

A Conception Of Multiagent Management System Of Dispersed Market Information – E-negotiations Area

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Abstract. The conception of multiagent system (MAS) as a tool aiding dispersed market information management in e-negotiations area was proposed in this article. The results of the conducted surveys concerning among other things identification of the application areas of intelligent software agents in the enterprises are also presented here. Attention was paid to the role of business negotiation in market information acquisition. Software environment Agent-Builder enabling elaboration of the simulating model of the proposed conception of the system was also described in the present article.

1 Introduction

The electronic markets develop mainly due to technology and computer technology advances. Particularly important here are: electronic data interchange (EDI), the Internet – the global network, and especially World Wide Web network service and electronic mail [5], [8].

Market information is a set of all data, information and news, also informal information and news acquired through direct contacts, which is essential to prepare market strategy and market operations, including operations on international markets. Ability to compete effectively and maintain own position on the market may be secured for the enterprise by an efficient system of market information. Thus, there are initiatives undertaken that aim to develop new access technology to dispersed and heterogeneous market information. Despite the fact that contemporary IT technology (Information Technology) offers great opportunity of quick and easy access to vital information from the point of view of business operations [11], finding required at a given moment information on the Internet is still troublesome to some managers and is a complicated and time consuming process.

One of the interesting conceptions is the application of intelligent software agents operating on behalf of the users [2], [3], [10]. Their task is among other things to search in many sources for information that meets set in advance criteria, and at the same time to draw conclusions on the basis of this information and formulate further search goals. Intelligent agent – as a concluding system – influenced by external impulses makes logical, precisely determined decisions. A group of cooperating software agents makes up a multiagent system. In accordance with the MAS systems

pragmatism even already existing information-decision making system can be treated as environment in which agents carrying out particular tasks are inserted [4].

The Internet has become communication medium and has created possibility of electronic business management. Its development lets us assume that greater and greater part of economic life will take place by means of the internet technology. Economic globalization forces constant communication of market participants and thus frequent negotiations.

Results of the survey conducted in Polish enterprises were presented in chapter 2. The aim of the survey was to show whether business negotiations are treated as a source of market information, and if they are supported by electronic media and what tasks would Polish managers delegate software agents to perform.

The conception of multiagent system, which is to show possibility of market information management in an enterprise was proposed in chapter 3.

2 Market Information And Business Negotiations Aided By The Internet

Business negotiations are the important source of market information acquisition. Being treated as the communication and information exchange processes, they give the enterprise opportunity to complete knowledge of the other, negotiating, side [9]. Connection of the contemporary enterprises by means of informatic networks, but first of all of production and cooperative ties causes that aiding negotiation processes - perceived as information-decision making processes - becomes an important task of the enterprise's informatic system. Business negotiations may take place on the Internet on the virtual B2B (Business to Business) markets, where auctioning mechanism is not enough. Sides have to use more advanced e-negotiation technologies in order to fix not only prices but also delivery conditions, technical details, guarantee conditions, payment terms and many more aspects of the agreement. Acquisition of reliable information is the basis to create loyalty, which in turn means, that there is a possibility of negotiations in new areas – among other things in the company-client relationships.

Within the confines of the research conducted at Czestochowa University of Technology, Management Faculty, in the Department of Management Information Systems, connected with the application of multiagent system and integrators of information flow in market information management in the enterprise, there was the survey "E-negotiations in Polish Enterprises" conducted. The subject of the study were the enterprises applying in their operations internet business model and mixed business model – traditional-internet one. The survey was conducted among four groups of respondents – presidents, members of the board, middle-level managers and employees. The total number of respondents constituted 172 people. The surveyed enterprises included:

- 31 employing more than 500 people,
- 14 employing 251-500 people,
- 44 employing 51-250 people,
- 49 employing 11-50 people,

- 34 employing fewer than 10 people.

The majority of 117 constituted the enterprises with 100% of Polish capital. The remaining enterprises were:

- 27 with the majority of Polish capital,

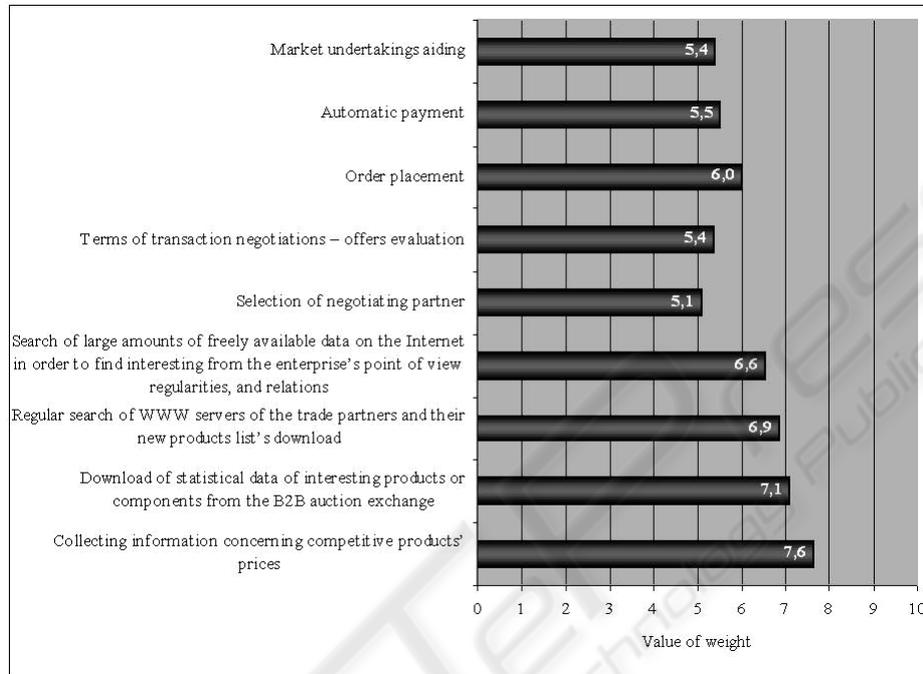


Fig. 1. Perception of tasks in Polish companies most willingly assigned for an intelligent software agent to perform. Source: own analysis.

- 24 with the majority of foreign capital,
- 4 with 100% of foreign capital.

With respect to the type of operation the biggest group of all the enterprises constituted service companies – 61, then production companies – 42, trade companies – 31, production-trade-service companies – 15, trade-service companies – 14, production-trade companies – 9.

The survey consisted of two parts and included 23 questions altogether that concerned business negotiation aiding and market information acquisition by electronic media, the Internet in particular. The results of the two questions directed to respondents are presented below. The questions were connected with the perception of the software agents' role and business negotiations, as the sources of market information (Fig. 1, Fig. 2).

It follows from the chart presented in Figure 1 that one of the most burdensome and important at the same time activities for managers responsible for business negotiations in Polish companies is – according to the respondents – collecting information about prices of competitive products (7,6 points in 10-point scale). It is acquisi-

tion of information on prices of competitive products that they would assign an intelligent software agent to perform these duties. Thus, there exists a real need to automate this activity and if at all possible quick implementation of such a solution. However, the respondents would be less willing to allow the software agent to select their negotiating partner (5,1 points).

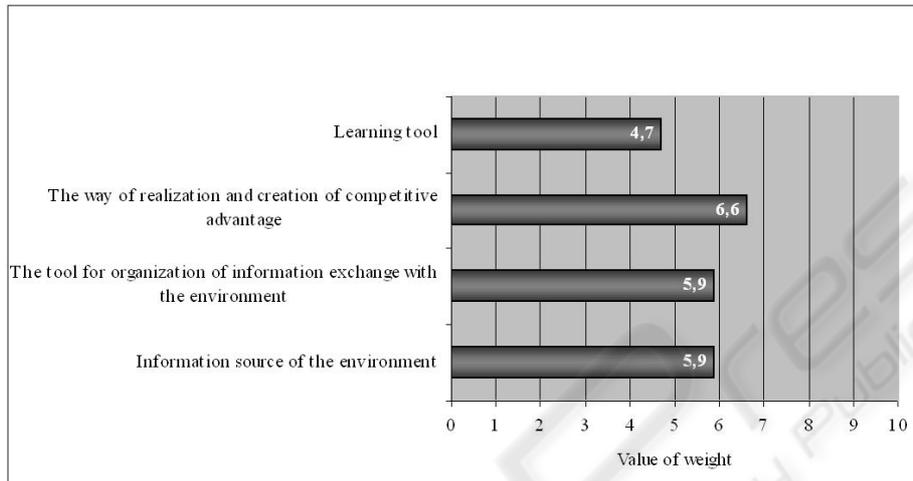


Fig. 2. Perception of business negotiations functions in Polish companies. Source: own analysis.

The result of the second answer is connected among other things with classical methods of the other side's credibility verification. Nevertheless, it should be stressed here that the respondents assigned substantial significance to every activity represented in Figure 1. It justifies the necessity of the intense research in the area of software agents application in social organizations, especially with regard to market information acquisition.

The second of the presented in this paper questions concerned perception of the role of business negotiations in Polish companies. The results received presented in Figure 2 indicate that the most important role of negotiations is maintaining or winning the competitive advantage (6,6 points). However, the two following positions are connected with the notion of information. Negotiations are as follows: the tools of organizing information exchange with the environment and the source of information of the environment (comparable significances – 5,9).

The most important role in enterprises is still played by traditional "face-to-face" negotiations where negotiators meet directly. This concerns particularly negotiations of very important or strategic for enterprises contracts. Undoubtedly, it is still the most interactive way of communication between the negotiating sides.

However, the analysis of the conducted survey and interviews justify necessity of work on application aiding managers in running e-negotiations, particularly in relations on electronic, B2B markets.

3 Proposed Model Of The System

One of the conceptions of a system aiding market information management in the e-negotiations area is its realization in the form of multiagent system. The proposed in the work model will comprise of two mutually cooperating groups of software agents (so called agencies):

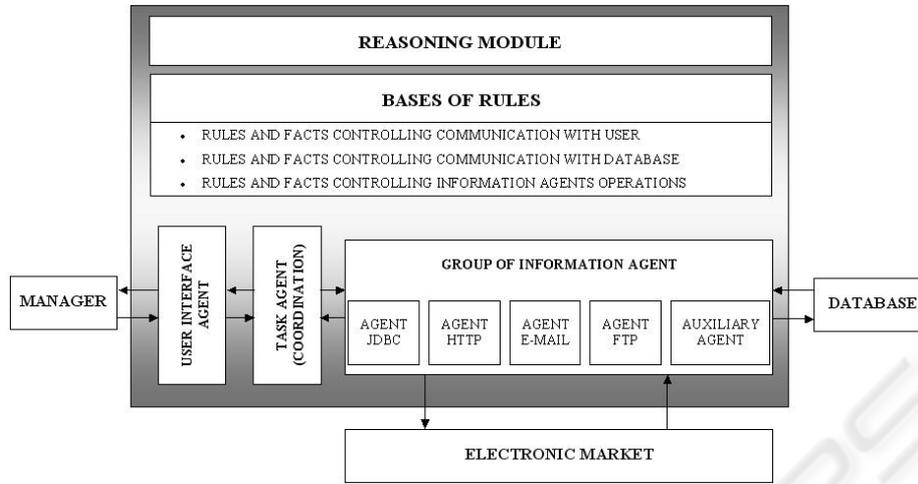
- First group – its task is to acquire, analyze and make market information available to manager, aids manager in preparation to negotiations phase,
 - Second group – its task is to aid manager in the terms of transaction negotiations; it takes over the task of offers evaluation and working out initial compromise.
- The above mentioned groups include three basic kinds of agents:
- Interface agents – their task is to facilitate man interaction with the system and presentation of the work results in accessible form.
 - Coordination agents – they analyze introduced by man tasks and divide them into elementary tasks.
 - Information agents – they realize elementary tasks, delegated to them to carry out by task agents (they take and store data from the available information resources, collect information acquired in the process of negotiation, take over tasks of offer exchange and working out initial compromise); they return results of their operations to Interface Agents.

General architecture of the first group of agents presents Figure 3.

Information agents take over tasks of collecting, analyzing and making market information helpful in preparation to negotiations with clients and suppliers available to manager. They also take over tasks of offers exchange – so called packages. Offers, that is lists of items to negotiate and their weights are sent as KQML (Knowledge Query and Manipulation Language) language commands. Items to negotiate are among others: price, quantity, quality, delivery terms and conditions, payment conditions, guarantee, discounts. Packages are subject to evaluation, and worked out by Information Agents possible compromises are presented to managers to accept or modify with respect to the weight of particular negotiated items. If the agreement is accepted, Information Agents cease their operation and the final part of the negotiations concerned with signing contract and accounting is taken over by man. In the case of lack of acceptance however, Information Agents work out compromise again or their operating is interrupted. Thanks to application of Information Agents and the possibility of holistic packages comparison by managers there exists a chance of Pareto-optimum compromises achievement [9].

The proposed in the work model was elaborated in the AgentBuilder environment of Acronymics Inc. The research of the simulating model was divided into three stages:

- formulating, describing and assigning tasks to software agents,
- multiagent system implementation – elaborating system's ontology, establishing concluding rules of particular agents, negotiating protocol and communication with database,
- elaboration of coordination method among agents,
- simulation and verification of the proposed model.



Where:

JDBC Agent - software agent for database service.

HTTP Agent – software agent carrying out function of information acquisition from websites.

E-Mail Agent – software agent for electronic mail service.

FTP Agent – software agent for file transfer service.

Auxiliary Agent – for communication with other software agents in KQML language.

Fig. 3. General architecture of the first group of agents. Source: own analysis.

At present the research focuses on the second stage – MAS system implementation. Initial simulations concerning contract negotiations among software agents representing two sides of negotiations are being carried out – Figure 4.

The criteria for evaluation of negotiated packages is value of their usefulness function described by the formula (1):

$$\sum_{i=1}^m \sum_{j=1}^{n_i} u_{ij} x_{ijk} = U(p_k). \quad (1)$$

Where:

$U(p_k)$ – p_k package usefulness,

k – number of packages,

i – i item to negotiate,

j – j option for i item to negotiate,

u_{ij} – partial usefulness of j option for i point to settle,

x_{ijk} – binary variable indicating if j option of i item is present in p_k package,

m – quantity of items to negotiate,

n_i ($i = 1, \dots, m$) – quantity of vital items to negotiate.

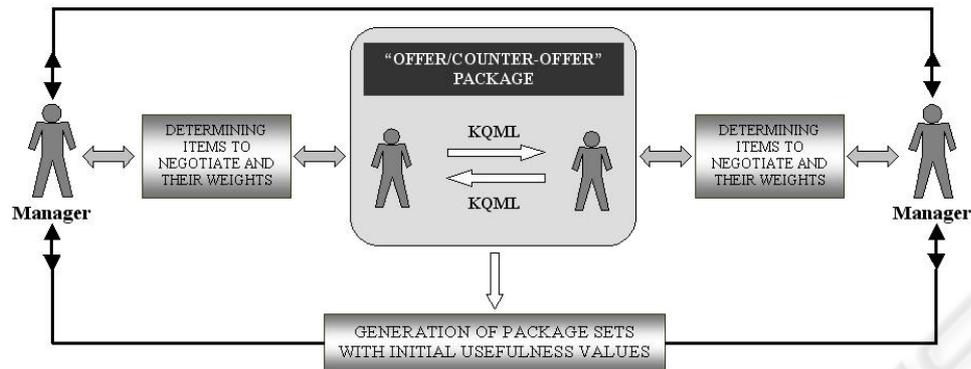


Fig. 4. Transaction terms negotiations – offers evaluation. Source: own analysis.

4 Summary

Acquisition of up-to-date market information is one of the crucial factors influencing management efficiency of contemporary enterprises. Enterprises possessing proper, efficient information will not perceive external environment as a barrier in their development, but rather as a stimulus to innovative operations. Due to this fact a higher efficiency level of market information management should become a goal to pursue. The fulfillment of this postulate requires a new model of information system to be designed, characterized by elasticity, autonomy and reactivity to changes occurring in the enterprise's environment. Its monitoring is a process of constant following and search for market changes, sending offer inquires, etc. Changes happening in the enterprise's environment often generate surplus of information [4]. Not all the enterprises are able to make the proper use of this fact. Efficient system of market information largely conditions creation of the market offer by the enterprise, and also influences maintenance or gaining of competitive advantage on the market. Moreover, enterprise management often requires real-time reaction, which means receiving information about an economic event the moment it happens and immediate dispatch of feedback information.

Business negotiations are an important source of market information – which is clearly visible when analyzing negotiating processes from the perspective of their full “life cycle”. Information is generated at various stages of the negotiating process.

The proposed in the paper conception of multiagent system aims to show possibility of market information management through improvement of enterprise's business negotiations with other, present in its environment subjects. This is particularly important because there are often multisided negotiations run in enterprises.

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References

1. AgentBuilder. An Integrated Toolkit for Constructing Intelligent Software Agents. User's Guide. Version 1.4 Rev.0. Acronymics, Inc. Arizona, Mesa (2004)
2. Chaves, I., Monteiro, E.: MATE – Mobile Agent Technology for Ecommerce. Proceedings of the International Association for Development of the Information Society International Conference e-Society 2003. Volume II. Lisbon, Portugal (2003) 730-734
3. Jennings, N. R., Wooldridge, M. J.: Applications of Intelligent Agents. Agent Technologies: Foundations, Applications, and Markets. Springer-Verlag: Heidelberg, Germany (1998)
4. Kiełtyka, L., Kucęba, R., Niedbał, R.: Coordination of information processes of the contemporary enterprise. Economic informatics. Scientific-Didactic Review No 1027. Scientific editors : Goliński J., Jelonek D., Nowicki A. Published by Wydawnictwo Akademii Ekonomicznej im. Oskara Langego we Wrocławiu, Wrocław (2004) 20-26
5. Kiełtyka, L.: Communication in management. Technology, tools and forms of information transfer. Agencja Wydawnicza PLACET, Warszawa (2002)
6. Kersten G., Kersten M., Noronha S.: Computer aiding and research of negotiating processes. Zagadnienia Naukoznawstwa, Vol. 136, No. 2 (1998) 202-227
7. Kiełtyka, L.: Multimedia in business. E-commerce, multimedia information technology, information management, multimedia in teaching. Scientific editor L. Kiełtyka. Kantor wydawniczy ZAKAMYCZE, Kraków (2003)
8. Kisielnicki, J., Sroka, H.: Business information systems. Informatics in management. Methods of system designing and systems implementation. Agencja wydawnicza PLACET, Warszawa (1999)
9. Rządca, R.: Negotiations in business. The way the organizations negotiate. PWE, Warszawa (2003)
10. Sycara, K.: Multiagent Systems. <http://www.aaai.org/Resources/Papers/AIMag19-02-007.pdf> (1998)
11. Várkoly, L.: Possibilities of PC and computer networks application in the selected economic departments. Trencianska univerzita v Trencine, Trencin (2001) (in Slovak)