BABEŞ-BOLYAI UNIVERSITY

Faculty of Economics and Business Administration
Doctoral School in Economics and Business Administration

DOCTORAL THESIS

- Summary -

Contributions to creating, designing and implementing some expert systems

Scientific supervisor:

Ghișoiu Nicolae, PhD Full Professor

PhD Candidate
Pop (Moisuc) Diana Aderina

Cluj-Napoca
2017

Contents summary

THESIS CONTENTS

Chapter 3. Knowledge engineering

3.1. Acquiring knowledge

3.2. Knowledge representation

3.3. Knowledge validation

3.4. Inference

3.5. Explanations and rationalization

Conclusions and personal contributions

Chapter 4. Expert systems developing methodologies

4.1. Traditional approach by the lifecycle of system development

4.2. Methodologies used in developing expert systems

Conclusions and personal contributions

Chapter 5. Development model of expert systems

5.1. Defining the nature and purpose of the problem

5.2. Identifying the experts and selecting the development tools

5.2.1. Identifying the experts

5.2.2. Selecting the development tools

5.3. Designing the ES prototype

5.4. Implementing the systems – Assessment (Post implementation)

Conclusions and personal contributions

Chapter 6. Conceiving and realizing the applications

6.1. Defining the nature and purpose of decisional problems

6.1.1. The nature and the purpose of decisional problems identified in the rural tourism field from Maramures

6.1.2. The nature and purpose of the decisional problems identified in the agricultural insurance field

6.1.3. The nature and purpose of decisional problems identified in the interpretation of the messages from advertisements

6.2. Identifying the experts. Selecting the building tools

6.2.1. Identifying the experts

6.2.2. Selecting the building tools

KEYWORDS

Expert System; Experts; Expertise; Architecture of expert systems; Inference; Decisional problems; Knowledge engineering; Web technologies; Rural tourism; Agricultural insurance; Advertising.

INTRODUCTION

Considering the exponential growth of the volume of information we are assaulted with in everyday life, the fast evolution of information technology, the problem of taking quality decision has become a very difficult task. The current business environment is very complex, because of the frequent changes that take place in every area of activity. Most the information tend to be digitized. They come from many sources, circulate fast and are difficult to process, leading to increased pressure to both the individual decision makers, as well as those leading organizations, which need fast reactions in this climate. The decision makers need to acknowledge the fact that to answer back to the pressure and opportunities of the business environment, they need to turn to the aid of decisional support systems, because of the many advantages which these can bring to the decisional process.

In present context, decisional support systems are developed by using technologies from the artificial intelligence field, with the purpose of creating intelligent decision support systems, by including human reasoning in them. Thus, more complex problems are solved and the quality of the decisional processes are significantly enhanced.

The systems which integrate knowledge, techniques and development tools in the artificial intelligence area are known as intelligent decisional support systems or expert systems (ES). The kind of problems that expert systems need to solve can’t be solved using algorithms, thus the design method of these systems is very different from the one used in traditional systems. For developing applications capable of bringing benefits to users, research results from the knowledge engineering area are used. The purpose of expert systems is to bring recommendations, find the meaning, and generate

solutions to identified decisional problems is accomplished by acquiring explicit knowledge, from human experts.

By making the expertise available and the acquired knowledge and experience, expert systems can come in the aid of the users, helping them find solutions to problems at an expert level.

Expert systems can be applied in every knowledge field because of the quick solving of problems, how easy it is to use and consult for taking the optimal decision. We consider that an expert system for solving decisional problems can be designed, for situations in which human experts will be able to explain the solving logic of that problem. Because of this, we decided to research expert systems, to create a development model of expert systems, a prototype which could be later used in different areas, considering the nature and particularities of decisional problems.

Research objectives

"As a response to the necessities of the intelligent decisional support, expert systems were developed by combining the artificial intelligence tools with techniques from the sphere of knowledge engineering and decisional support systems" (Moisuc & Avornicului, 2014). Because of the multiple advantages, they bring to both the simple decision maker level and decision makers which oversee organizations, there is a lot of attention given to these systems.

The main objective of this research is to create a development model of expert systems and to validate them by designing applications meant to solve specific decisional problems, in different areas.

To meet this objective, in the first part of the paper we will create the theoretical-conceptual frame, by classifying the basic concepts and particularities of the following areas of interest: decisional support systems, expert systems, knowledge engineering and system development methodology. The theoretical study developed in the first part of the paper has the purpose to create the premises to reach the goal we've set to accomplish, which is to design a development model for expert systems. Under this practical aspect, with the development model of expert systems, the paper is presenting in its own vision three expert system applications in different areas. We point out that

the proposed prototype of expert system has at its base the deep knowledge of current tendencies in the evolution process of information technology.

The areas of research picked enjoy a big interest, are very dynamic and complex and generate multiple debates, the result of which frequently didn't get a unanimous agreement.

With the research done we want to touch other objectives in the paper, some of which are:

- Doing an analysis of the decisional environment and studying the concepts from the DSS area
- Studying the DSS architecture and a general conceptual frame which could be used by a user as an aid for describing the architecture of expert systems
- The general presentation of techniques for using artificial intelligence for developing intelligent systems
- Familiarization with expert systems and technological aspects for them
- Creating a general frame for developing expert systems
- Explaining the processes which take part in each step from knowledge engineering favoring the actions taken for creating the expert systems development model.
- Presenting the methodologies used, of the steps taken in developing expert systems.
- Validating the model by creating, designing and implementing applications with the purpose of solving decisional problems in three different areas: rural tourism, agricultural insurance and advertisements.

Paper structure

Taking into consideration the objectives of the thesis stated above, the paper has the following structure: introduction, six chapters for each researched area, general conclusions and research perspectives, bibliography references.

With the purpose of obtaining an overview of the content and the structure of the paper with the subject: "Contributions to creating, designing and implementing expert systems" we created a schematic for the general structure of it (Figure 1):

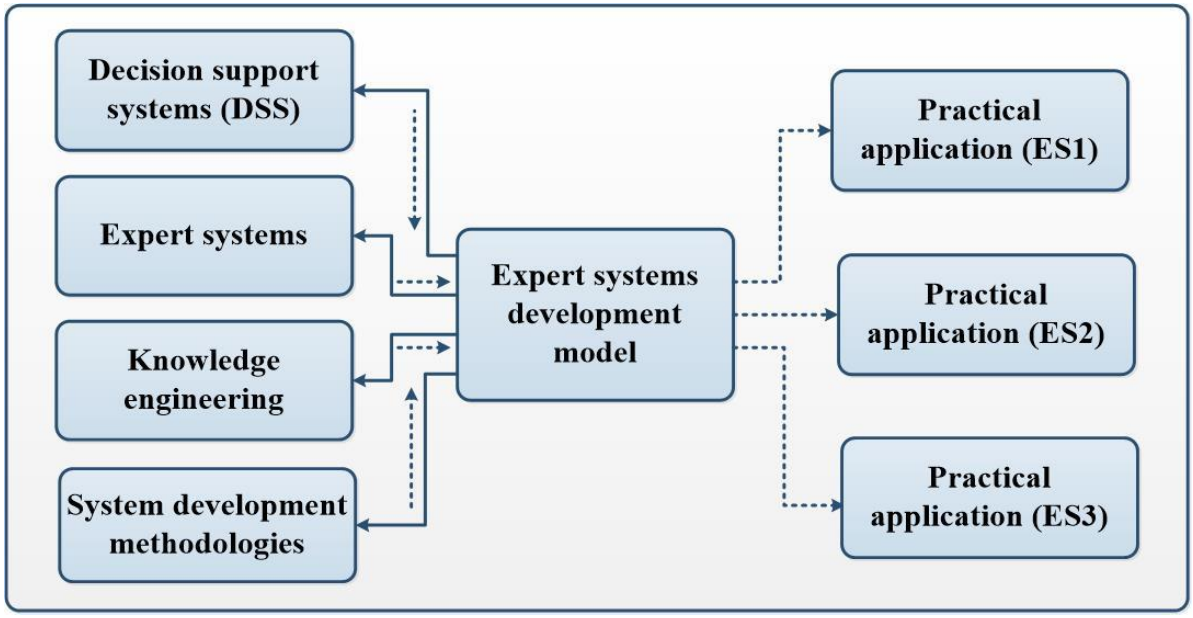

Figure 1. The general structure of the paper
Source: Author

The logic used for realizing the objectives can be associated with inference (the process of using knowledge to generate solutions), the strategy used in this paper being that of a combined control. This strategy is defined by the fact that at the beginning is using reductive methods to divide the problem in sub problems (the backward control strategy), which are then solved also by reductive methods, or by productive methods (the forward control strategy). The representation of the logic will provide the detailed structure of the paper (Figure 2).

The description of this paper, in terms with the combined strategy control is as it follows: the problems are broken down - the objective (creating the expert systems development model) in sub problems (approaching the four concerned areas) using the backward control strategy, and after verifying that the objectives have been completed we realize the development and applications model using the forward control strategy (Figure 2).

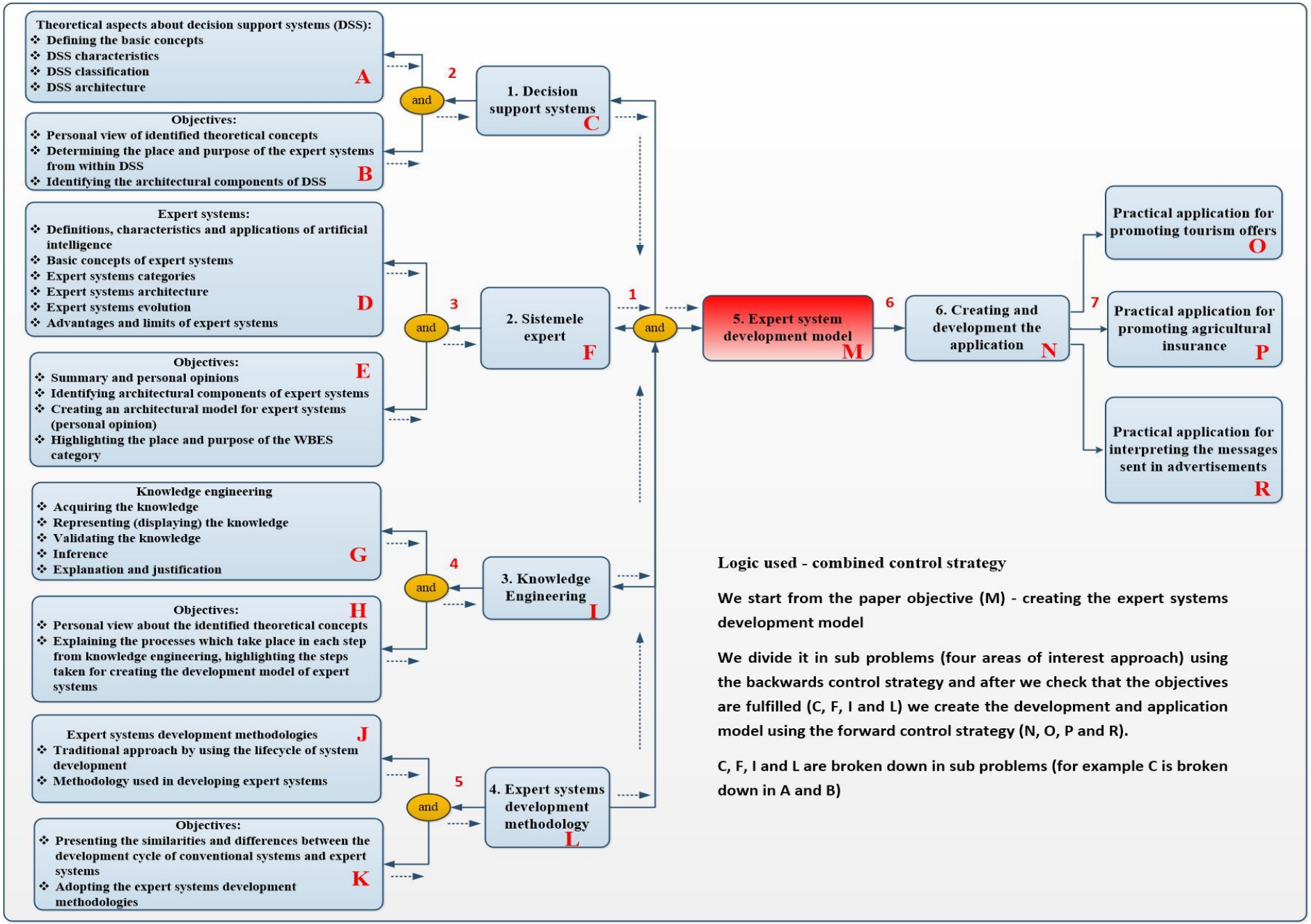

Figure 2. Detailed structure of the paper
Source: Author

CHAPTER SUMMARY

The first chapter called “Theoretical aspects about decision support systems” includes the study of decision support systems and their current context. As such, definitions, characteristics, advantages and disadvantages and the system limits, their classification for determining the place and the purpose of expert systems in the evolution of DSS are presented. Also, a generic conceptual frame of DSS is presented, which will be used as a starting point in approaching the expert systems architecture. The objectives of this chapter are: summarizing the important theoretical aspects needed for continuing the research and present our vision about the identified theoretical concepts; determining the place and purpose of expert systems in DSS; identifying the architectural components of the DSS.

The second chapter called “Expert systems” has as the main objective the study of techniques used in artificial intelligence, especially of expert systems. In this respect, at the beginning artificial intelligence concepts and definitions are presented and after characteristics of their most recent use. Categorizing these concepts allow us to continue using expert systems and defining their particularities. Furthermore, a study of the expert systems architecture is realized and an architectural model is created seen from our point of view. The chapter ends with the presentation of the evolution of these systems, the newest trends in developing them and highlighting their advantages and limits. The objectives of this chapter are: realizing a summary and expressing our own opinions; identifying architectural components of expert systems; create an architectural model of expert systems (in our opinion); highlighting the place and purpose of the WBES category (web based expert systems).

In chapter three, “Knowledge engineering” we are trying to describe every step of the knowledge engineering process from the detailed perspective: acquiring the knowledge, displaying the knowledge, validating the knowledge, inference, explaining and justifying. The objectives followed in these chapter are: clarifying and explaining the processes which take place at every step in knowledge engineering, thus promoting the steps done to create de development model of expert systems and its applications.

Chapter four, “Expert systems development methodologies” covers the study of the traditional development cycle of conventional systems and highlighting the similarities and differences between it and the development cycle of expert systems. The main objective of this chapter is to establish the methodology which will be used for creating the expert systems, presenting the steps which will be done for developing them.

In chapter five, “Expert systems development model” we touch the main objective of the thesis, which is creating the development model, using the theoretical conceptual frame created in the first chapter, creating connections between the knowledge from the studied areas. The objective is thus carried out by: establishing the most important aspects which need to be followed at each stage of the development of expert systems; creating (using our opinion) an expert systems architecture which uses generators and after of an architecture for these systems after implementation; presenting the knowledge engineering stages from the detailed perspective for the prototype developed by us; presenting the templates defined in the system conceptualization stage; highlighting the changes made in the management of expert systems after their implementation.

In chapter six called “Creating and implementing applications” we validate the created development model, by designing expert systems, as case studies, with applicability in different areas as: rural tourism, agricultural insurance and advertisements. We present the development steps for every application by identifying the decisional problems which will be solved and formulating the purpose for creating the systems, describing the way how we acquire the knowledge and the systems conceptualization, presenting the stages of formalizing, inference, validation specific to the picked generator. The conclusions are made for the designed applications and their efficiency is presented.

The current research ends with the presentation of the general conclusions and personal contributions; the perspectives of the research. For validating the conducted studies, we present the dissemination of the research results.

GENERAL CONCLUSIONS AND RESEARCH PROSPECTS

The key points of this paper were researching the expert systems field, discovering opportunities and gaps which this field could have, creating a development model of expert systems and using this model for creating new applications.

In the performed research, we had as a starting point theoretical concepts from these fields: decisional support systems, artificial intelligence, knowledge engineering and system development methodologies.

Contribution summary

We consider that the main contributions made are:

- Expressing own views about the researched area, creating the theoretical conceptual frame of expert systems, by clarifying basic concepts and areas of interest domains.
- Formulating in a synthetically manner of research and practices in the expert systems field.
- Presenting an expert system (ES) architectural model and then a web based expert system (WBES) architectural model in our own vision.
- Presenting the expert systems development methodologies.
- Using the researched done by creating an expert system development model.
- Identifying new application areas of expert systems, on segments which were less addressed like: rural tourism, agricultural insurances and advertisement.
- Creating and implementing the applications in the identified fields, underlining the benefits which these applications could bring.
- Presenting the efficiency of the designed expert systems.

In the first two chapters, we identified basic concepts: decision support systems, artificial intelligence and expert systems. Important theoretical aspects were summarized for continuing the study: characteristics, classifications, advantages and limits and problems types were highlighted with problems that can be solved with the help of expert systems and applications areas of them. We identified architectural components of decisional support systems and then expert systems. Starting from these conceptual frames we proposed two architectural models in our own vision, firstly the one of expert systems and then the one of web based expert systems.

By presenting and explaining all the processes which take place in the steps from the knowledge engineering process, from the third chapter and then establishing the expert systems development methodologies (chapter 4) the premises for creating and designing the development model and the applications implemented based on them were created.

In chapter five the focus was on the practical aspects and using the theoretical aspects described in the previous chapters, by achieving the main objective of the research, which is creating a development model of expert systems. In this chapter, essential aspects were established which needed to be achieved in the development phases and we presented in our own vision architectures of expert systems and the steps from the process of knowledge engineering for the developed prototype. We investigated types of possible development tools and concluded that expert system generators have the biggest advantages. Ways of acquiring knowledge were presented in detail and then the expert systems conceptualization. At the end of the chapter we highlighted the changes which need to be done after implementing expert systems, and their management way.

The validation of the development model was realized in chapter six by creating and implementing the applications on the next segments: rural tourism, agricultural insurances and advertisement. We analyzed the three fields and identified decisional problems for which expert systems can help solve. Thus, we materialized the proposed development model by designing the applications. We demonstrated that the systems can solve the problems for which they were designed, giving recommendations (in the first two cases) and interpreting (in the third case), thus accomplishing their goal. The analysis of the economic efficiency of the designed applications have highlighted the need of implementing these systems and the benefits which they can bring.

We can say that the success of applying the expert systems in the studied fields depends on acknowledging the importance of these systems, of the availability and capacity of the tenderers of tourism products, of insurance agencies and advertisement agencies to support this field.

The contributions brought with this paper were disseminated in a number of twelve articles published in BDI indexed journals, one article in ISI graded international conferences, two articles in international scientific conferences/volumes with BDI indexed editors.

Research prospects

The expert systems field is in continuous development. In the current decisional environment, there is a tendency for all the information to be digitized and transformed in data, which will generate the appearance of a global data warehouse. Business information and personal information of individuals will be translated in enormous data blocks. But, these giant warehouses of data will be useless and unusable if there won't be any way to process and interpret them. Expertise is needed in every field to be able to overcome the existent challenges, both at the organizational and individual level.

Starting from the important conclusion of our study that "in every field, in the case that human experts can specify the steps and reasoning from which a problem can be solved an expert system can be created to solve that problem", we are convinced that the area of applications fields of expert systems will expand.

We propose that the expert system development model and implement applications form a starting point for subsequent research. We can verify the implementation of these systems by using other expert systems generators, or other development tools.

The tendency already exists to integrate into expert systems other artificial intelligence tools such as fuzzy logic, neural networks, processing natural language, robots, thus resulting remarkable results.

Disseminating the results of the research

In terms of disseminating the results obtained and the research done for creating the current paper, these were materialized with published articles in the studied field, in different BDI indexed journals, papers in ISI graded international conferences, international scientific volumes with BDI indexed editors. I was a member in research collectives of two grans (PCCA Associated Projects) and three POSDRU projects.

Published articles in BDI indexed journals

1. **Moisuc Diana-Aderina, Steliac Nela,** *The importance of the implementation of integrated information systems in the restructuring and european integration process of organizations* , The Annals of the University of Oradea, Economic Sciences, Tom XIX 2nd Issue / December 2010 , P.1219-1225.

2. **Moisuc Diana-Aderina, Steliac Nela, Simion Simona-Alina,** *The use of expert systems in rural tourism in Maramureş*, The Annals of the University of Oradea, Economic Sciences Tom XX 2nd Issue / December 2011, P.859-865.

3. **Moisuc Diana-Aderina, Nan Anca - Petruta,** *The use of expert systems in agricultural insurance. Necessity vs. reality*, The Annals of the University of Oradea, Economic Sciences Tom XX 1st Issue / July 2011 , P.396-401.

4. **Moisuc Diana-Aderina, Steliac Nela, Simion Simona-Alina, Nan Anca - Petruta,** *E-tourism and how to promote accommodation services in rural Maramureş*, Journal of Tourism, No.12, 2011, P.39-44.

5. **Moisuc Diana-Aderina, Steliac Nela, Nan Anca - Petruta,** *The business environment and computerized decision support. New technologies and their impact*, Review of Management and Economic Engineering, Volume 10, No. 4 (42), 2011, P.129-142.

6. **Moisuc Diana-Aderina, Avornicului Mihai-Constantin,** *Web technology convergence with expert systems*, Management Intercultural, Volumul XVI, Nr. 2 (31), 2014, P.513-522.

7. **Moisuc Diana-Aderina, Avornicului Mihai-Constantin, Fulop Melinda-Timea,** *Cognitive systems. Redefining the cooperation between man and system*, Management Intercultural, Volumul XVIII, Nr. 3 (37) , 2016, P.273-279.

8. **Nan Anca - Petruta, Moisuc Diana-Aderina,** *Expert systems - development of agricultural insurance tool*, The Annals of the University of Oradea, Economic Sciences Tom XXII 1st Issue / July 2013 , P.910-918.

9. **Steliac Nela, Moisuc Diana-Aderina,** *Models of costs*, Review of Management and Economic Engineering , 2008, P.159-170.

10. **Steliac Nela, Pop Ciprian-Viorel, Moisuc Diana-Aderina,** *The knowledge society and the information society. The current situation in Romania*, Revista Economică, 2012, P.826-833.

11. **Pop Ciprian-Viorel, Moisuc Diana-Aderina, Steliac Nela, Nan Anca - Petruta,** *A Model for Determining How the Public Interprets Print Advertisements, by Means of a Smart Questionnaire*, International Journal of Computers, 2012, P.197-205.

12. **Avornicului Mihai-Constantin, Moisuc Diana-Aderina,** *Business modelling and database design in cloud computing*, Management Intercultural, 2015, P.21-30.

Published papers in ISI graded international conferences

1. **Pop Ciprian-Viorel, Moisuc Diana-Aderina, Steliac Nela, Nan Anca - Petruta,** *Expert Systems as Adjuncts in Assessing the Interpretation of Print Advertisements by Potential Customers*, 13th WSEAS International Conference on Mathematics and Computers in Business and Economics, 978-1-61804-098-5, 2012, P. 186-191

Published papers in international scientific conferences/volumes with editors, ISBN, BDI indexed

1. **Moisuc Diana-Aderina, Avornicului Mihai-Constantin,** *Architectural model of expert systems*, V International Symposium Engineering Management and Competitiveness 2015 (EMC 2015), University of Novi Sad, Technical Faculty "Mihajlo Pupin", Zrenjanin, Đure Đakovića bb, 23000 Zrenjanin, 978-86-7672-256-3, Index Copernicus, 2015, P. 307-312

2. **Steliac Nela, Nistor Razvan-Liviu, Moisuc Diana-Aderina, Nan Anca - Petruta,** *The Role of the Monetary Policy within the Present Context of Financial Crisis. The case of Romania,* The 12th International Conference on Finance and Banking Structural and Regional Impacts of Financial Crises, October 28 – 29, 2009, Ostravice, Silesian University, Czech Republic, Silesian University, 978-80-7248-554-3, http://web.ebscohost.com/ebhost, 2009, P. 629-645

Institutional project - team members:

1. Membru în grantul Proiect Parteneriate PCCA 2013, "Sistem inteligent de management, monitorizare și mentenanță a pavajelor și drumurilor folosind tehnici imagistice moderne - PAV3M" PN-II-PT-PCCA-2013-4-1762, nr.contract 3/2014, Unitatea contractantă: Universitatea Babeș-Bolyai Cluj-Napoca, COMPETITIA 2013. Director de proiect Prof.dr.Lucia Rusu. Parteneri: Centrul IT pentru Ştiință și Tehnologie, CCEE, Universitatea Politehnica din Bucureşti, Universitatea Tehnica din Cluj Napoca, Universitatea Galaţi,Univertitatea Târgovişte. Suma: 1.250.000 RON, perioada de desfăşurare: 1 iulie 2014 – 30 septembrie 2017.

2. Membru in grantul Proiect Parteneriate PCCA 2013, PN-II-PT-PCCA-2013-4-0619, nr.contract 315/2014 Asistent pentru persoane vârstnice bazat pe modele de mobilitate, Mobile@Old, Coordonator Universitatea Politehnica Bucuresti, Director de proiect: Conf.dr.Irina Mocanu, Unitatea contractantă: Universitatea Politehnica din Bucureşti, COMPETITIA 2013. Parteneri: Centrul IT pentru Ştiință și Tehnologie, Universitatea Babeș-Bolyai Cluj-Napoca, Universitatea Ştefan cel Mare Suceava. Suma: 1.250.000 RON, perioada de desfăşurare: 1 iulie 2014 – 30 septembrie 2017.

3. *Perfectionarea cadrelor didactice care predau limba română în învățământul preuniversitar în evaluarea competențelor de comunicare ale elevilor,* Contract POSDRU/157/1.3/S/133900, membru echipă.

4. Perfecţionarea cadrelor didactice din învăţământul preuniversitar care predau disciplina Religie", Contract POSDRU/157/1.3/S/134267, membru echipă

5. „Perfecţionarea cadrelor didactice, din învăţământul liceal, care predau discipline economice", Contract POSDRU/87/1.3/S/63908, membru echipă

BIBLIOGRAPHY

1. Ajith, A. & Semchenko, P. N., 2013. Rule- Based Expert Systems. *Bulletin of P.N.U.*, 30(3), pp. 29-40.

2. Alavi, M., 2000. *Managing Organizational Knowledge.* Cincinatti: Framing the Domains of IT Management. Projecting the Future.

3. Alpaydin, E., 2004. *Introduction to Machine Learning.* Cambridge, MA: The Mit.

4. Andone, I., 2002. *Sisteme inteligente hibride.* București: Editura Economică.

5. Andone, I., 2003. Valoarea cunoașterii în societatea bazată pe competiție. *Informatică Economică,* 1(25), pp. 7-13.

6. Andone, I., 2004. *Sisteme expert de gestiune.* Iasi: Editura Universității Alexandru Ioan Cuza.

7. Andone, I., Mockler, R., Dologite, D. & Ţugui, A., 2001. *Dezvoltarea sistemelor inteligente în economie. Metodologie şi studii de caz.* București: Editura Economică.

8. Andone, I., Pavaloaia, D., Bâcâin, I. & Genete, D., 2004. *Modelarea cunoasterii în organizații. Metodologie obiectuala pentru soluții inteligente.* Iasi: Editura Tehnopress.

9. Andone, I. & Păvăloaia, V. D., 2008. *Sisteme Expert în Contabilitate.* Iași: Editura Universității Alexandru Ioan Cuza.

10. Andone, I. & Ţugui, A., 1999. *Sisteme inteligente în management, contabilitate, finanţe-bănci şi marketing.* București: Editura Economică.

11. Apurva, A. & Singh, M. D., 2011. Understanding Knowledge Management: a literature review. *International Journal of Engineering Science and Technology,* 3(2).

12. Atanasova, I. & Krupka, J., 2013. Architecture and Design of Expert System for Quality of Life Evaluation. *Informatica Economicã ,* 17(3), pp. 28-35.

13. Avornicului, C. & Avornicului, M., 2010. *Managementul şi proiectarea sistemelor informatice de gestiune.* Cluj-Napoca: Risoprint.

14. Awad, E. M. & Ghaziri, H. M., 2004. *Knowledge Management.* Prentice Hall: Pearson Education Inc..

15. Awad, E. M. & Ghaziri, H. M., 2010. *Knowledge Management.* Second edition ed. New Delhi: The International Technology Group.

16. Başçiftçi, F. & İncekara, H., 2012. Design of Web-Based Fuzzy Input Expert System for the Analysis of Serology Laboratory Tests. *Journal of medical systems,* 36(4), pp. 2187-2191.

17. Beemer, B. A. & Gregg, D. G., 2008. Advisory Systems to Support Decision Making. În: F. Burstein & C. Holsapple , ed. *Handbook on Decision Support Systems 1: Basic Themes (International Handbooks on Information Systems).* Berlin: Springer, pp. 511-527.

18. Books Featuring Exsys Corvid, 2017. *Books Featuring Exsys Corvid.*, Available at: http://www.exsys.com/books.html, [Accesat 13 11 2014].

19. Brândaș, C., 2007. *Sisteme suport de decizie pentru managementul performant. Concepere, proiectare și implementare..* Timisoara: Editura Brumar.

20. Bratko, I., 2011. *Prolog Programming for Artificial Intelligence (International Computer Science Series).* 4 th Edition ed. Great Britain, Dorchester: Pearson Education, Addison-Wesley.

21. Buchanan, B. G. & Feigenbaum, E. A., 1978. Dendral and meta-dendral: their applications dimension. *Artificial Intelligence*, Volumul 11, pp. 5-24.

22. Chandler, P. R. & Pachter, M., 1998. Research Issues in Autonomous Control of Tactical UAVs. *Proceedings of the American Control Conference,* pp. 394-398.

23. Chang, C. C. & Tseng, C., 2008. A network problem diagnosis expert system based on web services.. *Proceedings of 7th International Conference on Machine Learning & Cybernetics,* Volumul IEEE, pp. 3726-3731.

24. Ciurea, I. V., Paveliuc-Olariu , C., Ungureanu , G. & Mihalache, R., 2011. Study regarding the situation of agricultural consultancy in the North-East Region of Romania. *Advances in Agriculture & Botanics International Journal of the Bioflux Society,* 3(1), pp. 15-19.

25. Cooper, L. C., 2005. The Blackwell Encyclopedia of Management, Management Information Systems. *Blackwell Pub.*, Edited by Gordon B.D.(2).

26. Currie, A., 2006. *The History of Robotics,* Available at: http://faculty.ucr.edu/, [Accesat 2011].

27. Deep Blue, I., 2017. *IBM100-Deep Blue.*, Available at: http://www-03.ibm.com/ibm/history/ibm100/us/en/icons/deepblue/, [Accesat 25 04 2017].

28. Dennis, A., Wixom , B. H. & Roth, R. M., 2008. *Systems Analysis and Design.* 4 th ed. New York: John Wiley & Sons, Inc. .

29. Dietterich, T. G., 2003. *Machine Learning In Nature Encyclopedia of Cognitive.* London: Macmillan.

30. Dinuca , E. C. & Istrate, M., 2013. Wine advisor expert system using decision rules. *Annals of the University of Oradea, Economic Science Series,* 22(1), pp. 1853-1864.

31. Dokas, I. M., 2005. Developing web sites for web based expert systems: a web engineering approach. *Proceedings of the 2nd International ICSC Symposium on Information Technologies in Environmental Engineering,* Volumul Shaker Verlag, pp. 202-217.

32. Dokas, I. M. & Alapetite, A., 2006. A Development Process Meta-Model for Web Based Expert Systems:The Web Engineering Point of View. *Risø National Laboratory, Roskilde, Denmark,* pp. 1-14.

33. Drools, B. R. M. S. (. S., 2014. *Drools Expert Rule Engine, JBoss Community.*, Available at: http://jboss.org/drools/drools-expert.html, [Accesat 13 11 2014].

34. Drools, B. R. M. S. (. S., 2014. *Drools Guvnor BRMS, JBoss Community.*, Available at: http://jboss.org/drools/drools-guvnor.html, [Accesat 13 11 2014].

35. Duan, Y., Edwards , J. S. & Xu, M. X., 2005. Web-based Expert Systems: Benefits and Challenges. *Information & Management,* 42(6), pp. 799-811.

36. Eni, L. C., 2012. Sistem expert pentru diagnoza ratingului bancar în etapa planificării auditului financiar. *Audit Financiar,* Volumul 10, pp. 13-21.

37. Exsys Corvid "How To", 2017. *Exsys Corvid "How To".,* Available at: http://www.exsys.com/HowTo.html, [Accesat 13 05 2017].

38. Exsys, K. A. E. S. T., 2017. *Exsys Inc - The Expert System Experts.,* Available at: http://www.exsys.com/, [Accesat 13 11 2014].

39. F/L/S Fuzzy Logic Systeme, G., 2017. *F/L/S Fuzzy Logic Systeme GMBH - systems that think with you.,* Available at: http://www.fuzzy.de/, [Accesat 10 06 2017].

40. Feigenbaum, E. A. & McCorduck, P., 1983. *The Fifth Generation.* s.l.:Addison-Wesley.

41. FICO Blaze Advisor, B. R. M. S., 2014. *Blaze Advisor — Business Rule Management System, FICO (Fair Isaac Corporation).,* Available at:

http://www.fico.com/en/Products/DMTools/Pages/FICO-Blaze-Advisor-System.aspx, [Accesat 13 11 2014].

42. Filip, F. G., 2007. *Sisteme suport pentru decizii, Ediția a II-a.* București: Editura Tehnică.

43. Finson, K. D., 2010. Tips for Teaching Students About the Importance of Quality Inferences. *Science and Children,* pp. 44-47.

44. Forslund, G., 1995. Toward Cooperative Advice-Giving Systems: A Case Study in Knowledge Based Decision Support. *IEEE Expert,* pp. 56-62.

45. Ganesan, V., 2006. Decision Support System "Crop-9-DSS" for Identified Drops. *Transactions On Engineering, Computing And Technology.*

46. Giarranto, J. C. & Riley, G. D., 2005. *Expert Systems: Principles and Programming.* Boston: Thompson Course Technology.

47. Glăvan, V., 2000. *Turismul în România.* București: Editura Economică.

48. Goldberg, H., Kirkland, D., Lee, D. & Ping, S., 2003. The NASD Securities Observation, News Analysis & Regulation System (SONAR). *IAAI,* pp. 11-18.

49. Grove, R. F., 2000. Internet-based expert systems. *Expert Systems,* Volumul 17, pp. 129-136.

50. Gupta , S. & Singhal, R., 2013. Fundamentals and Characteristics of an Expert System. *International Journal on Recent and Innovation Trends in Computing and Communication,* 1(3), pp. 110-113.

51. Hameed, M. și alții, 2013. *Expert System for Banking Credit Decisions.* Karlskrona, Sweden: Blekinge Institute of Technology.

52. Hammond, K. G., 2012. *Case-Based Planning: Viewing Planning as a Memory Task.* London: Academic Press Inc..

53. Heylighen, F., 2008. *Complexity and Self-organization.* s.l.:Encyclopedia of Library and Information Sciences.

54. Holsapple, C. W. & Burstein, F., 2008. DSS Architecture and Types. În: Springer, ed. *Handbook on Decision Support Systems.* Berlin: Verlag, pp. vol I, 163-189.

55. Holsapple, C. W. & Joshi, K. D., 2000. An investigation of factors that influence the management of knowledge in organizations. *Journal of Strategic Information Systems,* 9(2-3), pp. 237-263.

56. Holsapple, C. W. & Joshi, K. D., 2002. Knowledge manipulation activities: Results of a Delphi study. *Information & Management,* 39(6), pp. 477-490.

57. Holsapple, C. W. & Joshi, K. D., 2004. A formal knowledge management ontology: Conduct, activities, resources, and influences. *Journal of the American Society for Information Science and Technology,* 55(7), pp. 593-612.

58. Holsapple, C. W. & Whinston, A. B., 1996. *Decision Support System: A Knowledge Based Approach.* St. Paul: West Publishing.

59. Hopgood, A. A., 2011. *Intelligent Systems for Engineers and Scientists.* Third Edition ed. New York: CRC Press, Taylor and Francis Group.

60. Horn, L. & Ward, G., 2004. Relevance Theory. În: *Handbook of Pragmatics,*. s.l.:Blackwell Publishing, pp. 607-742.

61. IEEE, I. o. E. a. E. E., 2000. *Recommended Practice for Architecture Description of Software-Intensive Systems.* s.l.:s.n.

62. ITSM IT Service Manager, 2017. *BMC Software.,* Available at: http://www.bmc.com/solutions

63. JESS — The Rule Engine for the Java Platform, S. N. L., 2013. *JESS, The Rule Engine for the Java Platform.,* Available at: http://www.jessrules.com/, [Accesat 13 11 2014].

64. JRules BRMS, W. I., 2014. *IBM Websphere ILOG JRules, IBM Corporation,.,* Available at: http://www-01.ibm.com/software/integration/business-rule-management/jrules-family/, [Accesat 13 11 2014].

65. Jucan, C. N., 2003. *Sisteme expert în modelarea deciziilor financiare.* Vol I ed. Sibiu: Alma Mater.

66. Jucan, C. N. & Ciontu, S., 2008. *Sisteme expert în industrie, comerț, turism şi transporturi – teorie şi practică.* Sibiu: Alma Mater.

67. Jucan, C. N. & Ciontu, S., 2008. *Sisteme expert în instituții bancare şi nebancare – Aspecte teoretice şi practice.* Sibiu: Alma Mater.

68. Kiong, S. W. și alții, 2005. *Expert System in Real World Applications.,* Available at: http://www.generation5.org/content/2005/Expert_System.asp, [Accesat 29 08 2014].

69. Klein, D. A., 1994. *Decision-Analytic Intelligent Systems: Automated Explanation and Knowledge Acquisition.* Hillsdale, NJ: Lawrence Erlbaum Associates.

70. Krishnamoorthy, C. S. & Rajeev, S., 1996. *Artificial Intelligence and Expert Systems for Engineers.* s.l.:CRC Press.

71. Kumar, S. & Mishra, R. B., 2010. Web-based expert systems and services. *Cambridge University Press,* 25(2), pp. 167-198.

72. Kumar, Y. & Jain, Y., 2012. Research Aspects of Expert System. *International Journal of Computing & Business Research,* Volumul Proceedings of 'I-Society 2012' at GKU, Talwandi Sabo Bathinda (Punjab).

73. Landry, M., Malouin, J. L. & Oral, M., 1983. Model Validation in Operations Research. *European Journal ofOperational Research,* Volumul 14, pp. 207-220.

74. Lassing, N., 2002. *Architecture-Level Modiafiability Analysis.* Dutch Graduate School for Information and Knowledge Systems: SIKS.

75. Liebowitz, J., 2010. *The Handbook of Applied Expert Systems.,* Available at: http://ec.europa.eu/agriculture/publi/ms_factsheets/2010/ro_en.pdf, [Accesat 23 11 2014].

76. Lin, H. K., Hardingb , J. A. & Tsai, W. C., 2012. A rule-based knowledge system on semantic web for collaboration moderator services. *International Journal of Production Research,* 50(3), pp. 805-816.

77. Lopez, M. A., Flores, C. H. & Garcia, E. G., 2003. An Intelligent Tutoring System For Turbine Startup Training of Electronic Power Plant Operators. *Expert System with Applications, vol.24, No. 1.*

78. Luchian-Iancu, E., 2011. *Sisteme expert în contabilitate și informatică de gestiune.* Teză de doctorat ed. Timișoara: Editura Politehnica.

79. Luger, G. F., 2005. *Artificial Intelligence: Structures and Strategies for Complex Problem Solving.* s.l.:Addison Wesley.

80. Mahmoud, M., Algadi, N. & Ali, A., 2008. *Expert System for Banking Credit Decision.* Singapore, Computer Science and Information Technology, ICCSIT

81. Mallach, E. G., 2000. *Decision Support and Data Warehouse Systems.* Boston: Irwin McGraw-Hill.

82. Manning, C. D., Raghavan, P. & Schütze, H., 2008. *Introduction to Information Retrieval.* 1 ed. New York, USA: Cambridge University Press.

83. Marakas, G. M., 2003. *Decision Suport Systems în the 21st century.* New Jersey: Prentice Hall.

84. Medsker, L. & Liebowitz, J., 1994. *Design and Development of Expert Systems and Neural Networks.* New York: Macmillan.

85. Melis, E. S. J., 2004. *Activemath: An Intelligent Tutoring System for Mathematics.* 7th International Conference "Artificial Intelligence and Soft Computing" (ICAISC), Springer-Verlag.

86. Mican, D., 2012. *Contribuţii la dezvoltarea portalurilor prin sisteme de recomandare a conţinutului.* Cluj Napoca: Teza de doctorat.

87. Miletto, E. M., Pimenta, M. S., Vicari, R. M. & Flores, L. V., 2005. CODES: A web-based environment for cooperative music prototyping. *Organised Sound,* 10(3), pp. 243-253.

88. Mintzberg, H., 1976. *The Nature of Managerial Work.*. New York: Harper and Row.

89. Mocean, L., 2003. Sistemele expert si interacțiunea lor cu sistemele suport pentru decizii de grup. *Informatică economică,* 1(25), pp. 105-107.

90. Moisuc, D. A. & Nan, A. P., 2011. The use of expert systems in agricultural insurance. Necessity vs. reality. *The Annals of the University of Oradea,* Economic Sciences Tom XX(1), pp. 396-401.

91. Moisuc, D. A. & Șteliac, N., 2010. The importance of the implementation of integrated information systems in the restructuring and european integration process of organizations. *The Annals of the University of Oradea,* Economic Sciences Tom XIX(2), pp. 1219-1225.

92. Moisuc, D. A., Șteliac, N. & Nan, A. P., 2011. The business environment and computerized decision support. New technologies and their impact. *Review of Management and Economic Engineering,* 10(4(42)), pp. 129-142.

93. Moisuc, D. A., Șteliac, N. & Simion, S. A., 2011. E-tourism and how to promote accommodation services in rural Maramureş. *Journal of Tourism,* Issue 12, pp. 39-44.

94. Moisuc, D. A., Șteliac, N. & Simion, S. A., 2011. The use of expert systems in rural tourism in Maramureș. *The Annals of the University of Oradea,* Economic Sciences Tom XX 2nd Issue(2), pp. 859-865.

95. Moisuc, D.-A. & Avornicului, M.-C., 2014. Web technology convergence with expert systems. *Management Intercultural,* Volumul XVI(Nr. 2 (31)), pp. 513-522.

96. Moisuc, D.-A. & Avornicului, M.-C., 2015. *Architectural model of expert systems.* Zrenjanin, Index Copernicus, pp. P. 307-312.

97. Mora, M., Forgionne, G. A. & Gupta, J. N., 2003. *Decision Making Support Systems: Achievements, Trends and Challenges for the New Decade.* s.l., Idea Group Publishing.

98. Muntean , M., 2003. *Perfectionarea sistemelor suport de decizie în domeniul economic.* s.l.:Teza de doctorat, ASE București.

99. Muntean, C. & Hauer, I., 2010. Improving the management in organizations by using expert systems. *Agricultural Management / Lucrari Stiintifice Seria I, Management Agricol,* 12(2), pp. 1-6.

100. Muntean, C., Hauer, I. & Butuza, A., 2011. Decisions in negotiations using expert systems and mathematical methods. *Annals of the University of Petroşani, Economics,* 11(1), pp. 151-160.

101. Muntean, M., Dănăiață, D. & Margea, C., 2001. Managementul cunoștințelor în societatea bazată pe cunoaștere. *Informatică Economică,* 18(2), pp. 13-22.

102. Mylopoulos, J. & Levesque, H. E., 1983. *An overview of knowledge representation.* Berlin: Springer.

103. Nan, A. P., 2014. *Studiu privind asigurările agricole: între coordonatele clasice şi alternativele moderne.* Cluj-Napoca: Teza de doctorat.

104. Nan, A. P. & **Moisuc, D. A.**, 2013. Expert systems - Development of agricultural insurance tool. *The Annals of the University of Oradea*, Economic Sciences Tom XXII(1), pp. 910-918.

105. Nedovic, L. & Devedzic, V., 2002. Expert System in Finance: A Cross-Section of the Field. *Expert System with Application,* pp. vol.23, No.1.

106. Negnevitsky, M., 2002. *Artificial Intelligence: A Guide to Intelligent Systems.* First Edition ed. Harlow, England: Addison-Wesley.

107. Negnevitsky, M., 2005. *Artificial Intelligence. A Guide to Intelligent Systems.* Second Edition ed. Harlow, England: Addison-Wesley.

108. Negnevitsky, M., 2011. *Artificial Intelligence. A Guide to Intelligent Systems.* 3rd Edition ed. Harlow, England: Pearson Education, Addison-Wesley.

109. NeuroDimension, 2017. *NeuroDimension,* Available at: http://nd.com/, [Accesat 14 05 2017].

110. Newell , A. & Simon , H., 1972. *Human problem solving.* New Jersey: Prentice Hall.

111. Nikolopoulos, C., 1997. *Expert Systems: introduction to first and second generation and hybrid knowledge based systems.* New York: Marcel Decker Inc..

112. Nițchi, I.-Ș.și alții, 2006. *Esențial în informatica economică.* Cluj-Napoca: Risoprint.

113. Nofal, M. & Fouad, K. M., 2014. Developing Web-Based Semantic Expert Systems. *IJCSI International Journal of Computer Science Issues,* 11(1), pp. 103-110.

114. Nonaka, I. & Konno, N., 1998. The Concept of Ba Building a Foundation for Knowledge Creation. *California Management Review,* 40(3).

115. Nosratabadi, H., Nadali, A. & Pourdarab, S., 2012. Credit Assessment of Bank Customers by a Fuzzy Expert System Based on Rules Extracted from Association Rules. *International Journal of Machine Learning and Computing,* 2(5), pp. 662-666.

116. Nurminen, J., Karonen, O. & Hatonen, K., 2003. What makes Expert Systems Survive Over 10 Years. Empirical Evaluation of Several Engineering Applications. *Expert Systems with Applications,* 24(1).

117.O'Brien, J. A. & Marakas, G., 2007. *Management Information Systems with MISource.* 8 th ed. Boston: McGraw-Hill Education.

118.O'Keefe , R. M. & O'Leary, D. E., 1993. Performing and managing expert system validation. *Advances in Expert Systems for Management,* Volumul 1, pp. 141-176.

119.O'Keefe, R. M., Balci, O. & Smith, E. P., 1987. Validating Expert System Performance. *IEEE Expert.*

120. Online Exsys Corvid Tutorials, 2017. *Online Exsys Corvid Tutorials.*, Available at: http://www.exsys.com/CorvidTutorials.html, [Accesat 14 05 2017].

121. Orzan, G. & Orzan, M., 2005. *Sisteme expert de marketing.* București: Editura Uranus.

122. Pavaloaia, V. D., 2005. *Integration possibilities in Exsys Corvid.* s.l., The Proceedings of InfoBusiness'Conference in Information Systems.

123.Păvăloaia, V. D., 2009. Web Based Application for SMEs Economic and Financial Diagnose. *Communications of the IBIMA,* Volumul 9, pp. 24-29.

124.Păvăloaia, V. D., 2013. Study on the Computerizing Options of the Bankruptcy Prediction. *Audit Financiar,* 11(107), pp. 46-55.

125. Pop, C. V., **Moisuc, D. A**., Șteliac, N. & Nan, A. P., 2012. A model for determining how the public interprets print advertisements, by means of a smart questionnaire. *International Journal of Computers,* pp. 197-205.

126. Pop, C. V., **Moisuc, D. A.**, Șteliac, N. & Nan, A. P., 2012. Expert Systems as Adjuncts in Assessing the Interpretation of Print Advertisements by Potential Customers. *13th WSEAS International Conference on Mathematics and Computers in Business and Economics, WSEAS PRESS,* pp. 186-191.

127. Pop, D. & Negru, V., 2002. *Knowledge management in expert system creator.* Varna, Bulgaria, Proc. of the 10th Intl. Conf. AIMSA, Springer Verlag.

128. Power, D. J., 2000. What are the advantages and disadvantages of Data Warehouses?. *DSS News, Vol. 1, No. 7.*

129. Project Listen Summary, 2017. *Project Listen. A Reading Tutor that Listens.*, Available at: http://www.cs.cmu.edu/~listen/, [Accesat 28 03 201].

130. Rainer, R. K. & Cegielski, C. G., 2010. *Introduction to Information Systems: Enabling and Transforming Business.* 3 rd ed. New York: John Wiley & Sons, Inc..

131. Reichling , T., Veith , M. & Wulf, V., 2007. Expert Recommender: Designing for a Network Organization. *Springer,* Volumul Computer Supported Cooperative Work, p. 431–465.

132. Reichling, T. & Wulf, V., 2009. Expert Recommender Systems in Practice: Evaluating Semi-automatic Profile Generation. *CHI,* Volumul ACM, pp. 59-68.

133. Rud, O. P., 2009. *Business Intelligence Success Factors : Tools for aligning your business in the global economy.* Hoboken, New Jersey: John Wiley & Sons.Inc..

134. Ruiz-Mezcua, B., Garcia-Crespo, A., Lopez-Cuadrado , J. L. & Gonzalez-Carrasco, I., 2011. An expert system development tool for non AI experts. *Expert Systems with Applications,* Volumul 38, pp. 597-609.

135. Russell, S. și alții, 2003. *Artificial Intelligence: A Modern Approach.* Upper Saddle River, NJ: Prentice Hall/Perason Education.

136. Rusu, L. și alții, 2005. *Sisteme integrate și sisteme ERP.* Cluj-Napoca: Risoprint.

137. Sagheb-Tehrani , M., 1991. *Knowledge elicitation: some issues for further research and practice.* Skokie, IL: Knowledge Systems Institute, Proceedings of the 3rd International Conference on Software Engineering and Knowledge Engineering.

138. Sagheb-Tehrani, M., 2006. The design process of expert systems. *Expert Systems,* 23(2), pp. 116-125.

139. Sagheb-Tehrani, M., 2009. *A Conceptual Model of Knowledge Elicitation.*, Available at: http://proc.conisar.org/2009/1542/CONISAR.2009.Sagheb-Tehrani.pdf, [Accesat 09 09 2014].

140. Sariyar, O. & Ural, D. N., 2010. Expert System Approach for Soil Structure Interaction and Land Use. *Journal of Urban Planning & Development,* Issue SPECIAL ISSUE: Best Practices on Land Management Strategies, pp. 135-138.

141. Sauter, V. L., 2010. *Decision Support Systems for Business Intelligence, Second Edition.* Hoboken, New Jersey: John Wiley & Sons.Inc..

142. Schiaffino, S., Garcia, P. & Amandi, A., 2008. eTeacher: Providing personalized assistance to e-learning students. *Computers & Education,* Volumul 51, pp. 1744-1754.

143. Shim, J. P. și alții, 2002. Past, present, and future of decision support technology. *Decision Support Systems,* 33(2), pp. 111-126.

144. Smith, S. & Kandel, A., 1993. *Verification and Validation of Rule-Based Expert Systems.* New York : CRC Press.

145. Soufi, S. S. și alții, 2013. Investigate the Effect of Expert Systems Application on Management Performance. *Interdisciplinary Journal of Contemporary Research In Business,* 4(12), pp. 478-482.

146. Sperber, D. & Wilson, D, D., 2002. Pragmatics, Modularity and Mind-reading. *Mind & Language,* 17(1-2), pp. 3-23.

147. Stăncioiu, F., 2000. *Strategii de marketing în turism.* București: Editura Economică.

148.Șteliac, N. & **Moisuc, D. A.**, 2011. Overview of the romanian economy after the onset of the economic and financial crisis. pp. 318-323.

149.Șteliac, N., Nistor, R. L., **Moisuc, D. A.** & Nan, A. P., 2009. The Role of the Monetary Policy within the Present Context of Financial Crisis. The case of Romania. *The 12th International Conference on Finance and Banking Structural and Regional Impacts of Financial Crises, October 28 – 29, 2009,*

Ostravice, Silesian University, Czech Republic, Silesian University,, pp. 629-645.

150.Șteliac, N., Pop, C. V. & **Moisuc, D. A.**, 2012. The knowledge society and the information society. The current situation in Romania. *Revista Economică,* pp. 826-833.

151. Stoia, C. L., 2013. A study regarding the use of expert systems in economics field. *Procedia Economics and Finance,* Volumul 6, pp. 385-391.

152. Suduc, A. M., Bizoi, M., Cioca, M. & Filip, F. G., 2010. Evolution of Decision Support Systems Research Field in Numbers. *Informatica Economica,* 14(4), pp. 78-86.

153. Tanaka, K., 1999. *Advertising Language: a Pragmatic Approach to Advertisements in Britain and Japan.* London: Routledge.

154. Tanaka, K. & Niimuara, T., 2007. *An Introduction to Fuzzy Logic for Practical Applications.* New York: Springer.

155. Technical Publications on Exsys Systems, 2017. *Technical Publications on Exsys Systems;* Available at: http://www.exsys.com/techarticles.html, [Accesat 13 11 2014].

156. The right pension advisor, 2017. *Free Pension Advice.*, Available at: https://www.pensionsadvisoryservice.org.uk/, [Accesat 18 06 2017].

157. Tomic, B., Horvat, B. & Jovanovic, N., 2012. An explanation facility framework from rule-based systems. *International Journal on Artificial Intelligence Tools, World Scientific Publishing Company,* 21(4), pp. 1250013 (1-36).

158. Turban, E., 1998. *Decision Support Systems and Intelligent Systems.* 5th ed. New Jersey: Englewood Cliffs, Prentice Hall.

159. Turban, E. & Aronson, J. E., 2001. *Decision Support Systems and Intelligent Systems.* 6th ed. New Jersey: Englewood Cliffs, Prentice Hall.

160. Turban, E., Aronson, J. E. & Liang, T. P., 2005. *Decision Support Systems and Intelligent Systems.* 7th ed. New Jersey: Upper Saddle River, Prentice Hall.

161. Turban, E., Sharda, R. & Delen, D., 2011. *Decision Support and Business Intelligence Systems.* 9th ed. Upper Saddle River, New Jersey: Pearson Education, Inc. Publishing as Prentice Hall.

162. Turban, E. & Watkins, P. R., 1986. Integrating Expert Systems and Decision Support. *MIS Quart,* 10(2), pp. 121-136.

163. Vanguard, 2006. *Vanguard Software Corporation.,* Available at: www.vanguardsw.com/

164.Vîrlan, G. & Enache, C. M., 2007. *Sisteme expert financiar-bancare,* Galați: Universitatea Dunărea de Jos .

165. VisiRule, L. P. A. I., 2014. *L.P.A. VisiRule 1.5.,* Available at: http://www.lpa.co.uk/vsr.htm, [Accesat 13 11 2014].

166. Von Krogh, G., Ichijo, K. & Nonaka, I., 2010. *Enabling Knowledge Creation: How to Unlock the Mystery of Tacit Knowledge and Release the Power of Innovation.* New York: Oxford University Press.

167. Vujovic, A., Krivokapic, Z. & Jovanovic, J., 2012. Artificial Intelligence Tools and Case Base Reasoning Approach for Improvement Business Process Performance. În: T. Aized, ed. *Total Quality Management and Six Sigma.* s.l.:InTech, pp. 3-22.

168. Ward System, G., 2017. *Advanced Neural Network and Ganetic Algorithm Software.,* Available at: http://wardsystems.com/, [Accesat 29 05 2017].

169. Waterman, D. A., 1986. *A Guide to Expert Systems.* s.l.:Addison-Wesley.

170. Yu, C. C., 2004. A web-based consumer-oriented intelligent decision support system for personalized e-services. *ICEC'04: Proceedings of the sixth international conference on electronic commerce,* Volumul ACM Press, pp. 429-437.

171. Zaharie, D. și alții, 1999. *Sisteme expert-teorie și aplicații.* București: Dual Tech.