SCIENTIFIC INFORMATION

Global architecture of marketing information systems

Globální architektura marketingového informačního systému

F. Dařena

Mendel University of Agriculture and Forestry, Brno, Czech Republic

Abstract: The paper is focused on study of information systems that can be applied in the process of marketing planning. General terms from information systems theory are examined from marketing perspective, particular examples of marketing activities support are identified on the basis of literature review and global structure of the Marketing Information System (MkIS) is proposed. The main subsystems of MkIS – internal reporting system, marketing intelligence system, marketing research system, and decision support system are discussed in higher level of detail. The main attention is paid not only to supported marketing processes but also to technologies that can be used in individual parts of MkIS. The result is the architecture that integrates isolated marketing applications into one comprehensible framework. This architecture also creates a framework for following research in the field of marketing activities support.

Key words: Marketing Information System, marketing research, marketing intelligence, decision support systems

Abstrakt: Práce se zaměřuje na studium informačních systémů, které mohou být nasazeny v procesu marketingového plánování. Nejprve jsou zkoumány z hlediska marketingu obecné koncepty z teorie informačních systémů, dále jsou na základě studia publikací identifikovány konkrétní příklady podpory marketingových aktivit pomocí informačních technologií a následně je popsána globální struktura marketingového informačního systému (MkIS). Hlavní subsystémy MkIS – vnitřní informační systém, marketingový výzkumný a zpravodajský systém a systém pro podporu rozhodování jsou rozebrány podrobněji. Pozornost je věnována nejen marketingovým procesům, ale také technologiím, které mohou být v jednotlivých subsystémech MkIS použity. Výsledkem je architektura integrující jednotlivé izolované marketingové aplikace do jednoho srozumitelného rámce. Tato architektura zároveň představuje rámec pro další výzkum v oblasti podpory marketingových aktivit.

Klíčová slova: marketingový informační systém, marketingový výzkum, marketingové zpravodajství, systém pro podporu rozhodování

Today, marketing strategies play crucial role regarding the success of any organization in the market. Maintaining the correspondence between business resources and market opportunities requires the ongoing market orientation and adjustment in organization's behavior. To make this process manageable, information technologies represented by information systems must be incorporated into this process.

Marketing, as a specific and very important business process, requires special attention. Rough structure of the Marketing Information System (MkIS), that is one of the most vital elements of effective marketing (Talvinen 1995), can be seen in publications of several authors. Also applications for supporting particular marketing activities are quite well documented. However, they are mostly isolated and they are not set into a common framework.

The objective of this paper is to present complex perspective of the architecture of the Marketing Information System that specifies the structure and

Supported by the Ministry of Education, Youth and Sports of the Czech Republic (Grant No. MSM 6215648904) and within the framework of the institutional research of the Faculty of Business and Economics, MUAF Brno.

behavior of basic blocks of MkIS. It is not focused on particular marketing activities but rather on common framework that is able to embrace all important aspects of information systems in marketing.

MATERIAL AND METHODS

First, information system and the related concepts, like data, information, and knowledge are examined from the point of view of marketing and strategic marketing planning. The structure of information system for marketing activities support and the fields where information technologies are used in marketing process was observed by literature review of renowned journals and renowned authors in this field. The attention was paid to the process of marketing planning and the concept of marketing information system defined by various authors.

DATA, INFORMATION, KNOWLEDGE

Data is understood as raw facts that are the result of observation of the real phenomena (daily sales, product characteristics etc.) (Eom 2001). Information can be interpreted as a collection of facts from which conclusions can be drawn. Information is received as a message and for making a conclusion it must be understood.

Gorry and Scott Morton (1971) specify the characteristics of every information and Ashill and Jobber (2000) define most often occurring contents of the information. These results were based on the research carried out together with marketing specialists. Marketing information characteristics can be divided into following groups:

- information source – information come from within or outside the organization,
- the level of aggregation – detailed or aggregated information; for managers are the most important information aggregated mostly according time period, products/markets, analytical information (e.g. what-if analysis) and information for models for decision support,
- information scope – information of narrow (limited) scope do not have big significance for strategic decisions therefore the most important is information of wide scope that fall into following categories:
  - internal information,
  - external information,
  - historical information,
  - information oriented to the future,
  - quantitative information,
  - qualitative information,
- accuracy – information can be accurate or inaccurate; inaccurate information in not needed,
- time horizon – historical, actual, or future information; this perspective is included in broad-scope information,
- information use frequency – information can be used frequently or less frequently which is not important for marketing information.

Knowledge is the awareness and understanding of a set of information and ways that information can be made useful to support a specific task or reach a decision (Stair, Reynolds 2001).

Information system

An information system is a complex of methods, people, and facilities ensuring information processes that cover information collecting, manipulating, storing, processing, and presentation. If we talk about computer-based information system, the facilities include computer hardware, software, databases, telecommunications etc. The main purpose of information systems is to gather the information, to process it and to present it at desirable time, at proper way, and range to decision making people (Turban et al. 2001).

Information systems can be classified from several perspectives (Turban et al. 2001):

- organization structure – departmental IS, enterprise IS, interorganizational IS,
- functionality – accounting, financial, marketing, operational, human resource management,
- management level – transaction processing systems, management information systems, executive information systems.

Marketing information system

Many authors interested in marketing see incorporating information and communication technologies into marketing management process as a necessity. For creating, implementing and management of marketing plans and strategies information systems have been used for a long period of time. These information systems are known as the Marketing Information Systems (Kotler 2000), marketing support in the Management Information System (Waalewijn, Swaan Arons 1997), Marketing Management Support System (Bruggen et al. 1998) and (Wierenga et al. 1999), the Marketing Management Information System (Stair, Reynolds 2001) etc.

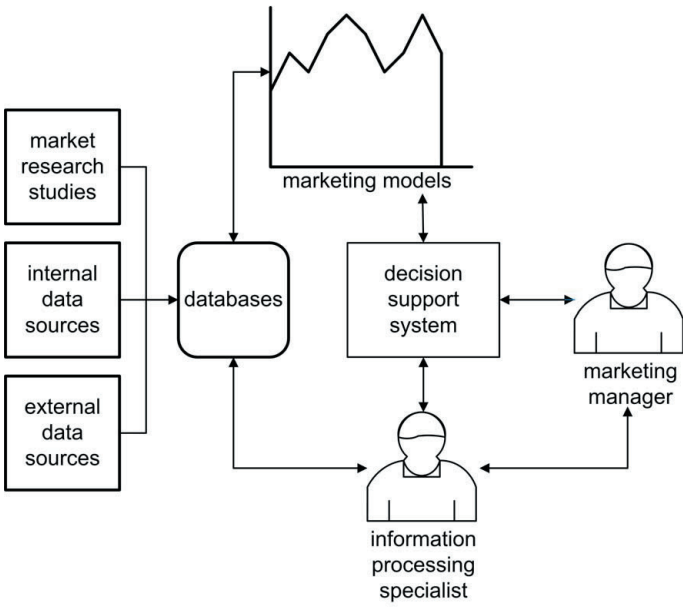

Figure 1. The structure of marketing information system

Source: Perreault, McCarthy (1993)

It is necessary to realize that there exist many marketing IS authors and their conception and terminology might be different. E.g. Churchill (2001) defines Marketing Information System as a system for support of the routine, planned and regular operations related to gathering, analysis and presentation of marketing information. Kotler (2000) defines the MkIS as a system consisting from the following subsystems:
– internal reporting system,
– marketing intelligence system,
– marketing research system,
– marketing decision support system.

Perreault and McCarthy (1993) and Talvinen (1995) define the MkIS similarly but they do not introduce the same terminology. They state that information enter from inside and outside the organization and from marketing research. Inside the system, the in-

Table 1. Major subsystems of marketing information systems

Subsystem	Subsystem use	Description
Marketing intelligence system	Analysis, control (external)	Identifying problems, changes and opportunities in the external marketing environment
Marketing research system	Analysis	Collecting information that is relevant to a specific marketing problem facing the company (e.g. market survey, advertising effectiveness study, product launch timing, pricing)
Market decision support system	Analysis, decision making	Consisting of all available data pertinent to marketing combined with extensive statistical and modeling capabilities and an appropriately designed user interface for making improved marketing decisions
Marketing planning system	Analysis, planning	Managing the whole marketing planning process from analyzing marketing opportunities to planning marketing tactics
Marketing control systems	Control (internal)	Monitoring of personnel, marketing activities and effectiveness, and performance against plans
Marketing report systems	Control (internal)	Reporting on sales calls, expenses, orders, order status, sales forecasts, account (customer) status, etc. (i.e. management reports)
Marketing and sales productivity and support systems	Data gathering, implementation	Managing distributors and accounts, tracking leads (prospects), co-ordinating sales activities, updating customer information, etc., updating mailing lists, personalized mailings (direct mail) and telemarketing activities

Source: Talvinen (1995)

formation is stored in business database and using Decision Support Systems, marketing models and specialists for information processing is the information presented on necessary places (see Figure 1).

Based on extensive literature review, Talvinen made an overview of using information systems in marketing where individual systems are classified according their function and use (Talvinen 1995). The results are in Table 1.

In this paper, the Marketing Information System concept corresponds to the definition of Kotler and Perreault, McCarthy.

RESULTS AND DISCUSSION

The following part of the paper describes the architecture of the marketing information system under the framework of mentioned works by Kotler and Perreault, McCarthy and specifies its individual parts in detail.

Internal reporting system

The source of information from inside the organizations can be various transaction systems represented by the Enterprise Resource Planning (ERP) systems. The main purpose of these systems is to gather and store data from day-to-day business operations, mainly from areas such as manufacturing, accounting, human resources and sales (Pearlson 2001). Such data are then used for building large business databases and applications for decision support (Business Intelligence tools). ERP systems therefore indirectly serve for the decision support during the process of marketing strategy planning although their primary purpose is the transactional processing, data and process integration and process optimization (Holsapple, Sena 2005).

Because the field of the ERP systems and Business Intelligence tools is well explored and documented, it is not necessary to further discuss this issue.

Marketing intelligence system

For decision making in marketing that is focused on the market, it is necessary to take into account information from outside the organization (the environment). The source of this information is the Internet, technical papers, magazines, books, corporate reports, statistical office reports, competitor's web pages, various newsgroups etc. There also exist a number of specialized databases that collect, store and provide information from many areas of the market. The main objective of marketing intelligence is finding information resources and procedures that enable getting information about expected trends in the environment (Kotler 2000). Lorenzon et al. (2005) and Dařena (2005) regard insufficient support for observing the environment as one of barriers that discourage strategic utilization of information systems.

According Perreault and McCarthy (1993), the marketing manager's framework consists of the following five categories (includes one internal and four external factors that must be considered by marketing managers):

– resources and objectives of firm,
– competitive environment,
– economic and technological environment,
– political and legal environment,
– cultural and social environment.

An extra attention should be paid to observation of competitors. This topic was popularized by Michel Porter (1980) who defined five major competitive forces:

– barriers to entry – scale economies, differentiation, access to resources, relationships with distributors etc.,
– substitutes – switching costs, value/price ration of other products etc., power of bargaining power of buyers – purchase volumes, price sensitivity, switching costs, input substitutes, product quality, threat of backward integration etc.,
– bargaining power of suppliers – concentration, importance of the input, differentiation, switching costs etc.
– rivalry among existing competitors – number of competitors, industry growth, high fixed costs, lack of differentiation etc.

Collecting information about competition is sometimes referred to competitive intelligence and Internet as a source of information is very often used (Turban et al. 2001).

Factors affecting the demand for organization's production include e.g. changes in interest rate, inflation rate, unemployment rate, tax rates, population, exchange rate (Foster 2002; Samuelson, Nordhaus 1989).

An important role in the process of collecting information from the environment play organization's employees (mostly the sales force). They operate in the environment and usually know the fact the best (information about customers, competitors etc.).

Marketing research system

Marketing research is a systematic activity that includes design, collecting, analysis, reporting and interpretation of information that are related to some situation, problem that the organization faces (Kotler 2000; Hague 2003). McDaniel and Gates (2002) place marketing research to the position of key instrument for creating successful long-term marketing strategies.

Marketing research process consists of the following phases (Kotler 2000; Hague 2003; McDaniel, Gates 2002):

- Setting the research objectives – in this phase, the reasons for the research as well as the desired results are defined.
- Developing the research plan – definition of information resources, methods of information collection, time and financial plan.
- Collecting the information – the most expensive phase where the information is collected and stored for further utilization. Various methods can be employed here:
  - survey research (most common),
  - observational research,
  - focus group research,
  - experimental research.
- Analyzing the information – statistical and other types of processing for finding the information in the collected data.
- Presentation of the results and making conclusions (decisions).

Marketing decision support system

In the past, computer technologies were used mainly for support of day-to-day operations and we talk about transactional systems. The demand for handling large amount of information lead to creation of managerial information systems that are able to provide aggregated data and because of the presence statistical, other analytical functions and various models support structured decisions. However, most problems at the strategic level are highly complex, ill-structured, individual objectives can be controversial and there exists certain level of risk and uncertainty. Therefore, there is a need for different support tools – these are called the Decision Support Systems (Eom 2001; Kivijärvi, Tuominen 1999; Yang 2002).

The decision support subsystem is intended mainly for managers and contains a set of statistical methods and marketing models that serve for analyzing various information and for better marketing decision making (Kotler 2000). The operation with such system is quite simple and straightforward; however, understanding of the utilized methods is often required. The outputs often have a graphical form with a high degree of clearness. LI et al. (2001) argue that many users see the advantage of the DSS in the ability of presenting a lot of numerical and textual information in the transparent graphical form.

Generally, decision support systems are employed in a wide variety of business activities. Eom et al. (1998) and Eom, Kim (2005) made a survey in publications (271 papers in scientific journals in 1998 and 210 papers in 2005) with the intention to discover the frequency of the DSS utilization in particular business activities. Their results are shown in Table 2.

Regarding management levels, the shift from operation to higher levels (tactical and strategic) is obvious, although the majority of support is directed into operation and tactic levels (Eom, Kim 2005).

The marketing decision support system is basically not too different from the classical DSS and its outputs are related to marketing problems, mostly divided into four main categories constituting so called marketing mix. The most prevalently strategic decision support systems are represented for distribution. In the field of promotion, the DSS are used for finding the best way of communication with the customer, optimal price determination or planning optimal sales effort (Eom, Kim 2005).

Particular areas within marketing and strategic management where decision support systems are used are listed below:

- marketing:
  - allocation of retail space,
  - determining competitive price,
  - measuring market share,
  - creating distribution paths,

Table 2. Decision Support Systems in various functional areas appeared in publications

Area	Frequency in publications (%)	
	1998	2005
Production and operations	41	44
Marketing, logistic, transportation	13	18
Managerial information systems	19	14
Multifunctional systems	3	8
Finance	10	6
Strategic management	6	4
Human resources management	4	4

Source: Eom et al. (1998); Eom, Kim (2005)

  – planning the distribution,
  – planning media for promotion,
  – measuring product profitability,
– strategic planning:
  – analysis of external environment and industry,
  – analysis of fusions and acquisitions,
  – multifunctional planning,
  – new product development,
  – product termination,
  – managing and evaluating strategies,
  – risk management.

The current position of the decision support system within global architecture of business information system and its integration is discussed by Waalewijn, Swaan Arons (1997). They deal with trends in the DSS area and propose an architecture that, in addition to the classic DSS kernel, contains also sensors and effectors. Sensors collect the information from the system and its environment, including its filtering and processing. Effectors subsequently influence the system's environment (sending messages, modification of data etc.) or participate in creation of various plans. Sensors and effectors situate the DSS into its environment more that in the case of the DSS in the classical conception (see e. g. SHIM et al. 2002) and the term situated decision support system appears (Vahidov, Kersten 2003).

The information obtained from sensors is stored in the internal memory of the system and the competent results are derived from it using various techniques (algorithms, statistical processing, artificial intelligence tools etc.). These results can be used as inputs for effectors (Parasurman et al. 2000). The integrated learning systems that include artificial neural networks, fuzzy logic, self-learning expert systems, and genetic algorithms can be used successfully (Duggal, Chhabra 2002; Rábová et al. 2005).

However, some authors, e. g. Ehrenberg et al. (2000), point at the fact that the automation of marketing decision is not documented very often. The reason is probably that when testing the reliability of models used for decision automation, it was was not very high. Another reason can be the fact that information technologies are not used enough to reach the necessary synergy of the technology and marketing processes (Stone, Good 2001).

Bucklin et al. (1998) and Fildes et al. (2006) argue that, contrary to the past, when most of the DSS were used for decision support, more decisions will be automated. The reason is the increasing amount of information that is available for decision making, decreasing the length of the interval between the individual decisions and the fact that information systems can often make better decision that a human (he or she is limited in information collection and processing). Decision automation is suitable mainly for the short-term decision making, in things that have the past (existing markets and products) and in stable environment. Human factor will still have the main importance in long-term, innovative and non-predictable situations. This theory is supported by Hayen et al. (2004) who talk about spreading of the decision support form strategic to operative levels where many of decisions can be automated.

The benefits that decision support systems bring are dependent upon several factors. Waalewijn, Swaan Arons (1997) have summarized them after the examination of literature:
– characteristics of the decision maker,
– decision support systems,
– marketing problem characteristics,
– the nature of environment.

During the decision making process, the managers can choose among several methods (which are not mutually exclusive) that will lead to finding the final solution (Bruggen, Wierenga 2000):
– optimizing – the problem is clearly defined, relations between the individual input variables are clearly described; mathematical models are used,
– reasoning – managers construct their own representations of the problem (mental model) that consists of variables deemed relevant to the problem; different managers may have different mental models depending on their knowledge and experience,
– analogizing – the support for solving a new problem is sought among the solutions of the preceding problems (these solutions can be adjusted to better meet the current needs),
– creating – searching for novel concepts, solutions, or ideas in responding to a situation that has not occurred before, using creativity and detailed problem analysis.

Decision support systems can offer the support for the manager in several ways. The fitness of these methods is subject to the character of the decision problem:
– automation – some decisions or their parts can be automated (clear rules must be defined),
– informating – information related to the problem domain are searched and presented to the manager,
– stimulating – support for finding new solutions.

Power (2004) distinguishes the following five DSS types:
– data driven DSS – emphasizes access to and manipulation with data and data series mainly from internal resources,

– communication driven DSS – emphasizes communication and network technologies that facilitate communication and collaboration,
– document driven DSS – includes technologies for storing, processing, presentation, searching and analysis of documents,
– knowledge driven DSS – serve for design and recommending some actions based on knowledge of the particular area and problems that are solved in this area,
– model driven DSS – emphasizes access to and manipulation with statistical, financial, optimization, simulation or expert models.

DSS architecture

Decision support systems generally consist of several parts (see e.g. Churchill 2001):
– data warehouse and data mining technologies – storage of the data, tools for finding associations, sequences, clusters etc.,
– model base – statistical, accounting, marketing models, realized by neural networks, algorithms, heuristics, simulations, expert systems,
– user interface – ensures communication between the system and its users.

H.A. Simon (see Eom 2001), Stair and Reynolds (2001) or Eom (2001) argue that decision support systems include another important component – decision making subjects. The reason is that non-structured or ill-structured problems cannot be completely programmed and in some cases, the human factor is necessary.

The user communicates with the system on the following levels (Churchill 2001):
– data input,
– data retrieval using query tools,
– using a system like a spreadsheet processor,
– graphical outputs,
– statistical analysis,
– reporting.

The communication uses possibilities of menus, application commands or active approach when the user creates his or her own queries. In this case, there must be a tool for such communication available (e.g. SQL-based language).

During the last few years, the integration of Internet technologies into various existing applications is obvious (Zelenka 2006). The same trend occurs in the field of decision support systems. The reason is that through the web, the information can be quickly presented to the decision maker and decision making becomes more efficient and also more used. The important factor is also the fact that web browser can be used as a component of the user interface (Shim et al. 2002).

The term model in the DSS is used for a set of procedures that are used for data manipulation for the purpose of data analysis and various computations from miscellaneous business activities (finance, marketing, operation, project management etc.). These techniques include (Stair, Reinolds 2001; Schultheis, Sumner 1998):
– what-if analysis – observing the results when making hypothetical changes in the data,
– simulation – imitation of the real system behavior,
– goal-seeking – finding the inputs starting from the desired result,
– finding an algorithm – defining an exact procedure of finding a solution from the given inputs.

Models can be divided into two groups (Schultheis, Sumner 1998):
– experiential models – are related to decision making subject, includes judgments and expert opinions,
– objective models – data are analyzed independently of the decision maker's experience.

The data part of DSS is realized by a data base, data base management system and tools for acquiring data from various business data bases and other internal and external sources (Churchill 2001). Data is mostly stored in a data warehouse and intelligent agents employing data mining techniques are used (Schultheis, Sumner 1998). For data mining, a variety of technologies are used – genetic algorithms, artificial neural networks, fuzzy logic, rough sets and others, including their combinations (Voges, Pope 2000).

CONCLUSION

In the present complex and changing environment, managers are confronted with large volumes of information that they must face and incorporate into their decision making process. This paper provides a global architectural framework for information systems managing marketing activities which reduces the wideness of marketing information system concept. It includes all important components mentioned in various publications with the level of detail that makes the architecture able to include the particular marketing applications.

The individual subsystems of marketing information system are perceived as regular information systems with their functionality and are discussed from the marketing perspectives – a special attention is paid to marketing specifics.

It is probably difficult to match this architecture exactly to the particular information system. However, this framework can be used for the future research in the field of marketing applications and their classification.

REFERENCES

Ashill N.J., Jobber D. (2000): Marketing Information System (MkIS) Design Characteristics: Preliminary Findings and Future Research Directions. In: Proceedings Australia New Zealand Marketing Academy Conference, School of Marketing and Management Griffith University (produced on CD Rom); ISBN 0-86857-978-5.

Bruggen G.H. van, Smidts A., Wierenga B. (1998): Improving decision making by means of a marketing decision support system. Management Science, *44* (5): 645–658.

Bruggen G.H. van, Wierenga B. (2000): Broadening the perspective on marketing decision models. International Journal of Research in Marketing, *17*: 159–168.

Bucklin R.E., Lehmann D.R., Little J.D.C. (1998): From decision support to decision automation: A 2020 vision. Marketing Letters, *9* (3): 235–246.

Churchill G.A. (2001): Basic Marketing Research. Harcourt, Orlando.

Dařena F. (2005): Využití podnikových informačních systémů dostupných v ČR pro podporu marketingových strategií (Using business information systems available in the Czech Republic for marketing strategies support). Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis, LIII (6): 203–214.

Duggal S.M., Chhabra R. (2002): Learning Systems and Their Applications: Future of Strategic Expert System. Issues in Information Systems, Vol. III.

Ehrenberg A.S.C., Barnard N.R., Sharp B. (2000): Decision models or descriptive models? International Journal of Research in Marketing, *17* (2): 147–158.

Eom S. B. (2001): Decision Support Systems. In: Warner M. (Ed.): International Encyclopedia of Business and Management, 2nd Edition. International Thomson Business Publishing, London.

Eom S.B., Kim E.B. (2005): A survey of decision support system applications (1995–2001). Journal of the Operational Research Society, *0*: 1–15.

Eom S.B., Lee S.M., Kim E.B., Somarajan C. (1998): A survey of decision support system applications (1988–1994). Journal of the Operational Research Society, *49* (2): 109–120.

Fildes R., Goodwin P., Lawrence M. (2006): The design features of forecasting support systems and their effectiveness. Decision Support Systems, *42*: 351–361.

Foster T.R.V. (2002): Jak získat a udržet zákazníka (How to acquire and retain a customer). Computer Press, Praha.

Gorry G.A., Scott Morton M.S. (1971): A framework for management information systems. Sloan Management Review, *13* (1): 55–70.

Hague P. (2003): Průzkum trhu (Market research). Computer Press, Brno.

Hayen R.L., Holmes M.C., Scott J.P. (2004): Decision support systems in information technology assimilation. Issues in Information Systems, *V* (2): 491–487.

Holsapple C.W., Sena M.P. (2005): ERP plans and decision-support benefits. Decision Support Systems, *38*: 575–590.

Kivijärvi H., Tuominen M. (1999): Computer Based Intelligence, Design, Choice, Implementation, and Control of Intangible Investment Projects. In: Proceedings of the 32nd Hawaii International Conference on System Sciences.

Kotler P. (2000): Marketing Management. Prentice Hall International, London.

Li T., Feng S., Li L.X. (2001): Information visualization for intelligent decision support systems. Knowledge-Based Systems, *1*4: 259–262.

Lorenzon A., van Baalen P.J., Pilotti L. (2005): Marketing Knowledge Management in Strategic Adoption of a CRM Solutions: Global Supports and Applications in Europe.

McDaniel C., Gates R. (2002): Marketing Research: The Impact of the Internet. John Wiley & Sons, New York.

Parasuraman R., Sheridan T.B., Wickens C.D. (2000): A Model for Types and Levels of Human Interaction with Automation. IEEE Transactions on Systems, Man, and Cybernetics – Part A: Systems and Humans, 30 (3): 286–297.

Pearlson K.E. (2001): Managing and Using Information Systems. A Strategic Approach. John Wiley & Sons, New York.

Perreault W.D., McCarthy E.J. (1993): Basic Marketing: A Global Managerial Approach. Irwin Homewood, Illinois..

Porter M. (1980): Competitive Strategy: Techniques for Analyzing Industries and Competitors. Free Press, New York.

Power D.J. (2004): Free Decision Support Systems Glossary. Available at http://dssresources.com/glossary/.

Rábová I., Konečný V., Matiášová A. (2005): Decision making with support of artificial intelligence. Agricultural Economics – Czech, *51* (9): 385–388.

Samuelson P.A., Nordhaus W.D. (1989): Macroeconomics. McGraw-Hill, New York.

Schultheis R., Sumner M. (1998): Management Information Systems: The Manager's View. McGraw-Hill, Boston.

Shim J.P., Warkentin M., Courtney J.F., Power D.J., Sharda R., Carlsson C. (2002): Past, present, and future of decision support technology. Decision Support Systems, *33* (2): 111–126.

Stair R.M., Reynolds G.W. (2001): Principles of Information Systems: A Managerial Approach. Course Technology, Boston.

Stone R.W., Good D.J. (2001): The assimilation of computer-aided marketing activities. Information & Management, *38*: 437–447.

Talvinen J.M. (1995): Information systems in marketing: Identifying opportunities for new applications. European Journal of Marketing, 29 (1): 8–26.

Turban E., McLean E., Wetherbe J. (2001): Information Technology for Management. John Wiley & Sons, New York.

Vahidov R.M., Kersten G.E. (2003): A Framework for Situated Decision Support Systems. In: Proceedings of the 11th European Conference on Information Systems, Naples, Italy, June 16–21.

Voges K.E., Pope N.K.L. (2002): An Overview of Data Mining Techniques from an Adaptive Systems Perspective. In: Proceedings of ANZMAC 2000: Visionary Marketing for the 21st Century: Facing the Challenge. Australian and New Zealand Marketing Academy Conference, Griffith University, Gold Coast, Australia, pp: 1323–1328.

Waalewijn P., Swaan Arons H. de. (1997): Are decision support systems helping marketers? (A framework for analysis and a literature review). Technical Report. Erasmus University, Rotterdam.

Wierenga B., van Bruggen G.H., Staelin R. (1999): The success of marketing management support systems. Marketing Science, *13* (3): 196–207.

Yang Q. (2002): Towards Statistical Planning for Marketing Strategies. In: Sixth International Conference on AI Planning and Scheduling. Toulouse, France, April 23–27,

Zelenka P. (2006): Modern methods of web applications analysis and design. Agricultural Economics – Czech, *52* (4): 152–154.

Arrived on 5th June 2007

Contact address:

František Dařena, Mendel University of Agriculture and Forestry Brno, Zemědělská 1, 613 00 Brno, Czech Republic
tel. +420 545 132 229, e-mail: darena@node.mendelu.cz