These three classes correspond roughly to the criteria used in the selection of ICT applications in general according to the information economics approach (cf., Parker, Benson & Trainor, 1988).

Criteria Regarding the Contribution to One or More Stages of the Intelligence Cycle

An (candidate) ICT application should contribute to one or more stages of the intelligence cycle. Criteria to judge the contribution of a particular ICT application to a certain stage (or to several stages) may refer to its appropriateness to deliver the desired *products* for the stage and to whether it fits the *process* leading to these products. For example, collection applications should be evaluated regarding their appropriateness to collect the desired data (e.g., patent data). Applications should also match process aspects—for example, a particular application should support the particular methods (to be) used in the intelligence activities—e.g., a SWOT analysis or a system dynamics analysis. For more examples of such criteria, we refer to the criteria used by Fuld et al. (2002) to judge CI applications.

Criteria Regarding the Relation with the CI Infrastructure

The (CI) infrastructure may be decomposed into three sub-infrastructures: the ICT-infrastructure (this consists of the 'technological infrastructure' (ICT hardware, software and telecommunications technology) and the applications running on the technological infrastructure (cf., Earl, 1989), the human resources infrastructure and the organizational infrastructure; i.e., the structure of the organization qua CI-tasks and responsibilities. For each of these sub-infrastructures, specific sets of criteria can be given.

The criteria regarding the ICT infrastructure focus on the question of whether the application fits the current ICT infrastructure. This fit depends, among other things, on the current set of ICT tools used to support the CI activities. Does the application fit into this set? Does it deliver more functionalities than this set? Is an easy link between the applications in this set (if desirable) possible? Other questions for judging the fit to the ICT infrastructure have to do with the "technological" fit (does the current hard- and software permit the implementation of the application—or does it require large changes? Is the application reliable? Maintainable?). Yet another question for judging the fit to the ICT infrastructure has to do with the contribution of an application to the improvement of the infrastructure—e.g., through a particular application obsolete applications are replaced (or may be replaced more easily), or, through a particular application other state of the art applications can be implemented and used more easily. A data warehouse, for instance, can be seen as a contribution to the current infrastructure, because it enables all kinds of tools for visualizing and analyzing (internal) data.

The second set of criteria reflects the fit of the application to the human resources infrastructure—i.e., whether it fits existing skills, knowledge and attitudes of those who are carrying out CI activities. Important questions are, for instance, whether the required knowledge and skills (if any) are acquired easily, or whether the CI staff is motivated to integrate the ICT application into their routines. Criteria regarding the human infrastructure relate to the concept of "social acceptability" of an application [cf., Hendriks & Davis (this volume); Nielsen, 1999; Hartwick & Barki, 1994; Venkatesh & Speier, 1999]. This refers to standards or to the existence or absence of pressure to use an application. Authors on the subject of knowledge management have formulated criteria to diagnose and design solutions regarding problems with motivational aspects regarding the use of ICT for supporting knowledge processes (see e.g., Bukowitz & Williams, 1999).

The third set of infrastructural criteria reflects the fit of the application to the current definition and allocation of CI tasks and responsibilities (see Gilad & Gilad, 1988 for several ways of defining and allocating them). It does not make sense to install groupware for the direction stage if direction is not seen as a group process. The same holds for using ICT tools structuring collection and analysis activities if the whole CI process has a highly informal nature. In some cases, a task structure may be designed poorly and ICT for CI may act as a leverage to change the current task structure. An ICT tool can be valued because of its contribution to the improvement of the task infrastructure. A common example of a non-CI application said to improve the task-structure is workflow management systems (cf., Laudon & Laudon, 2000). In a similar vein, a groupware application may be valued for contributing to implementing the direction stage as a group process. Philips (this volume) discusses an example of an organization using the implementation of a competitive intelligence system to analyze and change its whole CI infrastructure (including its human resources; technological and organizational structure).

Criteria Pertaining to Costs

These criteria refer to the costs of the application itself, its implementation (e.g., project costs, training, etc.) and its maintenance. These costs may be calculated by different methods (cf., Parker et al.).

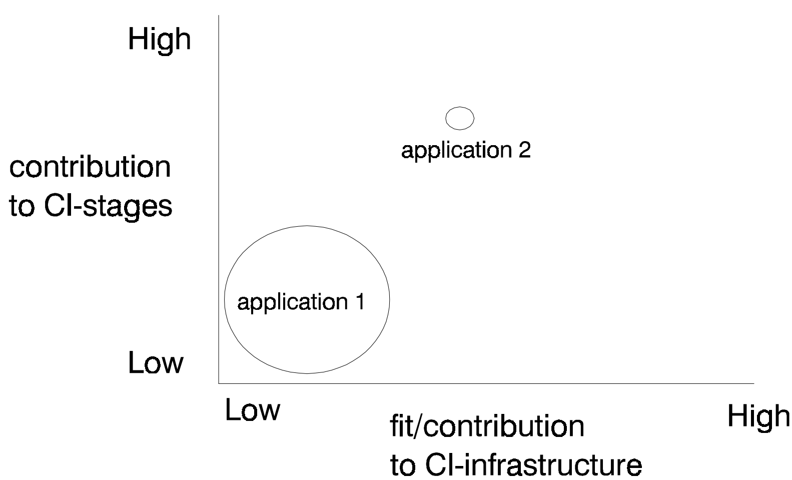
Selecting ICT for CI Using the Three Types of Criteria

To judge the appropriateness of an application for CI in a particular organization, the application should be "scored" regarding all three classes of criteria. To this end, the individual criteria in a class should all be identified, valued, and integrated into an overall score for the class. We will not treat all these sub-steps in this section—rather, we show how these overall scores can be used to select ICT for CI.

The overall scores of each class express (1) the contribution of a particular application to one or more of the intelligence stages, (2) the fit of the contribution to the CI infrastructure, and (3) the costs related to an application. These scores can be plotted in a graph (see Figure 6) — the size of the circle indicates the costs of an application.

In this figure, the scores of several applications are depicted (the size of the circles reflects the costs related to the application). For instance, application 1 may be a data warehouse (with an internal focus). This application is very expensive and contributes only partly to the intelligence stages (it contributes to the collection stage, but due to its internal focus its contribution to the CI stages is low). The data warehouse may contribute to the general infrastructure,

Figure 6. Classification of ICT Applications for CI Using Three Dimensions (See text)



but, in our view, contributes only partly to the CI infrastructure. By contrast, a data warehouse with explicit external linkages would still be very expensive, but may score higher on both other dimensions. Application 2 may be a groupware application. These applications are moderately expensive, may contribute to the direction stage and fit the infrastructure in several ways.

An organization may treat several ICT tools for the support of its CI activities in this way and eventually select some of them.

CONCLUSION

To select and use proper ICT tools for supporting the CI process, organizations should know (1) what the CI process is, (2) what the role of ICT (tools) in this process can be, and (3) judge the role of ICT (tools) for their own CI process. In this chapter, we discussed these three aspects. We defined CI both as a product and as a process. We then discussed the role of ICT tools in the CI process. Here, we presented four types of ICT tools relevant for supporting (and sometimes even replacing) CI activities: the Internet, general applications to be used in CI activities, specific CI applications and business intelligence applications. In the last part of this chapter we discussed three classes of criteria organizations can use in evaluating and selecting ICT tools for their CI process.

Although the definition of CI and the criteria for selecting ICT tools for CI seem to have stabilized, the possibilities of using ICT for CI increase rapidly. Some of the trends that may be acknowledged are:

- A convergence of BI and CI applications (e.g., data warehouses and associated software also tied to external and qualitative data) (cf., Li, 1999)
- Using ICT for qualitative data may increase (e.g., Chen et al., 2002)
- Using the Internet for more than just collection activities (e.g., for collaboration and dissemination purposes) (cf., Teo & Choo, 2001; Cunningham, 2001)
- Improvement of Internet applications for collection (more efficient and effective collection applications will continue to emerge)
- Implementing CI applications can be seen as a process by means of which the CI process and infrastructure can be re-analyzed
- Improvement of analysis applications (cf., Fuld et al., 2002)

Despite all the possibilities of ICT for CI, we would like to end this chapter with remarking that producing intelligence still remains the work of humans who are the only "machines" able to put the data from the applications in their proper strategic perspective. ICT tools, however, are invaluable in supporting this task.

REFERENCES

Achterbergh, J.M.I.M. & Vriens, D. (2002). Managing viable knowledge. *Systems Research and Behavioral Science*, *19,* 223-241.

Bernhardt, D.C. (1994). 'I want it fast, factual, actionable'—Tailoring competitive intelligence to executive needs. *Long Range Planning*, *27*(1), 12-24.

Bukowitz, W.R. & Williams, R.L. (1999). *The Knowledge Management Fieldbook*. Edinburgh: Pearson.

Chen, H., Chau, M., & Zeng, D. (2002). CI-spider: A tool for competitive intelligence on the Web. *Decision Support Systems*, *34,* 1-17.

Coleman, D.D. (1997). *Groupware: Collaborative Strategies for Corporate LANs and Intranets*. Upper Saddle River, NJ: Prentice Hall.

Cook, M. & Cook, C. (2000). *Competitive Intelligence*. London: Kogan Page.

Cronin, B., Overfelt, K., Fouchereaux, K., Manzvanzvike, T., Cha, M., & Sona, E. (1994). The Internet and competitive intelligence: a survey of current practice. *International Journal of Information Management, 14*(3), 204-222.

Cunningham, R. (2001). A toolbox for communicating competitive intelligence via the Internet. In C.G. Fleisher & D.L. Blenkhorn (Eds.), *Managing Frontiers in Competitive Intelligence* (pp. 90-99). Westport: Quorum.

Davenport, T.H. & Prusak, L. (1998). *Working Knowledge*. Boston, MA: Harvard Business School Press.

Dresner, H. (1993). *Business Intelligence: Competing Against Time*. Twelfth Annual Office Information Systems Conference, Gartner Group.

Earl, M.J. (1989). *Management Strategies for Information Technology*. Englewood Cliffs: Prentice Hall.

Fleisher, C.G. (2001a). An introduction to the management and practice of competitive intelligence (CI). In C.G. Fleisher & D.L. Blenkhorn (Eds.), *Managing Frontiers in Competitive Intelligence* (pp. 3-18). Westport: Quorum.

Fleisher, C.G. (2001b). Analysis in competitive intelligence: Process, progress and pitfalls. In C.G. Fleisher & D.L. Blenkhorn (Eds.), *Managing Frontiers in Competitive Intelligence* (pp. 77-89). Westport: Quorum.

Fleisher, C.G. & Blenkhorn, D.L. (2001). *Managing Frontiers in Competitive Intelligence*. Westport: Quorum.

Fuld, L.M. (1995). *The New Competitor Intelligence*. Chichester, UK: Wiley.

Fuld & Company. (2002). *Intelligence Software Report 2002*. Found at: http://www.fuld.com.

Gieskes, H. (2000). Competitive Intelligence at Lexis-Nexis. *Competitive Intelligence Review*, *11*(2), 4-11.

Gilad, B. (1996) *Business Blindspots*. Calne (GB): Infonortics.

Gilad, B. & Gilad, T. (1988). *The Business Intelligence System*. New York: Amacon.

Graef, J.L. (1996). Sharing business intelligence on the world wide web. *Competitive Intelligence Review, 7*(1), 52-61.

Graef, J.L. (1997). Using the Internet for competitive intelligence: a survey report. *Competitive Intelligence Review, 8*(4), 41-47.

Hannon, J.M. (1997). Leveraging HRM to enrich competitive intelligence. *Human Resource Management*, *36*(4), 409-422.

Hartwick, J. & Barki. (1994). Explaining the role of user participation in information system use. *Management Science*, *40*(4), 440-465.

Herring, J.P. (1999). Key intelligence topics, a process to identify and define intelligence needs. *Competitive Intelligence Review*, *10*(2), 4-14.

Inmon, W.H. (1993). *Building the Data Warehouse*. Chichester, UK: Wiley.

Kahaner, L. (1997). *Competitive Intelligence*. New York: Touchstone.

Kassler, H.S. (1997). Mining the Internet for competitive intelligence. How to track and sift for golden nuggets. *Online: The Magazine for Online Information Systems*, *12*(5), 34-45.

Lammers, A. & Siegmund, J. (2001). *Business Intelligence in Nederland* [Business Intelligence in The Netherlands]. Master's thesis, University of Nijmegen (in Dutch).

Laudon, K.C. & Laudon, J.P. (2000). *Management Information Systems*. Upper Saddle River, NJ: Prentice Hall.

Li, C. (1999). ERP packages: What's next? *Information Systems Management,* (Summer), 31-35.

Long, L.E. & Long, N. (2002). *Computers: Information Technology in Perspective* (9th ed.). Upper Saddle River, NJ: Prentice Hall.

Mahony, T.M. (1998). Data warehousing and CI: An evaluation. *Competitive Intelligence Review*, *9*(1), 38-43.

McClurg, R. (2001). Using the Internet for gathering competitive intelligence. In C.G. Fleisher & D.L. Blenkhorn (Eds.), *Managing Frontiers in Competitive Intelligence* (pp. 61-76). Westport: Quorum.

McGonagle, J.J. & Vella, C.M. (1999). *The Internet Age of Competitive Intelligence*. Westport: Quorum.

Nielsen, J. (1999). *Designing Web Usability*. Indianapolis: New Riders.

Nunamaker, J.F., Dennis, A.R., Valacich, J.S., Vogel, D.R., & George, J.F. (1991). Electronic meetings to support group work. *Communications of the ACM*, *34*(7), 40-61.

Parker, M.M., Benson, R.J., & Trainor, H.E. (1988). *Information Economics: Linking Business Performance to Information Technology*. Englewood Cliffs: Prentice Hall.

Pawar, B.S. & Sharda, R. (1997). Obtaining business intelligence on the Internet. *Long Range Planning*, *30*(1), 110-121.

Philips, E.A. & Vriens, D. (1999). *Business Intelligence*. Deventer: Kluwer.

Powell, T. & Allgaier, C. (1998). Enhancing sales and marketing effectiveness through competitive intelligence. *Competitive Intelligence Review*, *9*(4), 29-41.

Poynder, R. (1998). Patent information on the Internet. *Business Information Review, 15*(1), 58-67.

Prescott, J.E. & Fleisher, C.S. (1991). SCIP: Who we are, what we do. *Competitive Intelligence Review, 2*(11), 22-26.

Ringdahl, B. (2001). The need for business intelligence tools to provide business intelligence solutions. In C.G. Fleisher & D.L. Blenkhorn (Eds.), *Managing Frontiers in Competitive Intelligence* (pp. 173-184). Westport: Quorum.

Rouibah, K. & Ould-ali, S. (2002). PUZZLE: A concept and prototype for linking business intelligence to business strategy. *The Journal of Strategic Information Systems*, *11*(2), 133-152.

Sammon, W.L. (1986). Assessing the competition: Business intelligence for strategic management. In J.R. Gardner, R. Rachlin, & H.W. Sweeney (Eds.), *Handbook of Strategic Planning*. New York: Wiley.

Society of Competitive Intelligence Professionals. Found in: http://www.scip.org

Tan, P. & Kumar, V. (2002). Discovery of web robot sessions based on their navigational patterns. *Data Mining and Knowledge Discovery*, *6*, 9-35.

Teo, T.S.H. & Choo, W.Y. (2001). Assessing the impact of using the Internet for competitive intelligence. *Information & Management*, *39,* 67-83.

Venkatesh, V. & Speier, C. (1999). Computer technology training in the workplace: A longitudinal investigation of the effect of mood. *Organizational Behavior and Human Decision Processes*, *79*(1), 1-28.

Vennix, J.A.M. (1996). *Group Model Building*. Chichester, UK: John Wiley & Sons.

Vriens, D. & Hendriks, P.H.J. (2000). Viability through Web-enabled technologies. In M. Khosrowpour (Ed.), *Managing Web-Enabled Technologies in Organizations: A Global Perspective* (pp. 122-145). Hershey, PA: Idea Group Publishing.

Vriens, D. & Philips, E.A. (1999). Business intelligence als informatievoorziening voor de strategievorming. In E.A. Philips & D. Vriens (Eds.), *Business Intelligence*. Deventer: Kluwer.

Yuan, S. & Huang, M. (2001). A study on time series pattern extraction and processing for competitive intelligence support. *Expert Systems with Applications*, *21,* 37-51.

Zanasi, A. (1998). Competitive intelligence through data mining public sources. *Competitive Intelligence Review*, *9*(2), 44-54.