Web 2.0 Integration in a WEB-Based Decision Support System: Effect Study of Social Networking on Decision-Making

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ABSTRACT: *Entreprise collaboration is being enhanced by virtual communities that leverage social linking and tagging tools (like tools for social networking, social book marking and social search), user-contributed content management platforms (like entreprise Wikis, blogs and forums,) tools that leverage user opinions, etc. In this paper, we envisage a combination of Software agents and Web 2.0 technologies within a platform of a Web-Based Decision Support System. This paper develops a simple framework to help understand the collaboration that is afforded by Web 2.0 applications. The proposed framework is used to examine how production agents can create, share and exchange experiences on diagnosis and resources failures with each other to have new ideas or useful information for the decision-making process. ALFATRON electronics industry is selected as an application domain in this study.*

Keywords: Multi-agents System (MAS), Production Agent (PA), JADE, Web 2.0 technologies, Web-based Decision Support System (Web-based DSS)

Received: 18 February 2012, Revised 2 April 2012, Accepted 8 April 2012

1. Introduction

Entreprise collaboration has recently come to benefit from the emergence of an entreprise-oriented specialization of the Web 2.0 vision. Entreprise collaboration is being enhanced by virtual communities that leverage social linking and tagging tools (like tools for social networking, social book marking and social search), user-contributed content management platforms (like entreprise Wikis, blogs and forums,) tools that leverage user opinions, etc.

These digital platforms are already popular on the internet, where they are collectively labeled "*Web 2.0*" technologies.

The idea of using technology in organizations to facilitate social interaction is not new. Computer Supported Collaborative Work (CSCW) tools and group support systems like Lotus Notes have been around since the 1980s. More recent trends towards the use of portals and intranets to support knowledge management are also notable. McAfee [4] argues, however, that such technologies have generally been of two type: 'channels' such as email where there is widespread authorship, but access is limited to the few to whom the messages are addressed, or 'platforms' like intranets where authorship is centralized and narrow, but consumption widespread.

Users of both channels and platforms are dissatisfied with tools [15]. The use of Web 2.0 technologies in organizations, which McAfee calls "*Enterprise 2.0*" offers the potential for both widespread authorship and consumption of information.

The nascent concept of enterprise 2.0, however, has not yet been extensively researched, despite widespread adoption of the term in industry. The peer-reviewed academic literature consists of a number of conference papaers and a handful of journal papers for example [3][7] [8].

Few deal specifically with the use of social media for decision support business intelligence, tending to focus instead on adoption by operational staff.

As noted in [5], the practice of building Decision Support Systems can take advantage, in many ways, of the increased availability and growing sophistication of Web technologies. These technologies provide platform-independent, remote, and distributed computation and the exchange of complex multimedia information. Furthermore, these technologies enable companies to reach out their customers and influence decision-making in new and different ways [13].

Despite many DSS having been created for use specifically in production management and real-time resolution of flow-shop manufacturing systems, there has been little research works using Web 2.0 technologies that involve extensive interaction with remote computing resources. One can mention that Web 2.0 offers technologies that provide unparalleled access for non-technical people to server resources, databases and other networked information providers [10].

Decisions are inherently communicative acts : after a decision has been made, this is communicated to the rest of the organization, and the act of deciding itself is a communicative act that contributes to a social context [3].

Social networking enabled Web-based DSS could have the capabiity to support different groupings of users (e.g agents), either reflecting pre-existing social networks in the organization, or the formation of new groupings based on interests in various topics covered by the collaboration tool. For example, users (operators or managers) from a variety of services in shoop floor may have interest in the impact of a marketing campaign for a new product. In this sense, the kinds of coordination of interest, rather than just a coordination of activity in an organization.

Intelligent filtering (agents) is included in this study to refer to technologies used to automatically find, summarize and filter information. However, the kinds of algorithms that make use of the data generated by passive and social media platforms can be used to address these same problems.

The rest of this study is organized as follows. After the introduction section, the next section performs a review of prior studies and discusses the associated factors about an individual's continuous use of Web 2.0 applications. The research model, hypotheses, and operationalization are covered in Section 3 and the data analysis procedures and the obtained results are discussed in Section 4. Some concluding remarks are given in Section 5 in addition to providing future research directions and limitations to complete this study.

2. Related Research Work

The concept of Web 2.0 was originated from the 2004 International Symposium hosted by O'Reilly and MediaLive [1]. However, there was no clear definition of Web 2.0 and only an initial discussion of its principles was available. Furthermore, Web 2.0 did not have a strict boundary; but it consists of the following attributes such as ''*interaction, participation and sharing*'' as core values. In contrast to Web 1.0, Web 2.0 is characterized by services rather than software, and its platforms include any devices that can be connected to the Web rather than just personal computers.

As seen in Figure 1, Web 2.0 can be thought of as the technical infrastructure that enables the social phenomenon of collective media and facilitates consumer-generated content. The latter are distinguished by the difference in focus: social media can be thought of as focusing on content, and consumer generation on the creators of that content. Simply, Web 2.0 enables the creation and distribution of the content that is social media [15].

The scope of Web 2.0 is very broad since it includes social networks, search, multimedia, portal, online entertainment, and electronic business.

We were inspired by two main research works. Firstly, in [15**]** a brief overview of Web 2.0, social media, and creative consumers was provided, and the challenges and opportunities that these phenomena present to managers generally and to international marketers and their strategies in particular were explored.

To help managers understand this new dispensation, authors in [15] proposed five axioms as follows: (1) social media are always a function of the technology, culture, and government of a particular country or context; (2) local events rarely remain local; (3) global events are likely to be (re)interpreted locally; (4) creative consumers' actions and creations are also dependent on technology, culture, and government; and (5) technology is historically dependent. At the heart of these axioms is the managerial recommendation to continually stay up to date on technology, customers, and social media.

Secondly, Meredith et al. presented in [3] a functional model of social media and its application to Business Intelligence (BI). Their study explored the application and the role of Web 2.0 concepts within BI applications. It classified the functions that are provided in social media platforms to foster user collaboration and contribution.

More precisely, they developed an argument that the social nature of organizations implies that support of collaboration and interaction between end-users of a BI system would be useful addition to the standard BI system functionality.

Our main basic research consideration is that the developed framework in [3] provides developers of BI systems with a structured and comprehensive basis for design decisions they make about the use of Web-based social media within BI applications.

Our earlier work provided the base functionality needed to integrate agents into a DSS for the purpose of automating more tasks for the decision maker, enabling more indirect management, and requiring less direct manipulation of the DSS. We proposed an integrated approach for the development of a Web-based Decision Support System adaptable to industrial enterprise's needs [14].

In fact, Web technologies have been widely employed in developing manufacturing systems to associate various product development activities, such as marketing, design, process planning, production scheduling, customer service, etc., which are distributed at different locations into an integrated environment.

In production management, DSS can be considered as model, data and knowledge-driven DSS [12] [14]. The system we propose in this paper can be used to describe future DSS that uses Web 2.0 and Web technologies.

All types of DSS can be deployed using Web technologies and can become Web-based DSS. Managers increasingly have Web access to data warehouses and analytical tools.

A number of articles discuss architectural issues, frameworks, usability, and other technology topics that are generally applicable to Web-based DSS. See for example works presented in [5], [14] and [15].

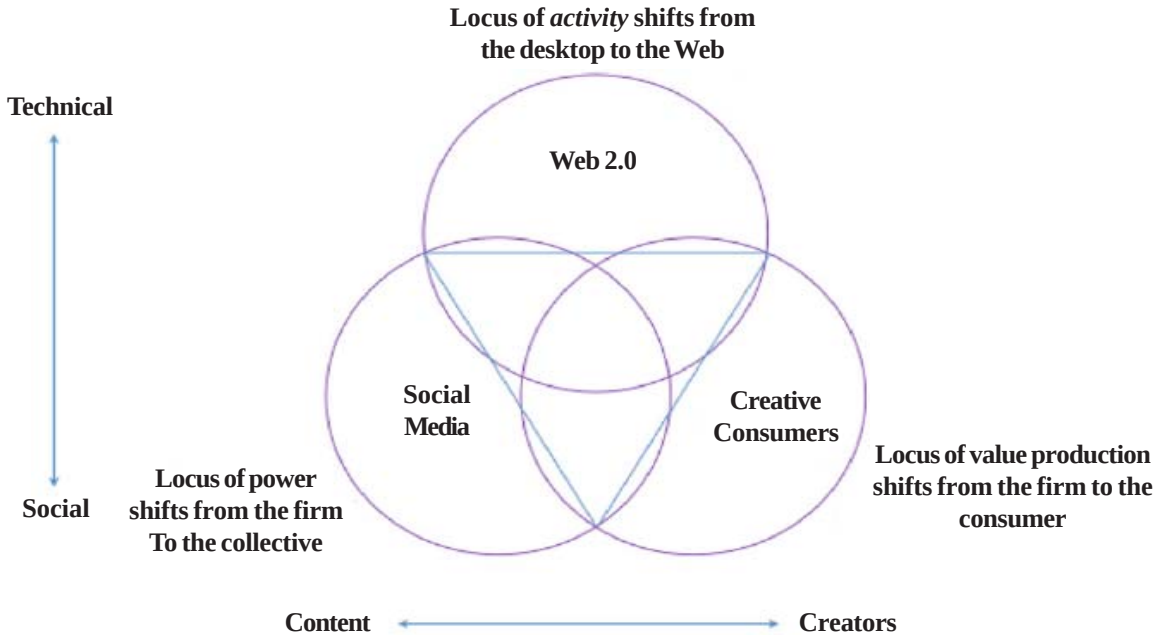

Figure 1. Web 2.0, social media, and creative consumers [15]

3. Contribution

The main contribution of our study is to provide an efficient tool that helps users find information resources available as an online service within Intranet. The decision-making is not only guided by the information provided by DSS but rather than the Web 2.0 technology, the process is entirely based on communication among the agents and Web applications. support to decision-makers at many different levels, to allow for the addition of the enterprise data and to utilize the power of one-to-one communications over the internet.

A brief explanation of what is Web 2.0 is provided before explaining how Web 2.0 based tools may support decision making processes.

More precisely, Web 2.0 technologies and Web services are proposed to allow DSS to provide different types of A Web 2.0 generally accepted definition is missing in literature, Tim O'Reilly defined Web 2.0 with a set of techniques and design metaphors [1]. Technology and services such as Wikipedia(Wikipedia), Flikr [18] or Youtube [17], highlight that Web 2.0 is more people-oriented, rather than data-oriented. Furthermore, the Web 2.0 is seen as a free platform exploiting open standards, cooperation agreements, and integrating products and technologies. Its force lies in a solid union of ideas, technologies and business models which are highly customizable and interoperable.

The key principle at the core of the Web 2.0 philosophy is that the service improves with the growth of cooperation and user involvement [1], [8]. E.g., Wikipedia offers to users a complete set of tools for creating and exchanging knowledge: collaborative editing tools, user feedback and reputation management, peer review support, search engines etc.

The paper develops an argument for the inclusion of social networking technologies within A Web-based DSS.

The purpose of this work in progress is to bring some rigor to the concept of Web 2.0 integration in decision support system.

The discussion forum provides a Web 2.0-based platform in which production agents may create, share, and discuss failures diagnosis and resolution of machines breakdowns with each other.

We argue that the exchange and sharing of experiences can inspire and promote new ideas or useful information for the decision-making process.

The contribution of this study may be that it develops an additional insight to the theoretical foundation and is generic enough to provide an understanding to a wide variety of Web 2.0 situations.

4. Proposed Approach

The proposed Web-based DSS mainly includes five components: Analyzer Agent (AA), Proposal Agent (PrA), Resource agent (RA), Production Agent (PA), and Coordinator Agent (CA). In particular, the agents are used to collect information and generate alternatives that would allow the user to focus on significant solutions. They communicate through the JADE platform, and exploit the potential advantages of Web 2.0 tools and Web services in carrying out their different tasks.

The major objective of this project is to provide a social network built into the overall structure of the web-based DSS, fostering interaction, discussion and sharing of information between the agents of production especially for dealing with nominal situations of resources faults. The functions of each component are discussed and a corresponding prototype system is developed.

4.1 The Production Agent Structure

As described in "*Figure* 3". The production agent includes several types of functional modules such as: Web Service, solutions generator module, a data base, a knowledge base, rules base and an interface. The Web Service is the core of this architecture; its research the solution as for the breakdown of the resource. At this time there, it will generate several solutions. The interface module manages the information exchanges between the agent proposal and the other agents.

4.2 Resource Agent

The Resource Agent has same architecture as the proposal agent, the only difference is that the Web service integrated in the agent resource makes a research concerning the reference of the resource (see "*Figure*.4").

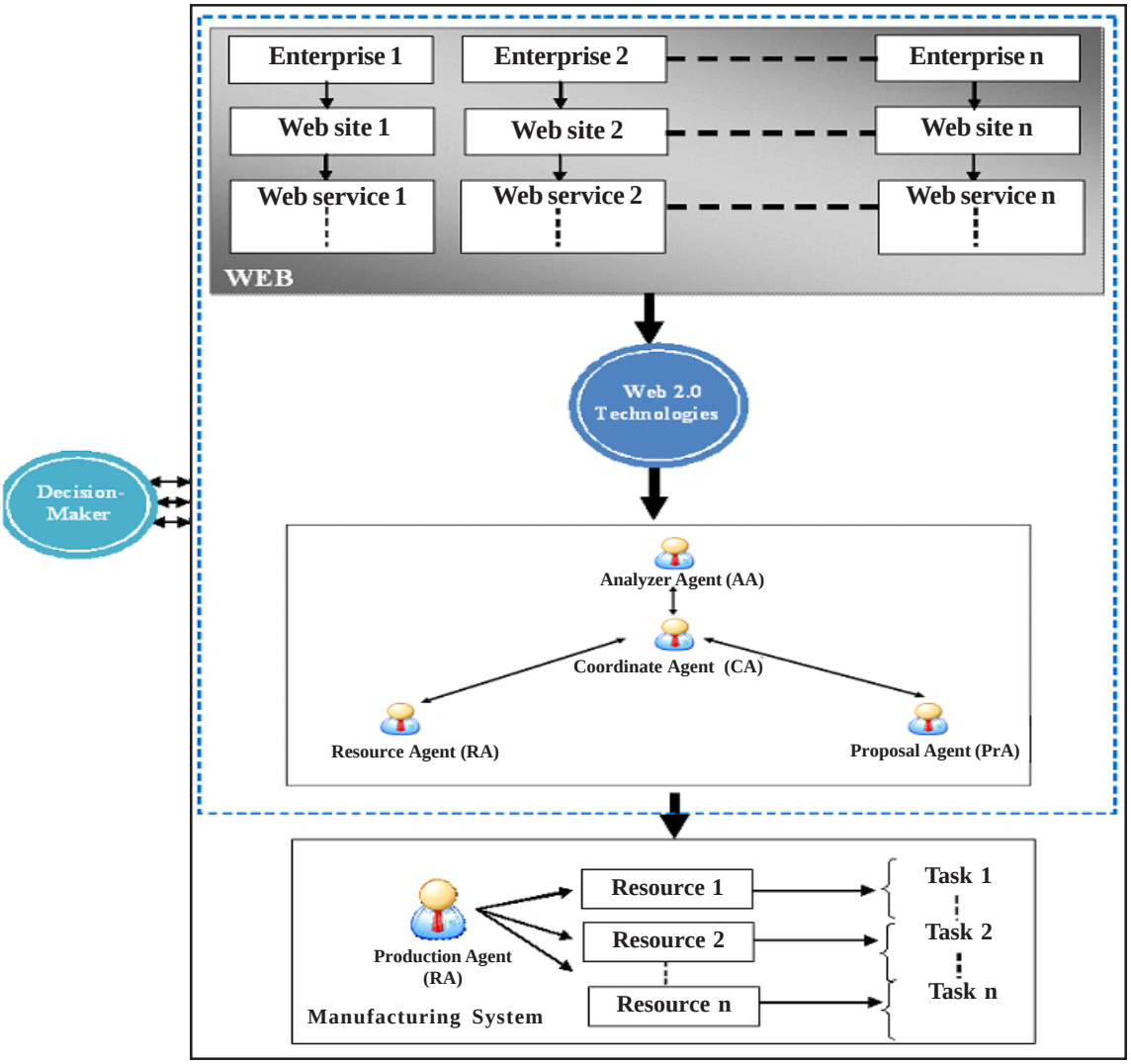

Figure 2. General Architecture of the Web-based DSS environmentManufacturing System

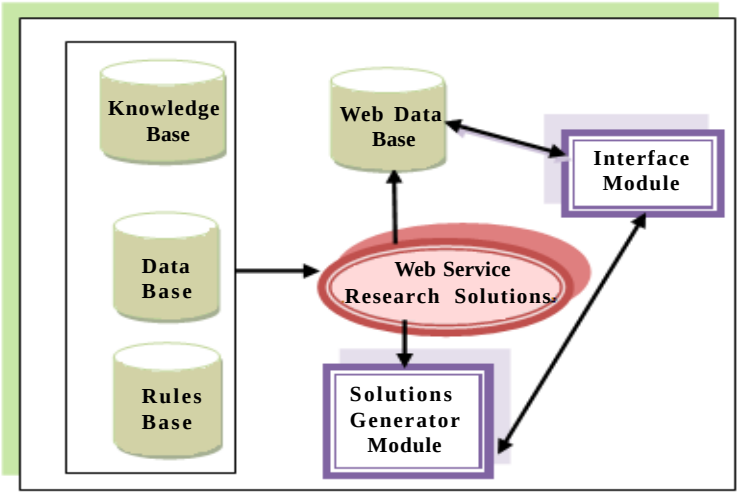

Figure 3. The Production Agent Structure

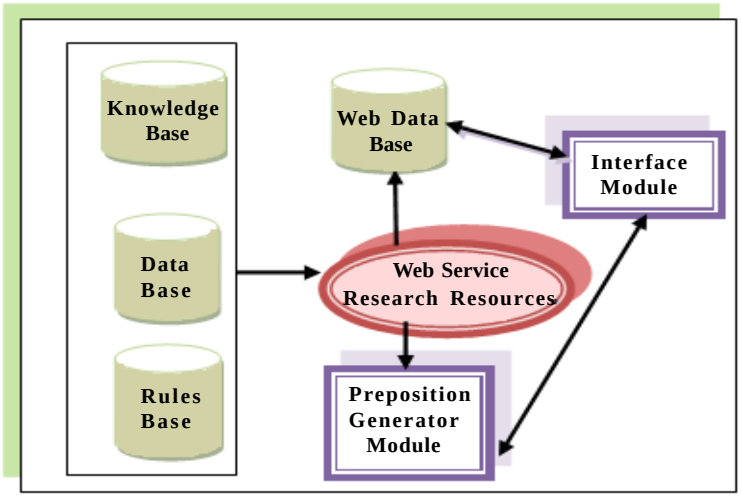

Figure 4. The Ressource Agent Structure

Figure 5. Production agent connection interface

4.3 Communication among agents

After detailing the functions of each component, we present an example of the communication among the agents (see Figure 5 and figure 6) :

1: The Production Agent (PA1) detects a breakdown.

2: The PA1 connects and sends a message of information on the breakdown to the other Production Agent of the manufacturing system.

3: The other Production Agent seek the solutions in their histories.

4: The Production Agent (PA2) and the Production Agent (PA5) answer and send their solutions to the PA1.

5: If: response time of PA2 < > response time of PA5 then the PA1 will recover the solution of the first Production Agent which sent its solution.

6: ELSE: the PA1 will recover the solution of one of the two, to repair the breakdown and disconnection.

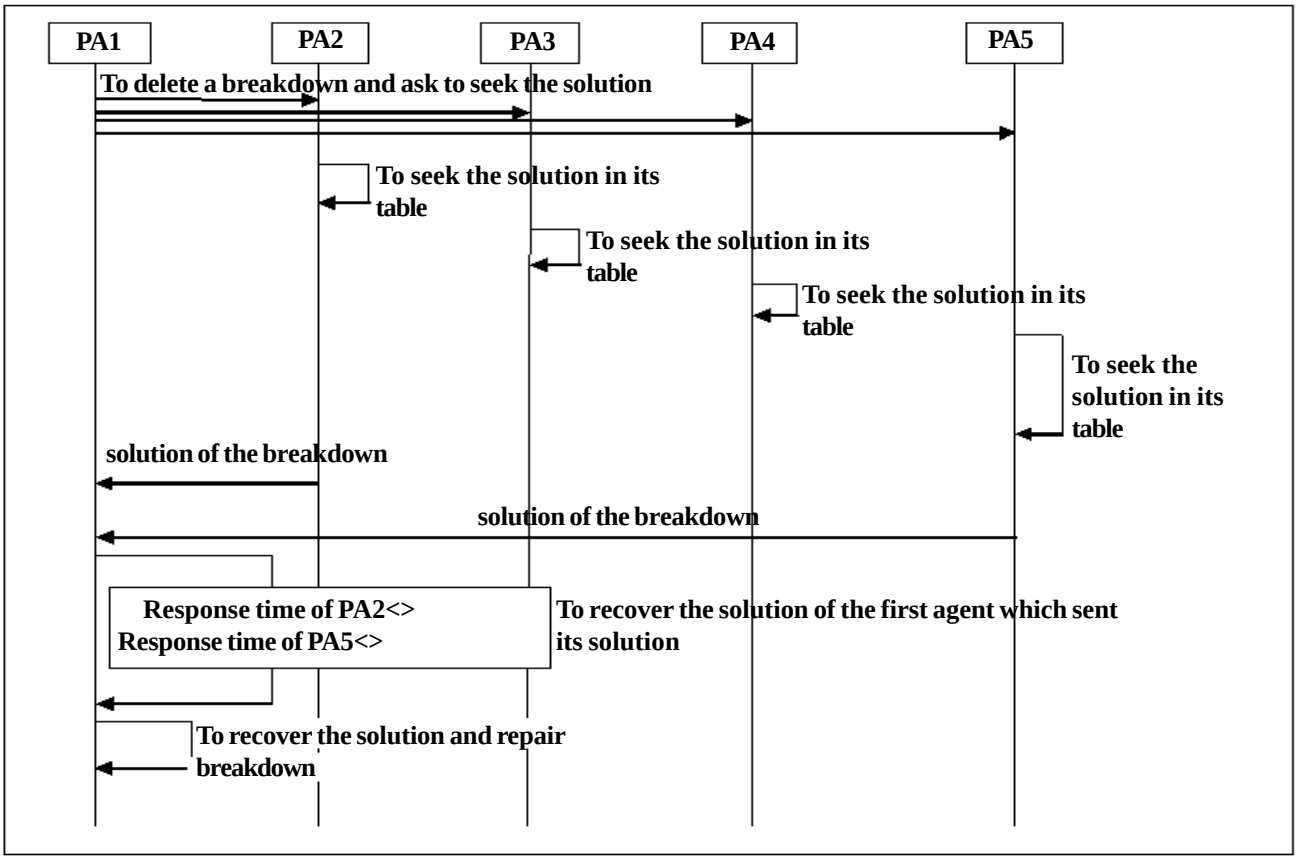

Figure 6. Production agent communication by using Web 2.0 : Scenario description with AUML

4.4 Case study : ALFATRON electronics industries

We use the resource allocation problem to demonstrate how the agents solve problems by interactions among agents. As an application example, we choose ALFATRON which is an Algerian Economic Public Enterprise established in 1993 by "*Entreprise Nationale des Industries Electroniques (ENIE)*". ALFATRON adopts a rigorous and technological choice perfectly suited for the composition of its computers. Thus, this company wishes to produce a special computer installation with its own hardware and software for a customer. The discussion forum provides a Web 2.0-based platform in which production agents may share, and discuss resources allocation problems and/or resources failures with each other (see figure 7)..

To recap, Web 2.0 technologies have enabled three main changes: a shift in activity location from the desktop to the Web, a shift in locus of value production from the firm to the citizen, and a shift in locus of power from the firm to the individual and the collective [16].

Furthermore, Web 2.0 offers technologies that allow a rich mix of media, interconnected streams of social conversation between

Figure 7. Simulation run

users, and one-to-one interaction between the user and the technology delivering the message. One can mention that not all social networks are explicitly embedded in the structure of the social media platform. Thus, groups and networks can form and evolve in a variety of ways, so long as it is possible to form relationship with other users.

Web-based technologies have enabled companies to reach out their customers and influence decision-making in new and different ways. In this paper, the proposed framework has a role in research area. It represents an underlying proposition that the inclusion of social networking will have a positive impact on a Web-based DSS.

We have validated our decision-making mechanism on a very simple example of manufacturing (see figure 7.) and it would be very interesting to adapt it to more complex model. Another future work is related to the joint use of Web 2.0 tools and statistical information systems for decision support.

References

[1] O'Reilly, T. (2007). What is Web 2.0 : Design patterns and business models for the next generation of software, *Communications & Strategies* 1.
[2] Bogg, P. , Finnegan, P., Land, L. (2010b). Design for Enterprise 2.0 : Articulating the Online Social Capital Hypothesis. Bridging the Socio-technical Gap in Decision Support Systems, Challenges for the Next Decade. A. Respício, Adam F., Phillips–Wren G., Teixeira C., Telhada J., (Eds.), ISO Press, Frontiers in Artificial Intelligence and Applications 212, 7-10, p. 163-172, July.
[3] Meredith, R., O'Donnell, P. (2010b). A functional Model of Social Media and its application to Business Intelligence. *In:* Bridging the Socio-technical Gap in Decision Support Systems, Challenges for the Next Decade. A. Respício, Adam, F., Phillips–Wren, G., Teixeira, C., Telhada, J., (Eds.), ISO Press, Frontiers in Artificial Intelligence and Applic*ations*, 212, 7-10, p. 129-140, July.

[4] McAfee, A. (2006). Entreprise 2.0 : The Dawn of Emergent Collaboration. *MIT Sloan Management Review*, 47 (3) 21—28.
[5] Bhargava, H. K., Power, D. J. , Sun, D. (2007). Progress in Web-based DSS technologies, *Decision Support Systems*. 43 (4) 1083—1095.
[6] Nahapiet, J., Ghosbal, S. (1998). Social Capital, Intellectual Capital and the Organizational Advantage. *Academy of Management Review*, 23 (2) 242—266.
[7] Boyd, D., Ellison, N. B. (2007). Social network sites : Definition, history and scholarship, *Journal of Computer-Mediated Communication*, 13.
[8] Driver, E. et al. (2004). Road Map to an Enterprise Collaboration Strategy. Forrester, August 2.
[9] Mussser, J., O'Reilly, T. (2006). Web 2.0 Principles and Best Practices. O'Reilly radar, November.
[10] Bharati, P., Chaudhury, A. (2004). An empirical investigation of decision-making satisfaction in Web-based decision support systems. *Decision Support Systems* 37 (2) 187-197.
[11] Mahesh, M., Ong, S. K., Nee, A. Y. C. (2007). A web-based multi-agent system for distributed digital manufacturing, *International Journal of Computer Integrated Manufacturing*. January –February, 20 (1) 11-27.
[12] Taghezout, N., Zaraté, P. (2010b). Using Multi-Agent Based Simulation in an IDSS for Evaluating Performance in Flow-shop Manufacturing System. *Bridging the Socio-technical Gap in Decision Support Systems, Challenges for the Next Decade.* A. Respício, Adam, F., Phillips–Wren, G., Teixeira, C., Telhada, J., (Eds.), ISO Press, Frontiers *in Artificial Intelligence and Applications*, 212, 7-10, p. 285-296, July.
[13] Phillips-Wren, G., Wygant, J. (2010b). Influencing Consumer Decisions Through Personalization. *Bridging the Socio-technical Gap in Decision Support Systems, Challenges for the Next Decade.* A. Respício, Adam, F., Phillips–Wren, G., Teixeira C., Telhada J., (Eds.), ISO Press, Frontiers *in Artificial Intelligence and Applications* Chunks Buffering, 212, 7-10, p. 152-162, July.
[14] Taghezout, N. et al. (2011). Multi-Agent Architecture for a Web-based DSS: Application to Resource Allocation Problems in a Flow-shop Manufacturing System, *Journal of Decision Systems* (JDS), Lavoisier, 20 (4) 443-466.
[15] Ray, J. J. (2007). A Web-based spatial Decision Support System optimizes routes for oversize/overweight vehicles in Delaware, *Decision Support Systems*, 43, 1171-1185.
[16] Berthon, P. R. et al. (2012). Marketing meets Web 2.0, social media, and creative consumers: Implications for international marketing strategy, 2012 Kelley School of Business, Indiana University.
[17] Wikipedia, http://www.wikipedia.org/.
[18] Youtube, http://www.youtube.com/.