Technical University of Cluj Napoca

HABILITATION THESIS
(TEZA DE ABILITARE)

RESEARCHES AND CONTRIBUTIONS TO THE DEVELOPMENT OF MANAGERIAL TOOLS FOR THE SUSTAINABLE MANAGEMENT OF CONVENTIONAL AND NON-CONVENTIONAL RESOURCES OF ENERGY AND FOR THE INNOVATION IN EDUCATION AND RESEARCH

Candidate: PhD. Cătălin Nicolae POPESCU

Cluj-Napoca
2016

CONTENT

Acknowledgment,

These research activities were carried out during 2003 - 2016 years, with an important and constructive support of my friends: Luminita Ion Boussier, Tatiana Cucu and Jean-Marie Boussier (Ecole d'Ingenieurs en Genie des Systemes Industriels, La Rochelle, France), Yves Ducq (University of Bordeaux, France), Omrani Hichem (Luxembourg Institute of Socio-Economic Research), Felix Cuesta (Universidad Alcala de Henares and Instituta de Empresa de Madrid, Spain), Murat Sari (Yildiz Technical University, Istanbul, Turkey), Marius Bulearca and Mihai Sabin Muscalu, Marina Badileanu, Cristian Sima si Cornelia Neagu (Center for Industry and Services' Economics, Romanian Academy, Bucharest, Romania), Constantin Ghiga (Bucharest University), Sorin Gheorghiu (Schlumberger, Kuwait) and my colleagues: Augustin Mitu, Daniela Uta (Vlad), Mirela Panait (Matei), Mihaela Suditu, Cornel Lazăr, Marian Zaharia, Lazar Avram, Irina Gabriela Radulescu, Silvian Suditu, Sorin Neacsu, Ionut Lambrescu, Mirela Lazar, Mihaela Otelea, Nicolaie Calota, Mihaela Ciopi Oprea, Liviu Toader, Viorela Iacovoiu, Madalina Albu.

Also I am deeply grateful to: Professor Ioan Dumitrescu (my PhD coordinator), Professor Cornelia Coroian Stoicescu, Professor Ioan Abrudan, Professor Umit S. Bititci (Heriot Watt University, School of Management and Languages, Edinburgh, Scotland) and Professor Peter Ball (The York Management School, University of York, UK), who have influenced my career and academic work.

I am more than grateful and I want to thank especially to my parents Dumitru and Maria for my education and continuous support, and also to my wife Gratiana and to my two children Matei and Daria for their unconditionally support, patience and understanding during all these years.

Ploiesti, June 2016

Introduction

The subject of energy is, these days, one of the major themes of human society, while technical and technological developments unprecedented in the last hundred years have the effect to generate diverse and complex problems which require appropriate solutions. At the present we cannot longer talk in terms of development as long as, it does not take into consideration issues such as energy production, energy consumption, exhaustible and renewable energy sources, green technologies, energy efficiency, protection and preservation environmental or sustainable development.

The fact that I work in an unique university by profile and the name of it has deep roots in the identification and use of various resources with the goal of their use in power generation necessary for sustainable economic development is an additional reason for which this work aims to provide clarity on many of the things described above.

The period which has elapsed since I get my PhD title, i.e. 2001, was dedicated to important concerns related to some major themes connected to the challenges of this century:

- analysis of exhaustible mineral resource efficiency and of potential of Romanian extractive industry on ensuring Romania's energy independence;
- analysis of sustainable solutions for environmental protection and conservation through the use of clean fuels and technologies, and promotion of innovative management measures in communities administration;
- analysis and development of innovative managerial tools useful to sustainable resource management;
- promoting innovative educational tools that are able to help the improving of qualifications, skills and expertise of graduates and contribute directly to increasing the level of absorption in the labor market in terms of a knowledge-based economy and in relation to a new type of society, the information society that generates new challenges for occupations, professions or jobs of the future.

These concerns had as main source of expertise the integration within national and international project teams that analyzed multiple aspects in relation to the aforementioned subjects. It's about:

- Internaţional Project CIVITAS II - SUCCESS, contract TREN/04/FP6EN/ S07.39573/513785 (registered 13/2005 to UPG Ploieşti); measure responsible for 10.6: Partnership for transport, roads and roads signs (february 2005-february 2009);
- PN II Programme, 2008 Round, PNCDI 2 - Program 4 - "Partnership in priority areas", Domain 9 – Socio-economical and humanistic research, with the title: "Capitalization of competitive advantages in extractive industry of Romania as an effect of decisions based on econometric methods and multicriteria analysis of exhaustible mineral resources utilization (ACIER)", 2008-2011, nr.68/2008 (registered UPG Ploieşti), as project coordinator for UPG Ploieşti;
- PHARE/2003/2005-551.05.03.02 " Elaboration of an educational package in the web environment to develop innovative skills to employees from SMEs" (within "Internet Module System for the Innovative Problem Solving Methods"), Leonardo da Vinci pilot project: INNOSUPPORT-Supporting innovation in SMEs, *responsible for 4.7 component: Systemic Management of internal innovative proposals;*
- PHARE RO2003/005-551.05.03.02.069: " Elaboration of an educational package in the web environment to develop innovative skills to employees from SMEs*",* as *assessment expert* for the period March 2006-February;
- POSDRU Project: „*From theory to practice through simulated enterprise*", Priority axis 2: "Linking lifelong learning and labor market", Major domain: 2.1 „The transition from school to work", ID no: POSDRU 90/2.1/S/58123 (2010-2013) – TIC internal expert – long term expert;
- POSDRU Project: „*Professional Training and Promoting of using of new technologies for the employees from oil and gas industry in order to increase the quality of services, professional competitiveness and to improve specific processes and activities*", Priority axis 3: „Increase adaptability of workers and enterprises",

Major domain: 3.2 „Training and support for enterprises and employees to promote adaptability", ID no: POSDRU 81/3.2/S/59102 – Curricula Coordinator Expert and Trainer;

- International Project ERASMUS + Capacity-building in the Field of Higher Education 2015: 561530-EPP-1-2015-1-RO-EPPKA2-CBHE-JP cu titlul *GAS AND OIL PROCESSING, A EUROPEAN LEBANESE COOPERATION* (GOPELC); member in UPG management team; partners: universities from France, Sweden and Lebanon (2015-2018);

On the other hand, concerns on scientific field were focused on research related to national cultural features and also on training and qualifying of the future graduates in the idea of an increased absorption on the labor market both in Romania and in Europe. These researches and analyzes were performed via several major national and international projects:

- Research International Project GLOBE (Global Leadership and Organizational Behavior Effectiveness) Romania 2006-2007, as regional responsible for Petroleum – Gas University de Petrol şi Gaze from Ploieşti (Contract no. 76/2006);
- Project within Research, Development and Innovation National Plan – PN II, Human Resources Programme, type MC (Researcher Mobilty Projects), no.83/23.06.2008 (registered CNCSIS) and no.40/20.06.2008 (registered UPG Ploiesti): *Methodological values and landmarks in selecting and evaluating school managers. Case study - Romania*, as project manager (http://www.cncsis.ro/PNCDI%20II/Resursa%20umana/MC/Martie2008/REZULTATE_FINALE_Tip_MC_Martie_2008.html);
- Research International Project Progress: *FIRST STEP TO FIRST JOB - Innovative methods leading Youth to a solid career*; Beneficiary National Research Institute for Labour and Social Protection - INCSMPS Romania; Grant Agreement No VS/2012/0017, project financed by EU, as project responsible for UPG Ploieşti;
- DOCIS Project: Developing of an operational system of qualifications from higher education from Romania/ contract no.POSDRU/2/1.2/S/2 (2009-2011), Main domain: Engineering Science, Study domain: Engineering and Management, Study programme: Engineering and Management in tourism industry, as short term expert,
- POSDRU Project: " *Consolidation of the institutional capacity of Regional Consortia for professional training and education in South Muntenia Development Region",* Priority Axis: 3. „Increasing adaptability of workers and enterprises", Major domain: 3.3. „Developing partnerships and encouraging initiatives for social partners and civil society", project ID: POSDRU 93/3.3/S/60080 (2010-2012), as Events' Coordinator;
- POSDRU Project: „*Projects Stock Exchange*", Priority Axis 1: " Education and training in support of growth and development of knowledge based society", Major domain: 1.2 „Quality in higher education", project ID: POSDRU 86/1.2/S/62885 (2010-2012), as Projects Stock Exchange Coordinator;
- POSDRU Project: „*Academic staff and students training in using modern information tools in academic education domain*", Priority Axis 1: "Education and training in support of growth and development of knowledge based society", Major domain: 1.2 „Quality in higher education", project ID: POSDRU 86/1.2/S/62689, as human resources expert;
- POSDRU Project: „VIA- Vocation, Self development path to professional success", Axa Prioritară 2 " Linking lifelong learning and labor market", Major domain 2.1. "The transition from school to work", project ID: POSDRU /90/2.1/S/63742, as vocational adviser.

Many of the findings and the results obtained after the completion of all these projects were integrated into articles published in prestigious journals and scientific papers presented in international conferences. Among all of them I could mention:

- *Inter-cities transfer of a transportation project,* Cătălin Popescu, Luminita Ion, Tatiana Cucu, Jean-Marie Boussier, Augustin Mitu, Daniela Uta, Environmental Engineering and Management Journal, November/December 2009, volume 8, issue 6, pg.1433-1438, Iasi, Romania (http://omicron.ch.tuiasi.ro/EEMJ/ ISSN 1582-9596);

- *Methodology to evaluate the quality of public services,* Cătălin Popescu, Tatiana Cucu, Luminita Ion, Jean-Marie Boussier, Augustin Mitu, Revista Amfiteatru Economic, vol. XI, nr. 26: Quality Management in services, iunie 2009, pg.260-269 (ISSN: 1582 – 9146); http://www.amfiteatrueconomic.ro/ArticolRO.aspx?CodArticol=865;
- *Public Management and Local Policy regarding city environment,* Augustin Mitu, Cătălin Popescu, Daniela Uta, Environmental Engineering and Management Journal, November/December 2009, volume 8, issue 6, pg.1479-1484, Iasi, Romania (http://omicron.ch.tuiasi.ro/EEMJ/ ISSN 1582-9596);
- *Modelling approach to estimate pertinent human criteria for a selection and orientation process of a technical profession*, Popescu Cătălin, Boussier Jean-Marie, Boussier Ion Luminiţa, Mitu Augustin, Uţă Daniela, ANNALS of DAAAM for 2007 & PROCEEDINGS of the 18th International DAAAM Symposium "Intelligent Manufacturing & Automation: Focus on creativity, responsability and ethics of Engineers", 24-27th October 2007, Zadar, Croatia, Vol. 18, no 1(ISSN 1726-9679; ISBN 3-901509-58-5);
- *Migration model of various socio-demographic Romanian categories*, Cătălin Popescu, Jean-Marie Boussier, Luminiţa Ion-Boussier, Augustin Mitu, Proceedings of 10th Toulon-Verona Conference "Excellence in Services", University of Aristotelis, Salonic, Greece, 3-4 september, 2007, pg.293-302 (ISBN 978-960-243-642-4);
- *Management of the acceptance degree for a technology transfer in automation field*, Omrani Hichem, Popescu Cătălin, Boussier Jean-Marie, Boussier Ion Luminiţa, Mitu Augustin, ANNALS of DAAAM for 2007 & PROCEEDINGS of the 18th International DAAAM Symposium "Intelligent Manufacturing & Automation: Focus on creativity, responsability and ethics of Engineers", 24-27th October 2007, Zadar, Croatia, Vol. 18, no 1, pg. 521 (ISSN 1726-9679; ISBN 3-901509-58-5);
- *How to incite the transferability of an innovative project in transport field*, Luminita Ion, Hichem Omrani, Jean-Marie Boussier, Dominique Breuil, Cătălin Popescu, Augustin Mitu, EET-2008, 3rd European Ele-Drive Transportation Conference „On the Way to Sustainable Development and Market Opening", Regional Policies Track, in cooperation with the International Advanced Mobility Forum, March 11-13, 2008, Geneva, Switzerland;
- *The utilization of Monte Carlo Simulation Method in the oil industry*, Sorin Gheorghiu, Catalin Popescu, Veronica Magdalena Gheorghiu, Buletinul Universitatii Petrol-Gaze din Ploiesti, seria Stiinte Economice, Special Issue with papers presented at the International Conference Science and Technology in the Context of Sustainable Development, vol LX, no.5C/2008, pg. 1-9, ISSN 1224-6832;
- *Improvement's Methodology, under Uncertainty, of the Management of a Public Transportation Service,* Cătălin Popescu, Tatiana Cucu, Luminita Ion, Y. Ducq, Augustin Mitu, http://www.wseas.us/e-library/transactions /economics/2009/29-267.pdf, WSEAS TRANSACTIONS on BUSINESS and ECONOMICS, ISSN 1109-9526, Issue 4, Volume 6, April 2009, pag. 189-198;
- *Managing information in the evaluation process of European projects for environmental sustainable transport systems*, Cătălin Popescu, Augustin Mitu, Daniela Uta, Proceedings of 12th IBIMA Conference on Creating Global Economies through Innovation and Knowledge Management: Theory & Practice, 29-30 June 2009, Kuala Lumpur, Malaysia, pg.44-48 (ISBN: 978-0-9821489-1-4);
- *SUCCESS: a demonstrative transportation project for the transferability of sustainable practices*, Cătălin Popescu, Daniela Uta, Tatiana Cucu, Augustin Mitu, Luminita Ion, Proceedings of 12th IBIMA Conference on Creating Global Economies through Innovation and Knowledge Management: Theory & Practice, 29-30 June 2009, Kuala Lumpur, Malaysia, pg.1036-1044 (ISBN: 978-0-9821489-1-4);

- *Identifying the companies' competitiveness through their structural profile: Romanian case,* Felix Cuesta, Cătălin Popescu, ANNALS of DAAAM for 2009 & PROCEEDINGS of the 20th International DAAAM Symposium "Intelligent Manufacturing & Automation: Theory, Practice & Education", 25-28th november 2009, Vienna, Austria, Vol. 20, no 1
- *Human Resource Management- a key point for SUCCESS Project,* Cătălin Popescu, Augustin Mitu, Daniela Uta, Luminita Ion, http://www.wseas.us/e-library/transactions/economics/2010/89-696.pdf, WSEAS TRANSACTIONS on BUSINESS and ECONOMICS, ISSN 1109-9526, Issue 2, Volume 7, Aprilie 2010, pag. 170-179, revistă indexată în Baze de Date Internaţionale (BDI) cum ar fi INSPEC, CSA, ELSEVIER, ULRICH, SCOPUS, EBSCO conform http://www.wseas.us/indexes;
- *Educational software for the calculation of the thermodynamic values of real gases for the training of Engineering students in Romania,* Sorin Neacşu, Silvian Suditu, Cătălin Popescu, Proceedings of the 9th WSEAS International Conference on Education and Educational Technology(EDU'10), Selected topics in Education & Educational Technology, published by WSEAS Press, 4-6 October 2010, Iwate Prefectural University, Morioka, Japan, pg.171-176;
- *Determining the level of extraction and price trend resulted in time,* Marius Bulearcă, Mihai-Sabin Muscalu, Cătălin Popescu, Marina Bădileanu, Cornelia Neagu, Cristian Sima, Proceedings of 15th IBIMA Conference Knowledge Management and Innovation: A business Competitive Edge Perspective, 6-7 November 2010, Cairo, Egipt, pg. 1754-1761;
- *Modern Teaching Instruments for the Establishment of the Thermodynamic Values of Real Gases in the Training of Engineer Students,* Sorin Neacşu, Silvian Suditu, Cătălin Popescu, http://www.wseas.us/e-library/transactions/education/2010/52-498.pdf, WSEAS TRANSACTIONS on ADVANCES in ENGINEERING EDUCATION, ISSN: 1790-1979, Issue 11, Volume 7, November 2010, pag. 347-358;
- *The importance of results dissemination within multinational projects. Case study: Project CIVITAS-SUCCESS,* Cătălin Popescu, Augustin Mitu, Daniela Uta, Proceedings of the International Conference on Development, Energy, Environment, Economics (DEEE'10), organized by Institute for Environment, Engineering, Economics and Applied Mathematics (IEEEAM), WSEAS and NAUN, 30 November-2 December 2010, Puerto de la Cruz, Tenerife, Spain, pg.177-181;
- *Models for determining taxes on pollution – a major goal for environmental purposes,* Marius Bulearcă, Marina Bădileanu, Cătălin Popescu, Mihai Sabin Muscalu, Proceedings of the International Conference on Development, Energy, Environment, Economics (DEEE'10), organized by Institute for Environment, Engineering, Economics and Applied Mathematics (IEEEAM), WSEAS and NAUN, 30 November-2 December 2010, Puerto de la Cruz, Tenerife, Spain, pg.310-315;
- *Special features of models for natural resources approach,* Marius Bulearcă, Cătălin Popescu, Cristian Sima, Cornelia Neagu, Proceedings of the International Conference on Development, Energy, Environment, Economics (DEEE'10), organized by Institute for Environment, Engineering, Economics and Applied Mathematics (IEEEAM), WSEAS and NAUN, 30 November-2 December 2010, Puerto de la Cruz, Tenerife, Spain, pg.316-320;
- *Procedure for transport projects dissemination,* Augustin Mitu, Cătălin Popescu, Daniela Uta, Proceedings of the 5th WSEAS International Conference on Business Administration (ICBA'11), 29-31 January 2011, Puerto Morelos, Mexico, pg.76-80 (ISBN: 978-960-474-269-1/ISSN: 1792-7331);
- *Sustainable Development and the Need to Manage Taxes on Pollution,* Marius Bulearcă, Marina Badileanu, Cătălin Popescu, Mihai Sabin Muscalu, Constantin Ghiga, http://www.wseas.us/e-library/transactions/environment/2011/52-677.pdf,

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- *Models for Natural Resources Management,* Marius Bulearcă, Cătălin Popescu, Cristian Sima, Constantin Ghiga, Cornelia Neagu, http://www.wseas.us/e-library/transactions/economics/2011/52-699.pdf, WSEAS TRANSACTIONS on BUSINESS and ECONOMICS, ISSN 1109-9526, Issue 2, Volume 8, april 2011, pag. 50-65;
- *Models for mining production determination,* Marius Bulearcă, Cătălin Popescu, Constantin Ghiga, Proceedings of 16th IBIMA Conference Innovation and Knowledge Management: A global competitive advantage, 29-30 June 2011, Kuala Lumpur, Malaysia, pg. 2310-2316 (ISBN: 978-0-9821489-5-2);
- *Impact measurement for CIVITAS SUCCESS Project,* Cătălin Popescu, Augustin Mitu, Daniela Uta, Proceedings of the 2nd WSEAS International Conference on Urban Sustainability, Cultural Sustainability, Green Development, Green Structures and Clean Cars (USCUDAR'11), September 26-28 2011, Prague, Czech Republic, pg.166-171;
- *The dynamic model for optimal oil extraction process management,* Marius Bulearcă, Cătălin Popescu, Mihai Sabin Muscalu, Constantin Ghiga, Proceedings of the 2nd WSEAS International Conference on Urban Sustainability, Cultural Sustainability, Green Development, Green Structures and Clean Cars (USCUDAR'11), September 26-28 2011, Prague, Czech Republic, pg.121-124;
- *Modelling And Simulation Of The Interaction Between Soil And The Heat Exchanger Pipe Of A Heat Pump, Sorin Neacşu, Silvian Suditu and Cătălin Popescu, Proceedings of 17th IBIMA Conference „Creating Global Competitive Economies: A 360-degree approach", november 14-15 2011, Milan, Italy, pg. 2243-2250;*
- *Factors affecting the reserve depletion level,* Marius Bulearcă, Claudia Elena Serban, Mihai Sabin Muscalu, Cristina Mioara Vasile, Cătălin Popescu, ANNALS of DAAAM for 2011 & PROCEEDINGS of the 22th International DAAAM Symposium "Intelligent Manufacturing & Automation: Power of knowledge and creativity", 23-26th November 2011, Vienna, Austria, Vol. 22, no 1;
- *Design and implementation of methodologies for transport (CIVITAS SUCCESS) project(s) impact measurements,* Cătălin Popescu, Augustin Mitu, Daniela Uta, http://www.wseas.us/e-library/transactions/environment/2012/54-736.pdf, WSEAS TRANSACTIONS on ENVIRONMENT AND DEVELOPMENT, E-ISSN: 2224-3496, Issue 1, Volume 8, January 2012, pag. 1-12;
- *Resources management and rent theory in mining industry,* Marius Bulearcă, Cătălin Popescu, Mihai Sabin Muscalu, Constantin Ghiga, Communications of the IBIMA Journal, IBIMA Publishing, United States, *Volume 2012 (2012), Article ID 790264, Communications of the IBIMA;*
- *Quality Management Procedure Applied in Transport Projects Dissemination,* Augustin Mitu, Cătălin Popescu, Daniela Uta, http://www.wseas.org/multimedia/journals/economics/2012/53-309.pdf, WSEAS TRANSACTIONS on BUSINESS and ECONOMICS, E-ISSN: 2224-2899, Issue 3, Volume 9, July 2012, pag.139-149;
- *Models for oil extraction process management,* Marius Bulearcă, Cătălin Popescu, Mihai Sabin Muscalu, Constantin Ghiga, http://www.wseas.org/multimedia/journals/economics/2013/55-129.pdf, WSEAS TRANSACTIONS on BUSINESS and ECONOMICS, E-ISSN: 2224-2899, Issue 1, Volume 10, January 2013, pag.1-13;
- *Management models for pricing in mining industry*, Marius Bulearcă, Cătălin Popescu, Proceedings of the 5th International Conference on Applied Economics, Business and Development (AEBD '13): "Recent Research in Applied Economics and Management, vol. II, August 27-29, 2013, Chania, Crete Island, Greece, pag. 40-49;
- *An optimized way for a better accuracy of gas consumption profiles,* Sorin Neacsu, Silvian Suditu, Cătălin Popescu, Proceedings of the 1st International

Conference on Power and Energy (POES'13): Recent Researches in Electric Power and Energy Systems, August 27-29, 2013, Chania, Crete Island, Greece, pag.276-280;

- *The extractive industry and its impact upon the environment,* Marius Bulearcă, Cătălin Popescu, Annals of the „Constantin Brâncuşi" University of Târgu-Jiu, Economic Series, nr.6/2014, Academia Brâncuşi" Publisher, pag 16-22;
- *Sustainable development and green transport in Australia*, Murat Sari, Aydin Sari, Cătălin Popescu, Annals of the „Constantin Brâncuşi" University of Târgu-Jiu, Economic Series, Special Issue/ june 2015, *Information Society and sustainable development*, 2nd ed.,„Academia Brâncuşi" Publisher, pag 63-67;
- *Renewable energy strategies: Where European Union headed?*, Irina Gabriela Radulescu, Cătălin Popescu, Annals of the „Constantin Brâncuşi" University of Târgu-Jiu, Economic Series, Special Issue/ june 2015, *Information Society and sustainable development*, 2nd ed.,„Academia Brâncuşi" Publisher, pag 102-107;
- *The strategy for sustainable use of natural resources and the role of state*, Marius Bulearcă, Cătălin Popescu, Annals of the „Constantin Brâncuşi" University of Târgu-Jiu, Economic Series, Special Issue ECO-TREND 2015, Performance, Competitiveness, Creativity, Academia Brâncuşi" Publisher, pag 260-264

In addition, a constant concern in terms of subjects taught, such as: *Quantitative methods and techniques for Management and Business Administration, Operations Management and Project Management*, was that of building materials in the form of book chapters and articles which contain the development of modern management tools. In this regard it was proposed some IT applications for solving resource allocation, utility problems, and linear programming or modeling/simulation techniques used in oil and gas industry.

My habilitation thesis covers all these subjects mentioned above and there are related with areas of Engineering and Management. In the next two chapters will be presented all these personal achievements followed by a chapter which contain main research directions and future plans for my career. In the last chapter will be included the references used over the entire thesis.

Chapter 1. SCIENTIFIC, PROFESSIONAL AND ACADEMIC ACHIEVEMENTS. GENERAL AND SPECIFIC ASPECTS CONCERN PARTICIPATION WITHIN PROJECTS TEAMS

1.1. CIVITAS II – SUCCESS Project

1.1.1 General aspects regarding project implementation

The partnership between La Rochelle, Preston and Ploiesti has generated a project called SUCCESS (Smaller Urban Communities in Civitas for developing green solutions) in response to CIVITAS scheme II. The first two cities, La Rochelle and Preston, recorded results at national and European level regarding sustainable development and environmental solutions in urban areas. These cities represent very well the smaller cities of Europe. Both are located on the outskirts Community Atlantic Ocean. Ploiesti city supported the partnership, combining obtained information with experience, applying them in a typical town in Eastern Europe. The project was carried out between 2005 and 2009.

The general objectives of SUCCESS Project were:

- Demonstrating that alternative fuels can be an efficient choice for urban transport;
- Demonstrating that, through use of bold steps for traffic control, can be obtained substantially results to develop a sustainable policy regarding energy and transport;
- Demonstrate that cities from the candidate countries can avoid the mistakes made by the cities from the Western Europe and could contribute to the development of public transportation systems at the municipal level;
- Support for research and assessment activities, including the new ones, as well as initiatives related to training and communication, in order to make known the results and encourage their transfer to the targeted areas.

In this way, it was desirable to implement projects for vehicles with diesel biological engine and those hybrid (buses, trams and taxis), based on a range of initiatives including plans to control access roads, Integrated Systems Prices, innovative transport, information systems and new concepts concern logistics at the municipal level.

The activities of this project took into account to check the strength of transport systems, in the sense that they have to be sustainable in terms of functionality but also in terms of the used fuel and of the endowment equipment over a life cycle.

In the specific case of Ploiesti main objectives of the project were focused on several critical issues:

- *eco - environmentally fleet* by introducing of two hybrid buses that consume organic fuel and by conversion of 25 diesel buses to LPG ;
- *control of access roads* by developing an ecological area of 5 km^2 through traffic decongestion and stimulating walking in the city center of Ploiesti;
- *boosting public transporting* by improving public transportation infrastructure and arranging of ten circulation passages;
- *goods distribution* through partnerships on shipments, establishment of signs and markings, within a specific system to provide real-time information to interested transport operators;
- alternative transport modes by planning alternative transportation and implementation of 12 km for bike trails and 8 km for pedestrian areas;
- information systems for transport through the development of a GPS system for RATPP fleet (Autonomous Transportation Public Company from Ploiesti) , implementation of a new ticketing system and of a system that provides real time information about public transportation.

1.1.2 Project work-packages description

CIVITAS II – SUCCESS Project (http://www.civitas-initiative.org/content/success), contract TREN/04/FP6EN/ S07.39573/513785 had 12 work–packages as follows:

- *Work-packages 1*: Project Management and coordination

This work package has considered to have a good relationship of coordination between the various partners in order to ensure high quality results, also the communication relationship with the European Commission have a high standard, the reports and statements of expenditures to be made on time, the project to be conducted in a responsible manner and the overall design of the project to be managed effectively.

- *Work Package 2*: Integration and Technical Management

The technical coordination was insured the support needed for the project works and for the works leaders for technical activities. Technical coordination of project works aimed at ensuring coherence between the process of the project implementation and the demonstrative process. Technical coherence aims to ensure the sharing of information by all partners and validating the technical quality of the results. Therefore there are made some activities, such as: regular analysis of the technical progress of the measures, risk technical assessment, validation of the technical parts within the reports developed to present the progress achieved, methodological and technical user guide elaboration for integration of the innovative and sustainable transportation system.

- *Work Package 3*: Assessment

This work package aimed to achieve a comprehensive assessment of CIVITAS II demonstrative activities in the SUCCESS programme. At this WP, University of Oil and Gas of Ploiesti was meant to establish a comprehensive methodology in order to estimate the impact that eco friendly transportation has on the environment, by using a range of management and evaluation indicators of the public transportation system to the municipal level. This methodology was based on social, financial and environmental indicators, and on analysis' instruments. The purpose of this methodology was to build a useful assessment tool in order to help local government to take appropriate decisions to promote measures on local ecological environmental protection and transportation.

- *Work Package 4*: Dissemination, awareness and exploitation

The project promoted a transfer to other cities of an "integrated package" of initiatives in order to boost the management more innovative in terms of eco-environmentally transportation system. Thus, it used a combination of methods both for interaction between decision makers from the local government and citizens and also to inform them about the effects that project it has.

Here, the project team from UPG, of which I was member, had an important role since in the period 2007-2011 compiled materials or articles that were published in scientific journals specialized or participated in international conferences with scientific papers. In Chapter 2 of habilitation thesis will be illustrated all these scientific works by mentioning all the works published or presented in connection with the project CIVITAS SUCCESS II.

- *Work Package 5*: Eco-friendly vehicles, efficient in terms of energy

Clean and efficient vehicles represent the central part of the demonstrations made within CIVITAS and SUCCESS projects. The main objective of this work package is to develop the use of eco-friendly vehicles in all possible situations in an urban context. Through such work package it was desirable to achieve lower emissions and significantly reduced air pollution and noise. This work package was focused on the implementation / conversion of a number of hybrid buses using on one hand diester (biodiesel) as fuel and on the other hand LPG.

- *Work Package 6*: Traffic management

This work package aims to identify the best means to implement control areas of traffic, to improve traffic and safety in the city (especially for tourists or people with disabilities), to decrease phonic pollution, to strengthen regulations traffic regarding traffic in the city.

- *Work Package 7*: Strategies for Integrated prices

It has considered the creation of a homogeneous and coherent taxation system for all modes of transport but also for the activities defaults to simplify the taxation system of the beneficiaries. Therefore, in this regard it have proposed various solutions: development of a new toll system that includes fares for other activities in town, such as entrances to museums, sightseeing etc., strategies price integration to the entire area of each community and surrounding areas, the introduction of a smart card transportation system across the entire transport network.

- *Work Package 8*: Stimulating types of public transportation

This measure has been considered to diminish dependency from own car, promoting flexible alternatives for public transportation, the possibility of creating facilities for car parking of personal property on the outskirts of cities, improving interconnection and interoperability within the urban transport network, improving infrastructure in collective transportation, promoting eco-environmentally means of transportation.

- *Work Package 9*: New forms of vehicle use and ownership

This work package has considered promoting the concept of sharing transportation systems, developing new car park shared, and implementation of the shared system of bicycles. In addition for crowded areas from the city centre was proposed to introduce vehicles that use alternative fuels (hybrid cars) or using electric cars that generate minimum values or close to zero in terms of environmental pollution.

- *Work Package 10*: New concepts in the distribution of goods

This work package aims in reducing the transport of goods of any kind in the city and optimize traffic to city centers. In this respect have to be designed another logistics of the city by developing services related to heavy cargo transport, construction of some areas for distribution of goods in the central areas of cities, creating pathways for quick and easy access to these areas, identifying places for parking spaces for traders with eco-friendly vehicles, the need to promote distribution of goods and merchandise by using electric vehicles at least in the city centers.

- *Work Package 11*: Innovative measures for “light” transport

This work package was one of the most important aspects that need to be implemented. It was desirable to improve the safety conditions for pedestrians and cyclists, to reduce walking time for pedestrians and cyclists by developing safe and affordable routes that are able to make the connection with points of general interest for members of the community: schools, hospitals, shopping areas and recreational areas. In addition it was followed to build facilities for pedestrian traffic especially for those who use wheelchairs, people who have problems in seeing things, children and older people. This project has allowed that in Ploiesti city to be built special lanes for cyclists linking downtown to its southern zone, was mounted special traffic signs containing information on those routes and was extended pedestrian area from downtown.

- *Work Package 12*: Telematics

Such a work package intends to develop and optimize the information in an integrated manner regarding the management and control of the overall transportation system in the cities. In this regard it have been implemented, in every city from the project, systems that provide in real-time information on traffic means of public transportation, by placing electronic panels in each bus stop. In this way people arrived in these stations are informed about traffic fluency and related to any disturbance occurred in public transportation. Bus monitoring is via a GPS - type system.

1.1.3 Relevant aspects of the project in terms of activities for Ploiesti

By the project implementation were obtained some important results in Ploiesti.

a) developing eco- friendly public transportation through concrete measures:

- were introduced two hybrid buses and other 25 have been modified to use GPL

b) construction of green areas by:

- development of an ecological zone of 2,4 km^2;

- blocking the central area of the city in the sense that the main boulevard of the city is liberated from traffic on weekends or during some events;

- recommendation to use the roads surrounding the city to reduce car traffic in the downtown area.

c) improving the optimal traffic flow through:

- expansion of facilities for public transport to new developing areas: the Hippodrome, the Albert neighborhood, the West zone, the North zone;

- extending the trolley transport system, including new lines: South Railway Station - Malu Rosu - West Road or Street Cantacuzino - street Malu Rosu.

d) generating facilities related to circulation infrastructure and access by:

- establish conditions for bicycles on Independence Avenue and in the south part of the city;
- conditions for increasing accessibility for people with mobility difficulties in the central areas;
- evolution of public transport terminals in the suburban areas : North, South and East.

e) new concepts for distributing goods through:

- implementation of a logistics plan for the Ploiesti city;

f) flexible innovative measures to manage demands on the transmission system by:

- development of facilities for cycling in the city (arboretum, several avenues: North-South, Independentei, Bucureşti) ;

1.2. Project „CAPITALIZATION OF COMPETITIVE ADVANTAGES IN EXTRACTIVE INDUSTRY OF ROMANIA AS AN EFFECT OF DECISIONS BASED ON ECONOMETRIC METHODS AND MULTICRITERIA ANALYSIS OF EXHAUSTIBLE MINERAL RESOURCES UTILIZATION (ACIER)"

ACIER project was registered in the competition of PN II programme, Round 2008 PNCDI 2, Programme 4 - "Partnerships in priority areas", Domain 9: "Socio - economic and humanistic research". The period of time for the project implementation was from 2008 to 2011. The project was coordinated by the Centre for Industrial Economics and Services (CEIS) within the Romanian Academy and the partners were: Institute for Economic Forecasting (IPE), Academy of Economic Studies (ASE) from Bucharest, University Petrol-Gaze from Ploiesti (UPG) and University Bucharest (UB).

1.2.1 Project summary

The project had as main goal to identify, to analyze and to develop new managerial tools, for econometric assessment and multi-criteria analysis of certain exhaustible resources utilization (such as coal, mineral ores, oil and gas), that may lead to the capitalization of competitive advantages organizations from Romanian extractive industry may feature.

Why such analysis and decision-making models are needed? Because "The place of mathematics among human sciences is today very important, but tomorrow will be crucial" says Kaufmann; a quote that one way or another occurs or results from most of works in which mathematics is used as a tool for researches, for deepening and discovering new rules, for predicting future trends, all of these not only in one field, but in very diverse domains of science, technology, economy, society and history, that is everywhere clarity and strictness are highly needed. Leonardo da Vinci once said that "there is no precision in science if one of the mathematics sciences can't be used, if there is no connection with figures".

During the project implementation, evolved econometric models were used (multi-factorial models, dynamic econometric models, firm-level econometric models, spatial econometric models, cross-section and panel models, analysis, simulation and forecast non-linear models etc.) and modern multi-criteria analysis and decision-making techniques (sensitivity analysis, assessment grids, financial and non-financial scoreboards, TOPSIS method, decision trees, composite indices method, main component method, factorial decomposing method etc.) were giving the opportunity to assess the decision-making effects upon the growth of the potential of organizations in extractive industry (mining and oil and gas industry) to capitalize their competitive advantages.

The subordinate derivate objective of project implementation was to use the managerial tools once developed aiming at the sustainable development of exhaustible mineral resources above mentioned under the conditions of complying to EU environmental regulations (the Maastricht Treaty, the action-plan "Environment 2010: our future, our choice" etc.). A relevant example for the amplitude and the dominant directions of the actions linked to the environmental dimension of sustainable development had been offered by the European Union's working out of "The 5th Program for environmental actions toward

sustainability", based on principles that orientate the environmental protection policies at European level included in Single Act of Union Treaty.

Finally, the use of new managerial tools had to strength the managerial capacity of extractive industry organizations that may lead to their competitiveness growth in the rough competition on the international markets.

1.2.2 Relevance of the project

Through its subject, the project complies with the objectives of the 4th Program that is "The growing of R&D competitiveness by stimulating partnerships in priority domains, materialized in technologies, products and innovative services to solve certain complex problems and to create implementation mechanisms" due to the following:

- it has as a main scope the strengthening of managerial capacity of extractive industry organizations as a result of using of new managerial tools, for econometric assessment and multi-criteria analysis of certain exhaustible resources use (such as coal, mineral ores, oil and gas), that may lead to the capitalization of competitive advantages organizations from Romanian extractive industry may feature;
- the partnership consists of two R&D institutes from the economic domain, one university with economic profile, one university with administrative and business profile, and one university with technical profile;
- had materialize in identifying of new managerial tools for econometric assessment and multi-criteria analysis in extractive industry;
- proposes action-plans and measures to be taken aiming the growth of the potential of organizations in extractive industry.

The project also was harmonizes with **the derivate goals** of the 4th Program that implies:

- the growth of managerial competences and the promotion of know-how transfer over the extractive industry organizations while complying to the sustainable development principles;
- the growth of competitiveness and creativeness, and of the development of organizational culture in economic systems.

According to its subject, the project was harmonizes with **the 9th domain – Social-economical and humanist Researches,** research direction no. 9.1 named: "New managerial, marketing and entrepreneurial development methods for organizational competitiveness", Research thematic no. 9.5.1 called: "Strategies for the establishment and capitalization of organizations competitive advantages".

The project called **ACIER** (acronym in English **CAIE**: **C**ompetitive **A**dvantages in **E**xtractive **I**ndustry) started from three premises that stood at initiating this research, namely:

- non-renewable mineral resources exhaustibility, that leads to the need for their use under quality and sustainability conditions;
- exponential increase of information amount modern managers have to manage, that leads the need to use new managerial tools in decision-making based on econometric methods and multi-criteria analysis;
- competition strengthens on international raw materials and energy markets that lead to the need to capitalize potential competitive advantages of extractive industry organizations.

Starting from these three premises, ***the scope of the project*** was to strengthen the managerial capacity of extractive industry organizations as effect of the proposed action-plans and measures to be taken aiming the growth of their potential that should lead to their competitiveness growth on the rough international markets competition.

1.2.3 Project description - scientific and technical description including the degree of novelty and the possibility of implementation of results

The abundant resources era is at sunset. The same is the era of high quality mineral deposits: the utile ore concentration (for mineral ore deposits), the caloric power (for coals), and the deposits pressure (for hydrocarbons) showed high values, and their use efficiency both as raw materials, and as energy sources showed the same high values. Their massive exploration, sometimes ruthless, without a time horizon and without taking into consideration

their exhaustiveness implacability of these valuable deposits had lead to the decrease of the reserves, to the growth of extraction costs, resulting in immediate effects upon manufactured increased prices, of produced energy and generally all human activities.

At the same time, another fact must not be overlooked: extractive industry's particularities differentiating it from manufacturing industries. Its scope not only consists of material transformation from one form to another, as in manufacturing industry and agriculture, but in extracting it from a natural deposit, and putting it at the disposal of other industries and for the population consumption.

The substance dislocated by the extractive industry from its natural bound with the Earth is not renewable and quantitatively limited. By continuing to exploit these deposits, they are step by step exhausted, and work conditions are depleting at the same rate, leading to the above mentioned consequences.

The step-by-step depletion of mineral deposits and the production-costs growth in extractive industry have negative influence over economic efficiency for the remaining economic activities. Based on these considerations, comparative advantages do not prevail any more in decision-making. They have shifted to competitive advantages, and the ability of capitalizing the competitive advantages stands as the key to success for the international market competition.

Thus, the need for multi-criteria decision-making in extractive industry is emphasized by the specific aspects implied by the dislocation of these deposits, as follows:

- during the exploitation process, the natural factor plays the leading role, influencing the level of all the indicators;
- the one-sided treatment, in respect to only one single point of view (economic, technologic, energy, social and environmental) regarding the extractive industry's activity is a great disadvantage if the influence of the other factors is not taken into account;
- decision-making in extractive industry must also take into consideration the length in time of the cycle to attract in economic circuit of new exhaustible mineral deposits as is well known that investments are made at one moment of time and the outcomes occurs after a long period of time.

Hence, decision of action in extractive industry, but not the only industry, implies the fully aware choice of one of many possible solutions. As professor Kaufmann said in his book *"Methods and models in operational researches" (Scientific Publishing House, Bucharest, 1967),* if in the past taking decisions was based mainly on *the complex "experience-intuition"*, in our days the modern society, knowledge-oriented, bases its decisions on *the complex "information-judgment".*

No manager is always right or always wrong, but some get it right more often than others. The examples from reality suggest that companies, like individuals, succeed or fail for a variety of reasons. Some of the reasons are circumstantial. Others are personal and human and include the decisions managers make and the actions they take. In business, there is no replacement for effective management. Companies may fly high for a while, but they cannot do well very long without good management. It's the same for individuals: *Business Weeks'* Manager of the Year *("A Dark Year's 25 Star managers", Business Week, January, 14, 2002)* succeeded by focusing fundamentals, knowing what's important and managing well. *The aim of this project is to help managers succeed in those pursuits.*

Performing management functions and achieving competitive advantage are the cornerstones of manager's job. When the key management functions are performed by managers who have these critical management skills *(R. Katz - "Skills of an Effective Administrator", Harvard Business Review, nr. 52, September-October, 2001)*, the result is a high-performance work environment. Hence, managers must have at their disposal new managerial tools helping them making quick, effective, efficient and good quality decisions, because on these decisions depend the way the organizations they manage will perform more or less good in the business contemporary competitive environment *(T.S.Bateman, S.A.Snell – Management: The New Competitive Landscape, McGraw-Hill/Irwin, 2004).*

Up till now, researchers related to extractive industry decision-making process based on mathematical tools for modeling and simulating economic processes aimed mainly at one-sided studies regarding only one mineral resource. Even on such conditions, researches aimed mainly the technical issues of the problems, namely: analysis of repartitions for

geological samples, establishment of optimal production or simulation of mining process, dynamic models for hydrocarbons extraction process or simulation models for hydrocarbons final recovery factor estimation, thru water dislocation (using geo-physic fields and hydro-physic method, and laboratory simulations) or material balance equations.

Thus, several books have been printed either in mining industry *(Dan Zorilescu - Mathematic methods for analysis and decision-making in geology and mining industry, Technica Publishing House, Bucharest, 1972; Dan Zorilescu – Operational methods of mining issues, Technica Publishing House, Bucharest, 1981 etc.)*, or in hydrocarbons industry *(Mihail Florescu et al. – Computer-aided modeling and simulation in hydrocarbon industry, Technica Publishing House, Bucharest, 1986 etc).*

Similarly, researchers related to econometric and multi-criteria analysis in extractive industry aimed either at one-sided studies regarding only one mineral resource, or at theory issues like presenting general concepts; the concept of "model" is rather new (it was first used by mathematician Beltrami in 1868 while developing an Euclidian model for geometry) as compared to modeling method that evolved once researchers seek for its scientific knowledge and its use in economic issues.

Thus, several books have been printed either in econometrics *(Eugen Pecican – Econometrics, All Publishing House, Bucharest, 1994; Octav Onicescu and Mihai Botez – Uncertainty and economic modeling (informational econometrics)*, *Stiintifica si Enciclopedica Publishing House, Bucharest, 1985; Ion Romanu – econometrics with applications to investments efficiency, Stiintifica si Enciclopedica Publishing House, Bucharest, 1975 etc.)*, or in analysis, decision-making, modeling and simulating economic process *(Camelia Ratiu-Suciu – Modeling and simulating economic process, Didactica si Pedagogica Publishing House, Bucharest, 1995; Ghe. Boldur-Latescu – Decisional logics and managing systems, Academia Romana Publishing House, Bucharest, 1992; D. Radulescu and O. Gheorghiu – Computer-aided flexible optimization and decision-making, Stiintifica Publishing House, Bucharest, 1986; M. Stoica et al. – Microeconomic modeling, Omegapres Publishing House, Bucharest, 1994 etc).*

But mostly of the decisions in extractive industry, and not only them, are multi-criteria. Although the multi-criteria character of decision-making process in extractive industry is closely tied to flexible optimization, it reflects only certain aspects of sub-optimality and fuzzy approaches. Any multi-criteria optimization problem in extractive industry generally emphasizes a local-to-global bond, that goes from every optional criteria considered as sequentially, individual part, to all criteria considered as a whole, an optimization that implies dealing distinctly of multi-objective optimization and multi-attribute optimization. But all these aspects enhance the difficulty and complexity degree of modern managers' decision-making process.

ACIER project sought to solve this unilateralist approach because:

- takes into consideration the studying of exhaustible mineral resources both at individual level of each resource (coal, mineral-ores, oil and gas), and at extractive industry level, where the econometric models and multi-criteria analysis should be aggregated;
- non-renewable resources exhaustibility constraint should be dealt thru studies and analysis taking into account several criteria, consisting of several indicators, under risk and uncertainty conditions, as a response to multi-criteria requirements of decision-making process in extractive industry;
- efficiency of exhaustible mineral resources use should take in consideration the sustainable development principles, so that present needs for raw materials and energy sources, and the need to preserve these resources for the next generations should be both respected;
- the proposed action-plan and considered measures should aim at managerial increasing of organizations in extractive industry that may lead to the capitalization of their competitive advantages on the international markets.

Due to the actual stage of the researches, *the novelty degree of the project* consists of identifying and implementing decisions based on econometric models and multi-criteria analysis of exhaustible mineral resources use (coal, mineral ores, oil and gas), to identify action-plans and measures for the capitalization of competitive advantages organizations in extractive industry (that will be assessed and diagnosed based on a thoroughly SWOT

analysis), finally aiming the growth of their competitiveness potential on the rough international markets competition.

Starting from the novelty of the proposed solutions, ***the originality of the project*** consist of the work-methods to be used, which include the use of combined analysis and decision-making mathematic methods that are specific for geology, mining and hydrocarbons industry *(binomial, Poisson, normal and log-normal, hyperbolic, exponential and righted-asymmetrical repartition, and other types of repartition; correlation and regression analysis; extracting process simulation models; hydrocarbons final recovery factor estimation models, thru water dislocation or material balance equation; graphs theory method, games theory and linear programming; Delphi and Brainstorming forecast methods etc),* on one hand, with econometric and multi-criteria analysis classical models *(the ELECTRE method; decisions under risk thru the von Neumann-Morgenstern axioms and the utility functions related to a decision-making process; multi-criteria linear programming; moments method used in ordering the decisional variants; fuzzyfication of determinist models; dynamic modeling of resource allocation aided by the Bellman's optimality principle; stochastic and numeric simulation models; Monte Carlo method and simulation economic process in extractive industry with the help of Forrester techniques etc),* on the other hand.

1.2.4 Detailed description of activities

ACIER project had four phases, each phase containing five activities:

Phase I: Competitive advantages analysis for organizations in extractive industry.

Activity I.1. Organization of a work-shop to start-up the project.

Activity I.2. Analysis of actual stage in extractive industry.

Activity I.3. Diagnosis of actual stage of organization and product competitiveness in extractive industry. SWOT analysis.

Activity I.4. Assessment of extractive industry potential competitiveness and identifying of its determinant factors.

Activity I.5. Organization of a work-shop to disseminate partial results of the researches. Conceiving and building the WEB page of the project.

Phase II: Studies regarding econometric models that can be used in decision-making in extractive industry.

Activity II.1. Organization of a work-shop to start-up the phase

Activity II.2. Identifying the specific elements encompassed in econometric models that can be used in extractive industry.

Activity II.3. Premises of using econometric models under the circumstances of extractive industry' characteristics.

Activity II.4. Selecting econometric models that may apply to extractive industry for which the identified premises are ensured.

Activity I.5. Organization of a work-shop to disseminate partial results of the researches. Updating the WEB page of the project.

Phase III: Studies regarding the decision typology of multi-criteria analysis in extractive industry.

Activity III.1. Organization of a work-shop to start-up the phase

Activity III.2. Theoretical and methodological database of multi-criteria decisions.

Activity III.3. Advantages of making decisions based on multi-criteria analysis in extractive industry.

Activity III.4. Typology of decisions based on multi-criteria analysis that may apply to extractive industry, by restrictions and specific problems categories.

Activity III.5. Organization of a work-shop to disseminate partial results of the researches. Updating the WEB page of the project.

Phase IV: Assessment of decision-making effects based on econometric and multi-criteria analysis upon the potential of organizations in extractive industry to capitalize their competitive advantages.

Activity IV1. Organization of a work-shop to start-up the phase

Activity IV2. Ways of act-plan and measures to be taken for the potential growth to capitalize the competitive advantages of organizations in extractive industry.

Activity IV3. Predictions related to the capacity growth for the organizations in extractive industry to capitalize their competitive advantages.

Activity IV.4. Assessment of decision-making effects based on econometric and multi-criteria analysis aiming to capitalize the competitive advantages of organizations in extractive industry.

Activity IV.5. Organization of a national symposium to disseminate final results of the researches. Final updating the WEB page of the project.

1.2.5 Scientific and technical results

The final result of project implementation consists of the fact that the use of new managerial tools has to strengthen the managerial capacity of extractive industry organizations that may lead to their competitiveness growth in the rough competition on the international markets. Many competitiveness scholars as referring to competitiveness say that at organizational level the problem is closed down. Organizations that survive are competitive and those leaving the market are not competitive. In reality, organizations act under very different conditions related to costs, technologies and profit rates *(Aiginger and Pfaffermayr, 1997).*

While competitiveness measurement at extractive industry level can be done through diverse methods (estimations based on internal resources cost analysis and dividing the capital and work-value by added value calculated based on international prices, that may lead to identifying the competitive advantages in those industries having higher rates), ***competitiveness measurement at organization and product level*** can be done based on quantitative and qualitative assessment elements aggregated in a coherent methodology, that should give the opportunity to do benchmarking and draw relevant conclusions regarding the main action-plan and the tools to be used and adopted, ***elements that will be considered at the end of the project.***

1.2.6 Project impact

- **Economic impact**

The results of the project represent the basis for establishing of economic policies aiming to promote competitive advantages of organizations both in extractive industry and in the whole economy under the market globalization conditions (raw materials, oil and gas markets included), and under the continuously growth impact of raw materials and energy prices over manufactured products and finally over the final consumer.

- **Social impact**

The use of new managerial tools by modern managers should take effect on creating new jobs, on labor productivity growing and its better correlation to salaries, and on amplifying human capital in extractive industry.

- **Environmental impact**

The use of new managerial tools proposed within project should ensure a sustainable management of exhaustible resources (coal, mineral-ores, oil and gas) while complying with EU regulations related.

1.2.7 Results' dissemination and capitalization; project's beneficiaries

The results of ACIER project were disseminated by using different channels:

- publishing partial and final results in domestic or international journals or reviews;
- presenting final results in international conferences;
- using a dedicated website (http://acier.iei.ro/);

Members of the project team created materials that were included in different papers which were presented with the occasion of some international scientific events and some of these findings will be described in the second part of the thesis.

Main beneficiaries of project's results are: Mining and Energy departments in the Ministry for Economy and Finance, companies and organizations in mining, oil and gas activities such as: CNH Petrosani, SNL Oltenia, SNC Ploiesti, SC MINVEST SA Deva, CN REMIN SA Baia Mare, SNGN ROMGAZ SA, SC PETROM SA.

1.2.8 Gantt chart of the project

Phase/Activity	**2008**					**2009**												**2010**												**2011**							
(month no.)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Phase I – 01.08.08-30.11.08																																				
Activity I.1	X																																			
Activity I.2	X	X	X																																	
Activity I.3		X	X	X																																
Activity I.4			X	X																																
Activity I.5			X	X																																
Phase II – 01.12.08-30.11.09																																				
Activity II.1					X																															
Activity II.2					X	X	X	X																												
Activity II.3						X	X	X	X	X	X	X	X	X	X																					
Activity II.4							X	X	X	X	X	X	X	X	X	X																				
Activity II.5								X	X	X	X	X	X	X	X	X																				
Phase III – 01.12.09 30.11.10																																				
Activity III.1																	X																			
Activity III.2																	X	X	X	X																
Activity III.3																		X	X	X	X	X	X	X	X	X	X									
Activity III.4																			X	X	X	X	X	X	X	X	X	X								
Activity III.5																				X	X	X	X	X	X	X	X	X								
Phase IV – 01.12.10 31.07.11																																				
Activity IV.1																													X							
ActivityIV.2																													X	X	X	X				
Activity IV.3																															X	X	X	X	X	
Activity IV.4																																	X	X	X	X
Activity IV.5																																	X	X	X	X

Figure 1.1. **ACIER' Gantt chart**

For planning, monitoring and assessing project's activities, the management of the project considered the use of the following documents: work-plan (on monthly and activity basis, see fig.1.1), submitted from the coordinator to the work-groups; activity report of each work-group; monthly progress analysis of achieving activity objectives for each work-group; activity report submitted by Project manager at the end of each phase in the project.

All the above mentioned resources were allocated according to each activity characteristics and length of time as they were presented in the Gantt graphic. Thus, financial and human resources are allocated based on the phases and activities presented in the detailed work-plan table (as is shown in fig. 1.2).

The method of allocating natural resources by using the instruments of market economy generates the following advantages: a) promotes consumer market, fulfilling their desires in a greater extent than in a command economy; b) achieve freedom of economic agents to enter into direct and multiple relationships with preferred manufacturers; c) lead to widening its product range of products and services that can be offered; d)increase competition in the use of resources; e)performs resource allocation flexibility to face changes in the domestic and international prices.

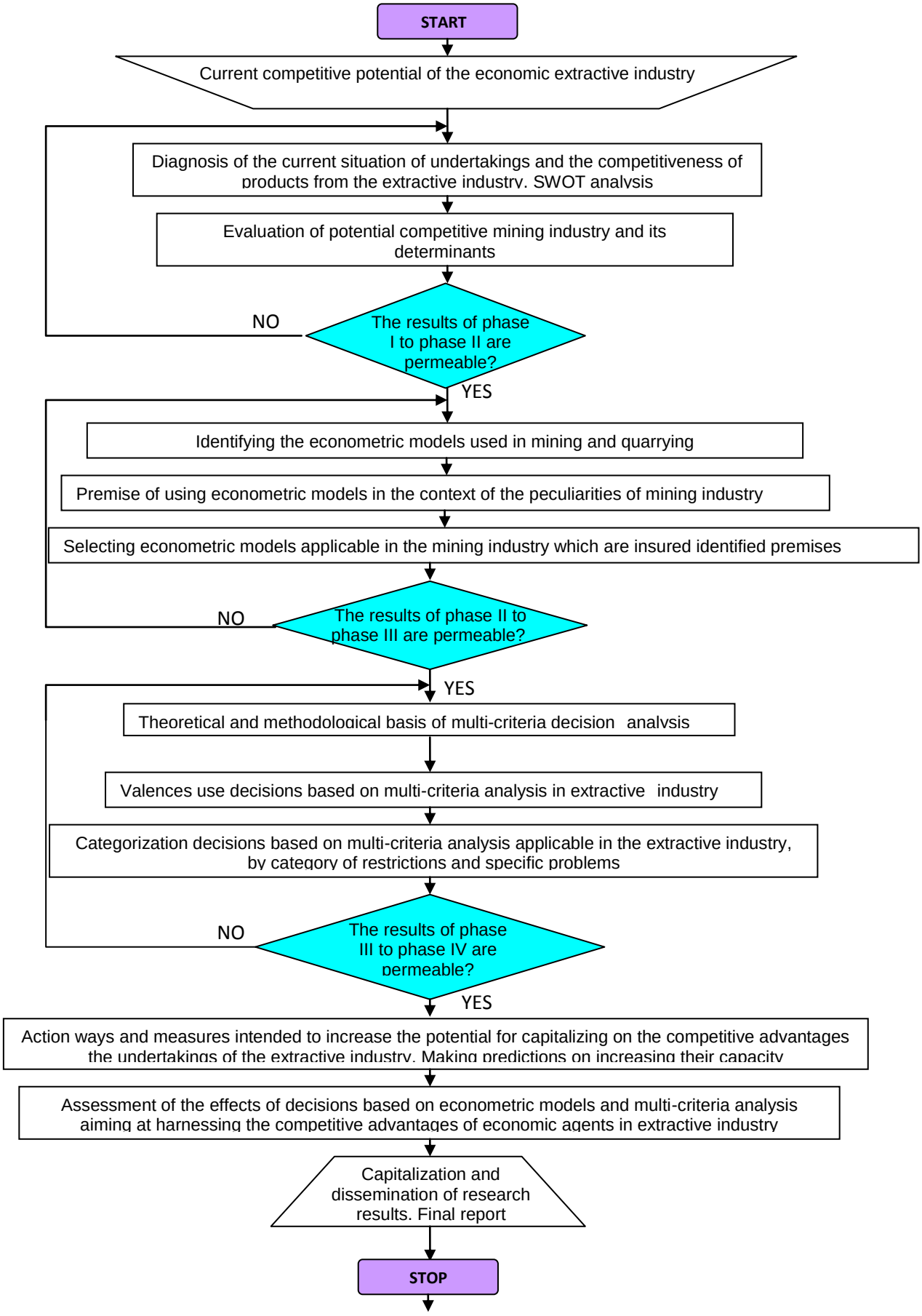


Figure 1.2. **Work-plan table**

1.3. INNOSUPPORT Project

A first international project that targeted innovation as a means of business development, of problems solving and of improving the level of skills acquired formally through education and research conducted in the university and that I was a member of the project team was INNOSUPPORT: Supporting Innovation in SME's. The components developed in the project were developed under the Leonardo da Vinci Pilot Project INNOSUPORT (01.10.2003-31.10.2005). The project was aimed at creating an Internet Module System for the Innovative Problem Solving Methods. My work focused in designing the 4.7 component called Systemic Management of internal innovative proposals. In the following paragraphs are mentioned aspects of the contribution of each member of the project team and after that is included the subchapter designed for the above mentioned component. The information concern the project is available at the website: http://www.innosupport.net/

1.3.1 Acknowledgements

The project partners would like to acknowledge the following individuals for their contribution to the development of the innovation guide for SMEs: Professor Klaus **Busch** for the project idea; Martin **Hagemann** (LINK MV e.V.) and Dr Gerd **Zimmer** (Institut für Projektbegleitung und Kompetenzentwicklung- pro-kompetenz- e.V.) for the development of the project application.

The following individuals for leading on the authorship of the components (table 1.1):

Table 1.1. **Authors' name responsible for the INNOSUPPORT components**

Authorship	*Component*
Uwe **Derksen** (The Surrey Institute of Art and Design University College)	1, 10.2, 12.3
Uwe **Derksen** with Catalina **Negoita** and Monica **Vladoiu** (University Petroleum-Gas of Ploiesti)	9.2, 9.3
Laila **Elina** (Latvia Technology Park)	12.1
Samara **Elpida** (University of Western Macedonia)	2.1, 2.2, 3.1, 3.2, 9.1, 10.3
Simona **Eftimie** (University Petroleum-Gas of Ploiesti)	4.1
Mag. Johannes **Gastrager** and Dr. Josef **Scheff** (Scheff GmbH)	10.1, 11
Nikos **Katsiadakis** (Thessaloniki Technology Park Management & Development Corporation S.A)	4.6, 6.1-6.4, 7.1-7.4
Gabriela **Moise** (University Petroleum-Gas of Ploiesti)	4.2
Catalina **Negoita** and Monica **Vladoiu** (University Petroleum-Gas of Ploiesti)	10.4
Cătălin **Popescu** and Ionut **Lambrescu** (University Petroleum-Gas of Ploiesti)	4.7
Markus Wolf (e-Novate Consultancy Ltd)	5.1-5.3, 8.1, 8.2

Dr. Gerd **Zimmer** (Institut für Projektbegleitung und Kompetenzentwicklung – pro-kompetenz – e.V.)	4.3-4.5, 12.2

Other contributions: Nils **Steindorf-Sabath** (LINK MV e.V.) for the online design and functionality of the components, Caron **Brenner** (**e-Novate Consultancy Ltd) and Suzanne Ferguson** (The Surrey Institute of Art and Design University College) for proofreading the components.

The project was funded with the support of the European Leonardo da Vinci programme and the InnoSupport partnership. The partnership also acknowledges the support it received from the various business support organisations, SMEs and individuals across Europe in realising this project.

The Intellectual Property Right (IPR) of the project results and components is vested in the InnoSupport partnership.

This project was carried out with the support of the European Community. The content of this project does not necessarily reflect the position of the European Community or the National Agencies, nor does it involve any responsibility for their part.

1.3.2 Component 4.7. Systemic Management of internal innovative proposals

Note: *In the following paragraphs will be presented all the information described in the* Component 4.7 *including the same count as in the original document.*

"Always people working in a firm will have ideas, they will try to improve something, but they have to do that in an environment where rules have to be followed. Has any worker on the assembly line the authority to make changes that he thinks will improve *its efficiency*? Of course not. So are we going to throw away the idea? Again, of course not. Regardless of size, any firm that wants to have good results has to think of a systematic management of internal proposals: how to stimulate them, how to put them into practice, how to reward the initiators etc. Maybe that under the pressure of the daily work and stress, some firms will neglect this aspect. This is a mistake. A mistake will also be to expect early benefits of managing the ideas and suggestions for improvement. It could take many months, but if properly set up, the system will bring its benefits and these should have impact.

The module tries to help companies to organize such a systematic management of internal innovative proposals, by offering ideas and examples.

What is Systemic Management of internal innovative proposals?

Systemic Management of internal innovative proposals refers to a framework for promoting, conducting, using and stimulating any innovative proposal from within the organization. This requires a proper structure within the company.

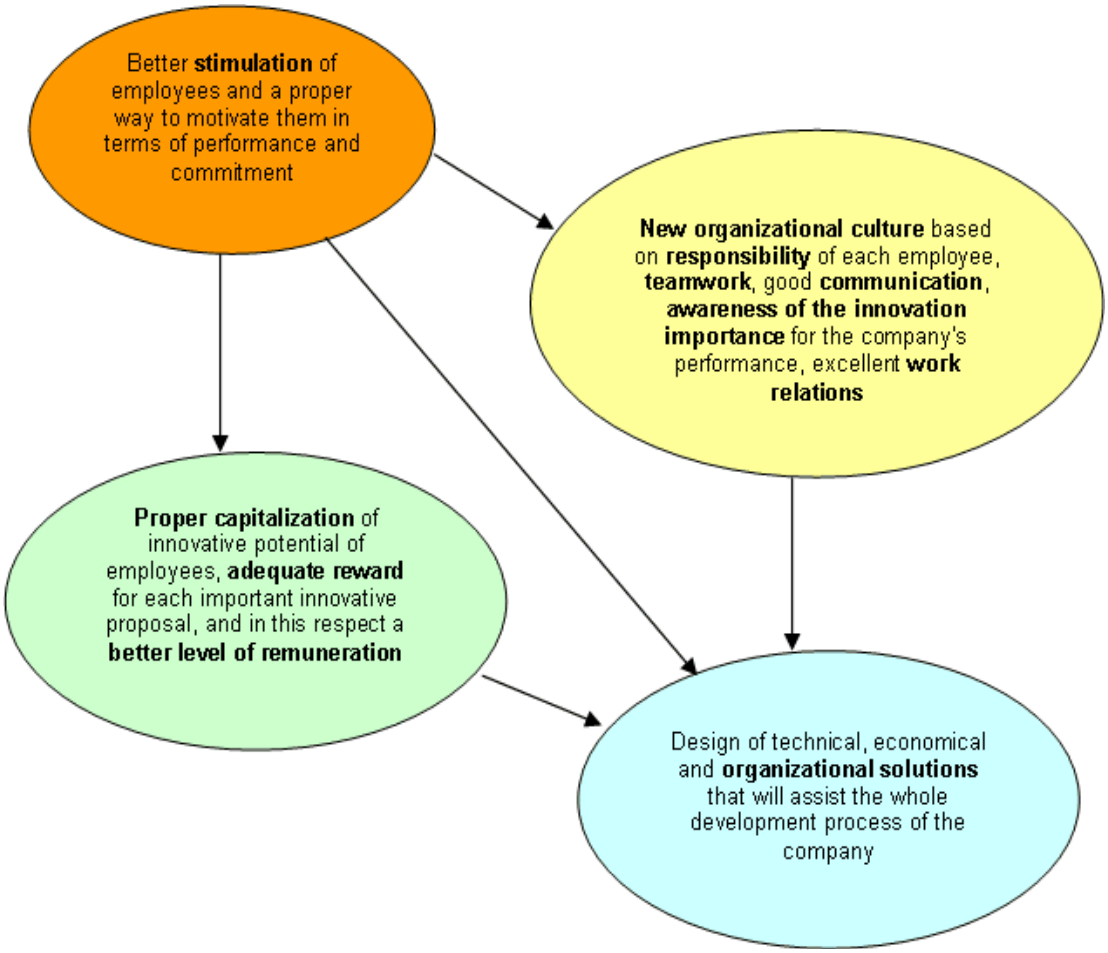
Large or small firms have to understand that it is worthwhile the effort of implementing a proper structure for a systematic management of the internal innovative proposals. If they do so, it will gain two major advantages that will be reflected in their success:

- They will not waste the innovative potential of their employees (practically the most valuable asset of a company).
- They will create among employees the sentiment of participation, the sentiment that their ideas are taken into account. This will result in a strong bond between the company and the employees, which is in itself beneficial.

4.7.1. Why and where is it used?

Why and where Systemic Management of internal innovative proposals is typically used?

Companies have to be innovative to survive on the market. The globalization will "kill" companies that do not understand the importance of being innovative. The most important competitive advantages obtained by using a systemic management of internal innovative proposals are presented below:



On the other hand, it is necessary to identify **where** it is to be recommended to implement a procedure consisting in a Systemic Management of internal innovative proposals. Firms have to consider three fields that represent three important organisational functions:

- management of research and development;
- human resource management;
- production and operations management.

Also, a methodology for Systemic Management of internal innovative proposals is required in any organisation in order to use every innovative proposal in improving performance for the firms and create certain competitive advantages in comparison with the main competitors.

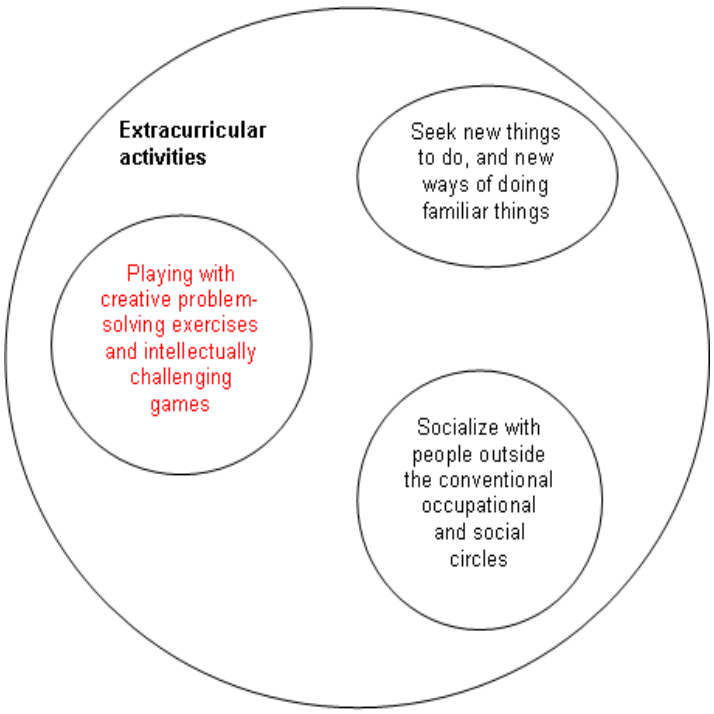
To exploit each element, the management have to design a standard procedure that makes possible to planning, organize and control the entire internal innovation process.

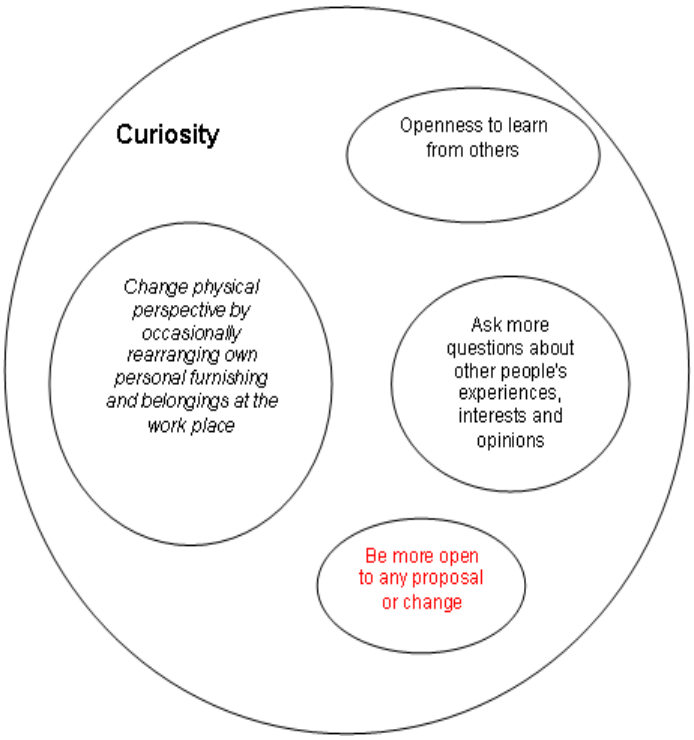
4.7.2. How to stimulate innovative proposals within companies

The process has two phases (components):

- Nurturing an environment that encourage the creativity of employees (blue sky thinking that use toys to stimulate creativity are to be considered - see links);
- Setting up organizational structures / mechanisms that support, reward, assess and implement innovation.

The first component has to focus on developing and supporting the key characteristics of creative thinkers. This can be achieved through:


Extracurricular activities
Seek new things to do, and new ways of doing familiar things
Playing with creative problem-solving exercises and intellectually challenging games
Socialize with people outside the conventional occupational and social circles


Curiosity
Openness to learn from others
Change physical perspective by occasionally rearranging own personal furnishing and belongings at the work place
Ask more questions about other people's experiences, interests and opinions
Be more open to any proposal or change

The second component is more complicated because it implies a real commitment from the management. Basically it consists of devising organisational structures, using tools that will make the most of the creative potential of the employees. Details on that subject will be given later in the module.

4.7.3. Factors that influence innovation and Methodology of Systemic Management

Factors that influence innovation

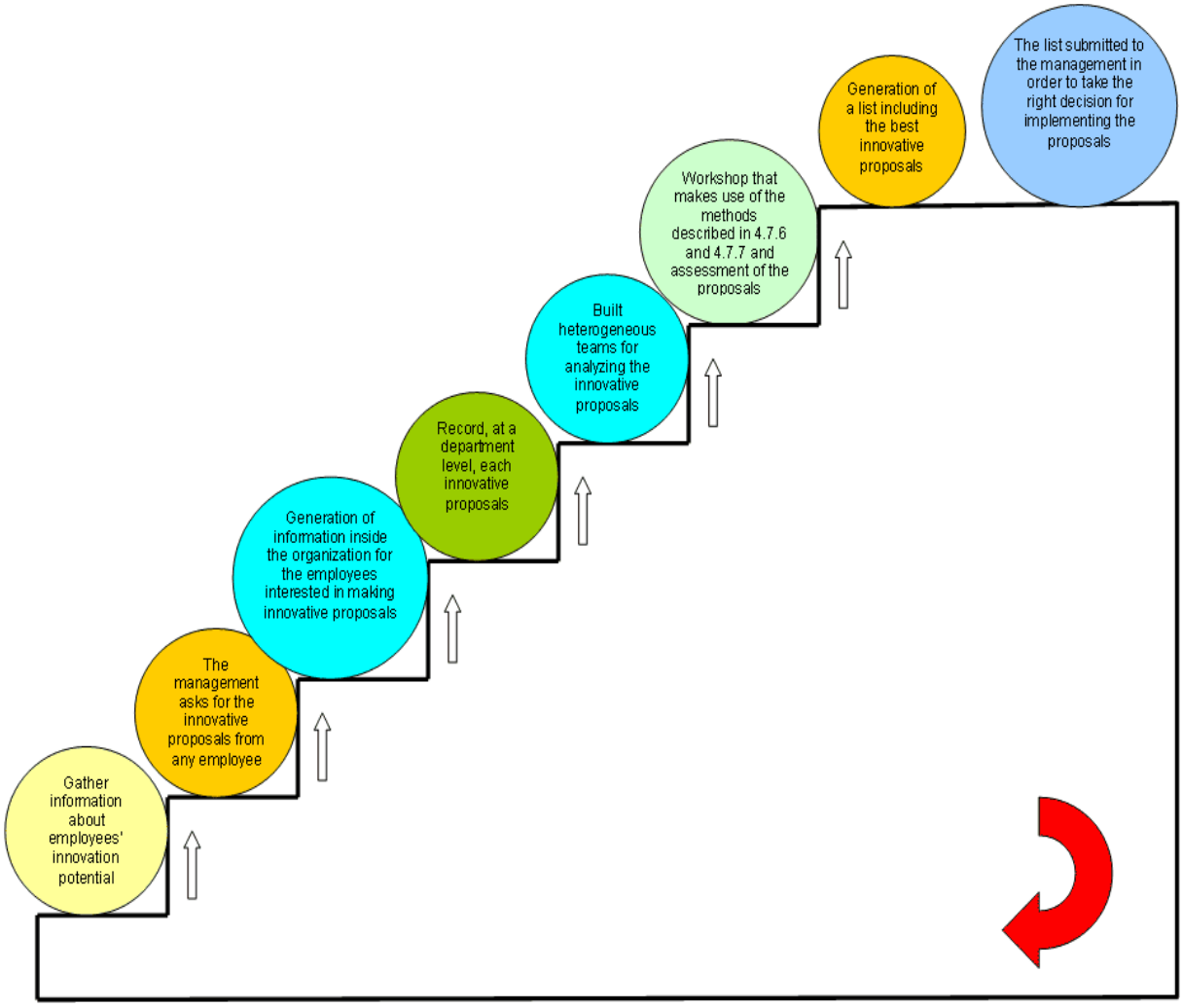
A study carried out by Euroconsult monitored a group of 400 managers, lead to the following results (the figures represent the number of persons that consider that factor as the most important):

Factors that support innovation

- Autonomy, freedom of action, responsibility (52)
- Involvement and motivation of personnel (48)
- Financial support (48)
- Explicit support by the management (36)
- Small team building, project oriented (27)
- A good mixture of competencies (27)
- A good management of the innovation process) (27)
- Good relations with clients (21)

Methodology of Systemic Management of internal innovative proposals

The methodology proposed is a step-by-step approach. Basically it implies a gradual process that aims at stimulate innovation and make sure that the results will be used properly in the firm, and will produce the expected results.



4.7.4. Tools to stimulate creative thinking and help innovative proposals

Brainstorming

The classic creative thinking tool is brainstorming. Its key concept is the enforced separation of the generation of ideas from their subsequent evaluation. It can be used by either an individual or a group, but is usually used as a group process.
A very good example is the case of the Sony Corporation that used the Brainstorming method in order to reconsider changes for the Walkman. A lot of questions were generated: “Smaller? Condensed? Miniature? Lower? Shorter? Lighter? Omit? Streamline? Split up? Understate?" These provocative questions led to Sony’s redesign of the classic tape recorder into a smaller — but groundbreaking — new product: the miniaturized, recordless, speakerless "Walkman".

Analogical Reasoning

The most common creative process is analogical reasoning--the transfer of an idea from one context to a new one. Perhaps 80 percent of creative ideas are rooted in analogical reasoning, and examples abound in every field of human creativity. We also see analogical reasoning in the mechanical realm. The irreplaceable fastener Velcro was inspired by the obnoxious cocklebur. Gutenberg's printing press was a combination of the stamper used for minting coins and a wine press. Finally, virtually every architect and designer keeps stacks of books and magazines filled with ideas waiting to be adopted.
But you need not sit back and wait for analogous connections to appear by themselves. Analogical reasoning can be a conscious technique if you deliberately ask questions like these:

- "What else is like this?"
- "What have others done?"
- "Where can I find an idea?"
- "What ideas can I modify to fit my problem?"

Attribute Listing
Attribute listing is a specific idea-finding technique (one that could even be used while brainstorming). You identify the key characteristics, or attributes, of the product or process in question. Then you think up ways to change, modify, or improve each attribute (in design engineering this is called the substitution method). Almost anyone can "disassemble" a product into its attributes and then think of modifications for most of them. For example, a can of soda has these attributes: size, shape, color, color pattern, decorative theme, material, possible uses after modification, other audiences for the product if modified. Can you invent alterations for each of these attributes? Fran Stryker supplied himself with plots for Lone Ranger radio and television episodes for a couple of decades by modifying these characteristics: characters, goals, obstacles, and outcomes.

Morphological Synthesis (http://www.cc.gatech.edu/faculty/ashwin/papers/git-cc-94-01.pdf)
Morphological synthesis is a simple elaboration of attribute listing. After completing the list of attributes, list changes in one attribute (such as “products”) along the horizontal axis, and list changes in a second attribute (such as “markets”) along the vertical axis. Idea combinations, or syntheses, will appear in the intersections, or cells, of the table. Morphological synthesis will force you to look at many surprising combinations.

Idea Checklists (See ref: "Making hard decisions: an introduction to decision analysis", Robert T. Clemen. Belmont, Calif.: Duxbury Press, c1996. Edition 2nd ed) Have you ever consulted a telephone directory or a supplier's catalog as a "checklist" of resources or ideas for solving problems? You may not know that checklists have been written expressly to solve problems creatively. The best known is Osborn's "73 Idea Spurring Questions." Consider how you would invent a better mousetrap as you read these examples from his idea checklist:

- *Put to other uses*? New ways to use as is? Other uses if modified?
- *Modify*? New twist? Change meaning, color, motion, sound, form? Other changes?
- *Magnify*? What to add? Greater frequency? Longer? Extra value? Duplicate? Multiply? Exaggerate?
- *Minify*? What to subtract? Condensed? Miniature? Lighter? Split up? Understate?
- *Rearrange*? Interchange components? Other sequence? Change schedule?
- *Combine*? How about a blend, an assortment? Combine units? Combine purposes? Combine appeals?

Quality circles http://www.freequality.org
Quality circles were initially a method to improve quality, but they proved very useful also in stimulating innovation in firms. The first quality circles appeared in the 60s in Japan.

A quality circle is a group of persons that work in the same workshop or office, that meet once or twice a week in order to examine how to improve the quality of the products they deliver, the procedures they use, the environment they work in. Basically, the success of the quality circles is based on the feeling the employees get, that they are taken into account that their opinion counts. When implementing quality circles, it is better to start with two-three pilot circles that will be encouraged to function for at least one year.

Suggestion boxes http://www.its.qut.edu.au/cip/qmf/section1/1_2_4/
The method implies the creation of a number of boxes where the employees deposited ideas, suggestions, and innovative ideas. In order to assure the success, a number of issues have to be considered:

- All suggestions, propositions, ideas, have to receive an answer, preferably in a face-to-face meeting. Good ideas will be encouraged, while people with bad ideas will be encouraged to continue.
- The author(s) of ideas that have been implemented has/have to be rewarded.
- The method to not produce results immediately, one has to wait a couple of months, maybe a year.

Innovation engines http://www.accenture.com
Workshops may be a kind of innovation engine in a company. They are important because they help prevent a firm from running out of the initial enthusiasm and voluntary activity.
Well-functioning innovation engines have the following qualities:

- They are regular events
- Well-known fast channels,
- Market-like environments.

Good engines also allow broad enough perspectives to enter the innovation activity. Cross-functionality and/or cross-business-unit (or cross-geography) quality is critical.

Innovation routines http://www.melbourneinstitute.com/wp/wp2003n05.pdf
Innovation is first and foremost a behavioral issue. Hence, innovation routines seek to emphasize the kinds of changes in behavior, attitudes and daily routines that need to be accomplished in order for innovation to become a true capability and not just a slogan. These routines involve new voices and perspectives to be included in the search for innovation. For instance, Theragenics, a medical treatment company in the U.S., involves people from the plant floor in its innovation processes. Cemex, a Mexican cement company, regularly uses all its employees and its customers for ideas. These firms understand that corporations cannot have “out-of-the-box” thinking if the same people are always involved in the discussions. New ideas and fresh thinking are necessary. Other innovation routines may include mentoring of innovators by senior management, seeking advice and resources outside established channels, celebration of successes and learning from failures.

Checks and balances
Finally, checks and balances need to be in place. This is particularly critical in innovation environments that allow people to move forward with their ideas without too much management interference early on.
Such checks and balances certainly include metrics that accelerate or eliminate ideas, experiments and ventures from the innovation pipeline. They involve techniques to assess the value of a pipeline in terms of its growth potential for the company as a whole. And they involve ways to ensure transparency — management and employees may see, at a glance, for instance, what kind of innovations are under development in the pipeline. An important issue, as well, is the manifest passion and commitment to innovations in the pipeline. Finally, innovation incentives need to be carefully balanced. Out-of-proportion individual rewards may create a cut-throat environment for competition that over time is detrimental for cultivating the team spirit necessary to drive complex innovations in alignment with business unit goals. However, potential entrepreneurs may end up leaving the company if the incentive structures don’t recognize the extra efforts and personal risks taken to drive innovation in the organization.

4.7.5. Guidelines for installing a corporate innovation system

1. Always create the motivation first. Then build the basic necessities. Motivation may be about having the right to work on the ideas that one feels passionate about. Or it may be about establishing enough credibility for the corporate commitment to innovation so that it is worth bothering with. In addition, make the rules of the game explicit. Do I have a right to work on my idea for one month exclusively if I submit it to the pipeline? Do I have the right to join an innovation team part-time? What kinds of risks (implicit, career-wise) am I taking if I dedicate my time to innovation?

2. Ensure management commitment - *concretely, consistently and explicitly.* Avoid situations where there is a lot of talk but no action. That is a sure way to erode the credibility of the entire effort for years to come.
Open up the strategy dialogue about innovation so that general managers talk to each other, to their organizations, and to top management. Then create a platform that has commitments such as:

- I will invest 5% of my budget in the innovation pipeline.
- I will dedicate 10% of my time to mentoring innovators in my business.
- I will evaluate the success of innovative efforts according to the following targets: 50 ideas in the next 6 months, 5 experimental business concepts in 12 months, 2 ventures ready for commercial launch within 24 months, 10% of innovation projects in the pipeline receiving support from my organization in the form of labor, seed capital or use of other assets.

Also, ensure that you obtain the cooperation of middle managers.

3. Start the innovation engines. Innovation is hard work. Most managers make the mistake of assuming it will just happen. There may be a few ideas floating out there that are going to be easy to harvest, but beyond such easy catch it is going to take time, energy and dedication. Create your innovation engines that will drive the effort over time. For example, at Kraft Foods, a small dedicated staff skilled in networking with the business divisions is driving innovation. R&D labs often function as an engine, but the challenge is to build the capability for turning technologies or scientific discoveries into business concepts.

4. Cultivate innovation routines, and name your innovation ambassadors. Study what makes innovation tick in the organization; catalogue what has worked and what hasn't. Identify people who can mentor others in these routines. Name your innovation ambassadors and let them spread the best practices. For example, computer-services company EDS has instituted a fellows program to recognize innovative individuals who can serve as mentors for aspiring innovators in the company. Appointment to fellow does not change an employee's work function or business unit. But, in exchange for the honour, fellows assume an ambassadorial role in the company. As ambassadors, they typically spend a fair amount of time presenting their ideas to clients, speaking at professional conferences, or representing EDS at industry consortia.

5. Put the checks and balances in place. Assess their effectiveness and purposefulness regularly. It is difficult to get the criteria, metrics and innovation incentives right the first time. Adjust them periodically based on your accumulating experience. Focus on quantity first to develop an innovation habit. Then slowly move to quality to make the most efficient use of resources. Over time, link the use of the best-practice innovation routines to the evaluation. And, finally, reward your executives as entrepreneurs - not simply as stewards of the corporate legacy.

4.7.6. Case studies

Case study 1

A firm's (working in house appliances) experience in organizing quality circles can be summarized as follows:
A first quality circle has been created in the assembly workshop. The circle comprised of 12 workers, under the supervision of a foreman. They met one hour every week. After one year, they achieved the following results:

- 25 improvements at the working places (posts)
- 17 product modifications
- 5 proposals for improving the safety
- 10 simplifications of administrative forms used in the workshop
- Improvement of a machine tool. The costs were approximately 100 euros, and the benefits of about 70000 euros.

The quality circle functioning was the following:

Propositions were made during the meetings, they were then discussed and taken to the engineers. At the beginning the proposals were not seriously considered. Then they imagined a form with three columns (like below). In 15 days the management has to return the form with the third column filled in. The form had been displayed in the workshop.

Problem	Solution	Measures to be taken for applying the solution
…..	…..	…..

In order to obtain better results, the members of the circle also followed courses on: team working, use of board platforms, methods to improve innovation (brainstorming, Ishikawa diagrams, Pareto diagrams, mind-mapping, statistical analysis etc).
In order to assure the success of quality circles, some ideas have to be considered:

- they have to be supported by the management;
- they have to be supported by people with academic degrees;
- they have to be accompanied by campaigns of dissemination and increased visibility;
- they have to be helped by a support team (eventually outside bodies that can inform, train, organize).

Case study 2

Starting with March 2003, in the Romanian Bank for Development - RBD - (member of Groupe Société Générale), a program called “innovation” started. The aim of the initiative was to maintain a permanent flow of ideas and communication between the person/team that had the idea and an Innovation Committee in the RBD Central Headquarters. More, annually prizes are granted for the best and most innovative ideas.

The program functioning:

The program will evolve in stages:

- Initiation: all the departments and groups will designate a correspondent responsible with innovation (Innovation Correspondent – IC).
- Transmission: all the ideas/innovations will be centralized using a common e-mail address. The person responsible for the sending the idea is the IC. Here a person/group will centralize the ideas and a first selection will take place. Ideas can also be sent through regular mail.
- Selection: Ideas that passed the initial selection are further analyzed and one verifies if they respond to a read need/problem, if they are feasible. All the people that sent ideas will receive confirmation of receipt of the idea(s)/innovation(s).
- Assessment: Ideas will be scored (marked) in accordance with a predefined grid.

A central Innovation Committee will be created at a central level. This committee will meet every two months and its main role will be to evaluate the ideas/innovations. Also the committee will analyze the feasibility of the idea(s) and will approve the process of putting it into practice.

The first three ideas will receive important prizes: the first prize: a trip to Paris (3000 Euros), second prize 1600 Euros and the third prize 1000 Euros.

One has to mention that every employee has the right to participate to the program. The above case study involves a large organization, but a simplified version can be envisaged also for a SMS”.

1.4. PHARE RO2003/005-551.05.03.02.069 Project „Develop an educational package into a web framework in order to develop innovative skills for the employees of SMEs”

This project was implemented during the period March 2006 and February 2007. In this project I was responsible to design a methodology that could measure the innovative potential of SMEs. Specifically, the methodology has to underline the possibility to develop innovative skills for the employees of SMEs, by proposing innovative themes that could help SMEs to get superior technical and financial performances by using the creative potential of their human resources.

This methodology takes into account to highlight the relevant and recoverable aspects regarding the possibility of developing innovative skills to employees from SMEs.

It is normal that the methodology to capture some point and that is why the elements will be pursued in particular:

- theme opportunity; innovativeness of the idea; running costs of the proposal implementation concomitant with the emphasis on sources of funding (through its own resources or through external financing) and in what proportion; the objective content and perfectly feasible of the implementation strategy for the proposal; the realism and rationality of the proposed innovative methods; the existence of concrete proposals to improve the platform proposed by the program.

General analysis of the proposals may take into account several scenarios:

a) consideration of a smaller number of elements;
b) consideration of equal importance to the issues mentioned above;
c) providing differentiated weighting coefficients (k) to considered elements.

Following a previous study and discussions with some experts in the proposals assessment will be considered as vital elements:

-innovative character of idea;
-the costs for running the proposal concomitant with an emphasis on sources of funding (through its own resources or through external financing) and in what proportion;
-the realism and rationality of the proposed innovative methods;
- theme opportunity.

The level of importance in the overall assessment will consider the following:

a) the innovative nature of the idea: k = 0.4 ;
b) the costs for running the proposal concomitant with an emphasis on sources of funding (through its own resources or through external financing) and in what proportion: k = 0.3 ;
c) the realism and rationality of the proposed innovation methods: k = 0.2 ;
d) theme opportunity: k= 0.1.

The scores for each analyzed aspect will range between 1 and 10 so that the on the whole evaluation of each theme it will be a cumulative score also located between 1 and 10 (through the weighted coefficients). On this basis can be achieved a ranking of the proposals.

To make objective assessment will be considered the proposal assessment in two situations:

1.the evaluation criteria are of equal importance;
2.the criteria have different importance.

This methodology was applied in the case of 20 SMEs from Ploiesti and Prahova county. Each company had to answer to a questionnaire which contained a well defined structure: identification Data Company, identification data of the authors of the proposed idea, summary description of the topic, the implementation strategy of the idea, highlighting the innovative nature of the idea, evaluating the approximate cost of implementing, proposed innovation methods or techniques, suggestions for improving the project platform.

1.5. GLOBE – Romania Project

This project refers to the framework of Global Leadership and Organizational Behaviour Effectiveness Research Program (GLOBE), an existing research program with 62 participating cultures, with the intention of extending it to Romania.

GLOBE is directed toward the development of systematic knowledge concerning how cultures affect leadership and organizational practices in sixty nations. GLOBE addresses two major issues. The first concerns the universal processes by which transmission of cultural influences take place with respect to three levels of analysis: societal, organizational, and leader. The second, and equally important issue addressed by GLOBE concerns the unique (culture specific) leadership and organizational processes in each of the 62 cultures studied. The specific topics of investigation are the relationships between the societal level cultures of the managers studied, the practices of the organizations of which they are members, leader attributes, leadership behaviors, and the effects of leadership on others.

In Romania' case the industries studied are food processing, financial services and telecommunication services. These industries were selected because they are universal and because we expect to have access to a substantial amount of data about them. The middle managers will be typical middle managers of the three industries

The research program was expected to have several additional beneficial social and economic applications. Within regions, countries that share similar regional resources and backgrounds can make comparisons to determine similarities and differences among themselves, and share ways to improve inter-country relationships, economic productivity and quality of citizen life. The research program was also expected to lead to increased communication between cultures which normally would not have relations and contacts with each other, and thus result in a. greater cultural awareness and social interaction between nations.

The research thus had significant implications for inter-cultural interaction: increased communication between peoples of different cultures, increased quality of that communication, and positive political and economic relationships between countries.

The Country Co-Investigators (CCIs), being indigenous to their cultures, are likely to be influence and change agents within their cultures at least with respect to those with whom they have contact in their roles as university faculty members, social scientists, and consultants. The intra-country social influence of the CCIs will most likely be substantially enhanced by participating in the research. These CCIs, in turn, were served as country boundary spanners and were facilitated importation and transfer of knowledge within their countries.

GLOBE select Country Co-Investigators who has the license to translate the questionnaire, use the research instruments, and represent GLOBE in the participating countries. Doina Catană and Alexandru Catană, Professors of Technical University, Cluj--Napoca and Bakacsi Gyula (Dean of Sapientia University, Miercurea Ciuc) hold the rights of CCIs for Romanian research.

Also in the project-management team were another two persons: Kiraly Agota from Sapientia University, Miercurea Ciuc as Administrative project Co-ordinator and Lazar Ede also from Sapientia University, Miercurea Ciuc as Mathematical-statistical project Co-ordinator. Doina and Alexandru Catană and Bakacsi Gyula (Country Co-Investigators of GLOBE-Romania research project) agreed to involve academic scholars from Universities all around Romania to carry out the research, founding a research Consortium, of which they are founding members. Joining members have equal rights in the project.

The participating members in the Consortium were contributed to the GLOBE-Romania project forming groups that represents their fields as sub-projects. Each sub-project nominated a sub--project leader. I was Sub-project leader for University Petroleum-Gas from Ploieşti. In this complex research were involved 48 persons from 11 Romanian universities which create the GLOBE- Romania Research Consortium.

The names of all these persons and the corresponding affiliation are: Gheorghe Alexandru Catană, Doina Catană (Universitatea Tehnică din Cluj-Napoca) and Gyula Bakacsi (Universitatea Sapientia, Miercurea Ciuc) – Country Co-Investigators of Globe-

Romania research project; Gheorghe Bălan (Universitatea din Piteşti), Gabriel Bîzoi (Universitatea de Vest Timişoara), Nicolae Bibu Aurelian (Universitatea de Vest Timişoara), Viorel Bucur (Universitatea din Piteşti), Casian Valentin Butaci (Universitatea Agora din Oradea), Buzogany Agnes (Universitatea Sapientia, Miercurea Ciuc), Alexandru Căpățână (Universitatea "Dunărea de Jos" din Galați), Emil Cazan (Universitatea de Vest Timişoara), Lucian Chiriac (Universitatea Petru-Maior din Târgu-Mureş), Liviu Ciucan Russu (Universitatea "Petru-Maior" din Târgu-Mureş), Delia Ştefania Ciurba (Universitatea Agora din Oradea), Cătălin Ioan Clipa (Universitatea "Alexandru Ioan Cuza" din Iaşi), Anca Constantinescu Dobra ((Universitatea Tehnică din Cluj-Napoca), Mirela Cristea (Universitatea din Craiova), Radu Cătălin Criveanu (Universitatea din Craiova), Ion Criveanu (Universitatea din Craiova), Maria Criveanu (Universitatea din Craiova),Csata Andrea (Universitatea Sapientia, Miercurea Ciuc), Raluca Drăcea (Universitatea din Craiova), Ioan Dzițac (Universitatea Agora din Oradea), Simona Mirela Dzițac (Universitatea Agora din Oradea), George Enescu (Universitatea Petrol-Gaze din Ploieşti), Loredana Florentina Galea (Universitatea Agora din Oradea), Gheorghe Ionescu (Universitatea de Vest Timişoara), Ion Iarca (Universitatea Petrol-Gaze din Ploieşti), Kolumban Gabor (Universitatea Sapientia, Miercurea Ciuc), Lazar Ede (Universitatea Sapientia, Miercurea Ciuc), Liviu Onoviu Marian (Universitatea "Petru-Maior" din Târgu-Mureş), Nagy Istvan (Universitatea Sapientia, Miercurea Ciuc), Ştefan Andrei Neştian (Universitatea "Alexandru Ioan Cuza" din Iaşi), Panaite Nica (Universitatea "Alexandru Ioan Cuza" din Iaşi), Rozalia Nistor (Universitatea "Dunărea de Jos" din Galați), Adriana Olaru (Universitatea "Dunărea de Jos" din Galați), Constantin Oprean (Universitatea "Lucian Blaga" din Sibiu), Ioan Petrişor (Universitatea de Vest Timişoara), Bogdana Pop (Universitatea Agora din Oradea), **Cătălin Popescu** (**Universitatea Petrol-Gaze din Ploieşti**), Sanduly Edit (Universitatea Sapientia, Miercurea Ciuc), Elena Sărătean (Universitatea de Vest Timişoara), Daniela Ştefănescu (Universitatea "Petru-Maior" din Târgu-Mureş), Szabo Arpad (Universitatea Sapientia, Miercurea Ciuc), Zsuzsanna Szabo (Universitatea "Petru-Maior" din Târgu-Mureş), Tanko Zoltan (Universitatea Sapientia, Miercurea Ciuc), Mihail Ţîţu (Universitatea "Lucian Blaga" din Sibiu), Silvia Vlad (Universitatea de Vest Timişoara).

Consortium was expected to collect a data base according to the GLOBE sampling policy. Once contributing to the overall (cross-cultural) GLOBE research data base, members are eligible to extend the research to other samples, and publication purposes. Members collectively decide on research extensions.

It was signed a Consortial Agreement discussed and amended on 7th of September 2006. With this occasion was proposed a very rigorous policy concern intellectual property. In this light I would like to present some important issues.

Consortium applies the Intellectual Property Policy of the overall GLOBE Project. In terms of ownership:

1. Data are jointly owned by GLOBE and the Consortium members who collected the data;
2. The overall Romanian data base, centrally-done analyses, scales, instruments and protocols are owned by the Consortium members collectively;
3. Translated instruments are jointly owned by GLOBE and the CCIs (Doina and Alexandru Catană) who provided the translation. According to GLOBE Constitution the questionnaire is the intellectual property of GLOBE, and the translated questionnaire is the intellectual property of Doina and Alexandru Catană. GLOBE and Doina and Alexandru Catană kindly provided the questionnaire for the purpose the consortial research project GLOBE-Romania. We use the questionnaire with the permission of GLOBE and Doina and Alexandru Catană. No other use is possible without their written agreement!

In terms of authorship and copyright:

1. Authorship of planned Romanian research results in the consortium projects will include all Members who have contributed to the project. By default rule, the order of appearance will be alpha by family name unless there are obvious primary and secondary roles which dictate another order;
2. Once contributing (and only if contributing) to GLOBE-Romania data base,

Consortium members representing Faculties and/or Universities (sub-project) are eligible to initiate bi-lateral and multi-lateral joint-research and publication with each-other.

In terms of access policies:

1. Members have free access to Consortium-owned research material;
2. Non-members desiring, to use Consortium-owned research material will address requests to the Consortium. If the Consortium finds reason to approve such a request, it will: a) specify the conditions of use, b) may charge a usage fee, c) require the non-member user to provide to the Consortium all data collected using Consortium-owned research material, and d) hand over to the Consortium any royalties or fees earned by the use of such material;
3. Data collected by non-members and provided to the Consortium will not be used for purposes that will preempt the major objectives or hypotheses for which the data were collected. Such data may be used for other research purposes by members or non-members with the approval of the Consortium.

The Final Report on the results of Globe Romania project has 84 pages, including 8 appendixes.

Members of the consortium had the opportunity to present their research in some conferences. In the following I will include the content of the paper called: Leadership's patterns within banks and financial organisations from Romania, which represent the contribution of the GLOBE project team from University Petroleum-Gas from Ploieşti. This paper was presented with the occasion of VIII Chemnitz East Forum called "Cooperation between East and West: Westernization of the East or Easternization of the West?" which took place in Chemnitz, Germany in 2007 between 13 and 15 of September.

The content presented to the conference was suffered some changes in order to be included, at that time, in a special issue of the Journal of East European Management Studies. Before to present the paper I would like to mention that main tables and figures are included with the permission of Assoc. Prof. Gyula Bakacsi (Universitatea Sapientia, Miercurea Ciuc) – Project Manager and Country Co-Investigators of Globe-Romania research project. For this, the team' members from Ploiesti are grateful and thanks for the opportunity to present a research related with the GLOBE Romania research Project.

Paper topic: Spread of management practices in CEE countries compared to the West.

Presented Content (including the changes made for the journal)

We, from Central and East European countries, and especially we, from Romania have to face with a big problem of our time: leadership of our organisations. Now, when the last obstacle is down, I mean our integration in the EU is fulfilled, we need to analyse impartial the level or the stage concern the leadership of our organisations in terms of comparison with similar structures from EU countries. Why this? Because we have to recognise, the economical gap between Romania and many other countries from Western Europe still is very important and the real reason of this gap drive, firstly, to the leadership. We have a poor level of productivity, we have poor performances and we have a very weak relation motivation-performance. This paper tries to underline honestly, objectively and, as much as possible, transparently the present state concern the leadership in one of the most important and dynamic domains: finance and banking. For this we used the results obtained from one of a very important and extended international research that has made in Romania: Globe Romania. Of course, we were involved in this research and we have the approbation to publish a paper with this subject.

Present paper, which describes some results of GLOBE Romania research project, is a resume about leadership concern, first of all, the middle management level in three important kinds of organisations and secondly, focused on the banks from Romania. This project, funded by Hungarian Telecom, was carried out by a consortial cooperation of 12 universities in Romania at the end of 2006.

The research is based on:

- 362 questionnaires on national culture (Beta version); every questionnaire had to be completed in 60 minutes; each questionnaire contains a total of 217 questions,

divided in 5 sections: sections 1 and 3 refer to Romania, sections 2 and 4 concern the leaders and management in Romania and final section is about the person which participate to the questionnaire);

What is important is that, usually each question from sections1 to 4 has 7 levels of appreciation in order to mark the opinion of each respondent to the questionnaire.

- 365 questionnaires on organisational culture (Alpha version); every questionnaire had to be completed in 60 minutes; each questionnaire contains a total of 214 questions, divided in 5 sections: sections 1 and 3 refer to the organisation of any respondent, sections 2 and 4 concern the leaders and management from organisation and final section is about each person which is respondent to the questionnaire);
- 356 questionnaires on leadership (both versions).

With the permission of persons involved in the GLOBE Romania research project, especially thanks to Bakacsi-Catana-Catana we could deliver the contribution given by different members of the research project (see table 1.2).

Table 1.2. **The composition of the sample by the contribution of consortium member Universities**

UNIVERSITIES	FOOD INDUSTRY			COMMERCIAL BANKING			TELECOMMUNICATION				TOTAL	
	no. of Companies	*no. of questionnaires*		*no. of Companies*	*no. of questionnaires*		*no. of Companies*	*no. of questionnaires*		*no. of Co m-pan ies*	*no. of questionnaires*	
		alpha	**beta**		**alpha**	**beta**		**alpha**	**beta**		**alpha**	**Beta**
Agora University of Oradea	-	-	-	-	-	-	-	-	-	-	27	21
"Alexandru Ioan Cuza" University of Iaşi	3	9	9	3	19	19	2	6	6	8	34	34
The Vest University of Timişoara	2	12	10	4	47	47	2	9	9	8	68	66
University of Craiova	-	-	-	8	17	16	2	5	3	10	22	19
Piteşti University	-	-	-	5	16	15	-	-	-	5	16	15
University "Dunărea de Jos" of Galați	3	9	9	5	20	20	4	10	10	12	39	39
"Lucian Blaga" University from Sibiu	2	9	9	3	6	6	-	-	-	5	15	15
Petroleum-Gas University of Ploieşti	-	-	-	1	8	8	-	-	-	1	8	8
Petru Maior University, Tîrgu-Mureş	4	17	17	7	18	18	3	7	5	14	42	40
Sapientia University, Miercurea-Ciuc	5	28	28	2	5	5	1	13	12	8	46	45
Technical University of Cluj-Napoca	2	5	9	6	31	19	7	31	32	15	67	60
									TOTAL	86	384	362

Notice. Most of the respondents filled both Alpha and Beta version of the questionnaire (not duplicating the Leadership questionnaire blocks).

Source: Bakacsi-Catana-Catana et al., Globe Romania, Final report, 2006., p.2.

Also is important to mention that the number of companies that was involved in the research and which belongs to commercial banking was 44 with a total of 195 respondents.

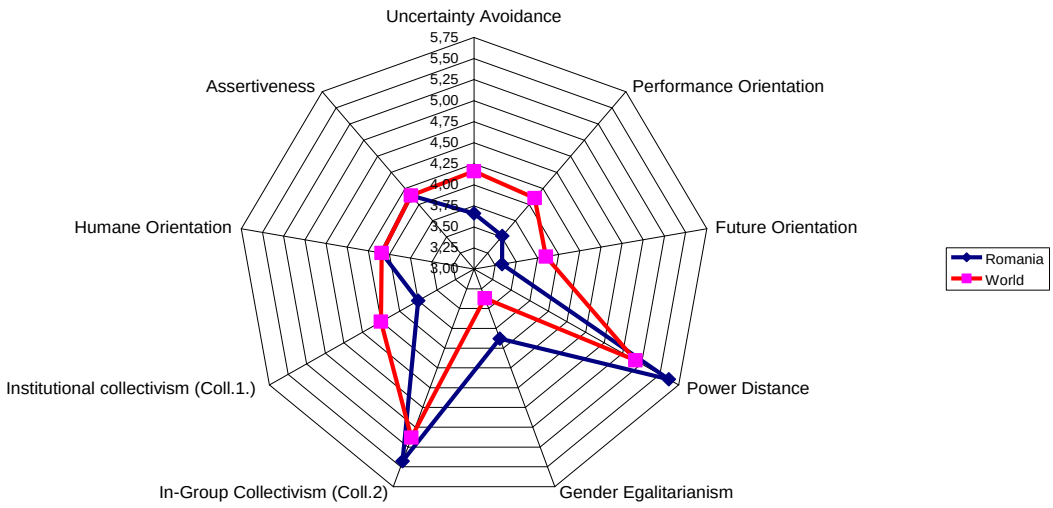
In the research was involved only the middle managers from the companies; organisations involved in research are related with three kinds of industries (as was already mentioned before in the abstract):

- telecommunication industry;
- finance industry;
- food processing industry.

In the next phase, the questionnaires were fulfilled by these managers and then the questionnaires were gathered by the research teams from the universities in order to process data. The method for processing data was the well known *set of statistical tools* in order to resume the information and interpreting the results. In order to explain this last idea, for many variables, parameters or characteristics were use the calculation of the rank of the cultural variables and the mean, the level of standard deviation, the standard error and ANOVA tests.

With this occasion we could supply, for instance, some conclusions of the final report. First of all, in connection with societal culture, looking to figures related with societal practice variables we could use the comparison of Romanian cultural profile to the world average (see figure 1.3).

Figure 1.3. **Comparison of Romanian cultural profile to the world average (societal practice)**[1]



Source: Bakacsi-Catana-Catana et al., Globe Romania, Final report, 2006., p.14.

In this way:

- Romanian middle managers perceive relatively high power distance and would like to substantially reduce this high power distance in their society;
- Orthodox religion has been developing a strong cult for hierarchy, obedience and submission to the authorities in charge;
- The balance of power is still strongly biased towards the upper end of the society; middle class is still developing, although the situation is improving fast;
- At top level managers mostly belong to the older generation, managing mostly by ”experience”, few having training in management, with limited real managerial competence;
- At middle level, mangers are of a medium age and young, possessors of new managerial competences developed in the new market economy.

Also:

1) concern uncertainty avoidance

- Romanian middle managers feel relatively high uncertainty and would like to belong to a society much more certainty, and predictable environment.

2) in terms of institutional collectivism

- Romanian middle managers perceive relatively high individuals and would like to belong to a much more collectivistic society;
- People from Romania, perceive as unfair the ratio between give and receive, expecting to receive from society, from others, and give afterwards, if they have what to be given.

[1] Please notice, that in order to make the differences more tangible the scale of web chart spreads from 3 to 5,75.

3) related with in-group collectivism
- Romanian middle managers seem to perceive and expect much more collectivism, cohesiveness and cooperativeness in their closer community compared to their perception on their broader social environment

4) concern gender egalitarianism
- Romanian middle managers seem to perceive and expect femininity and gender egalitarianism in a relatively masculine world. Actually the number of Romanian women working practically in most of the jobs and professions, at every managerial level, including banks has increased during last years;

5) in terms of assertiveness
- Romanian middle managers perceive a high assertiveness in their society;

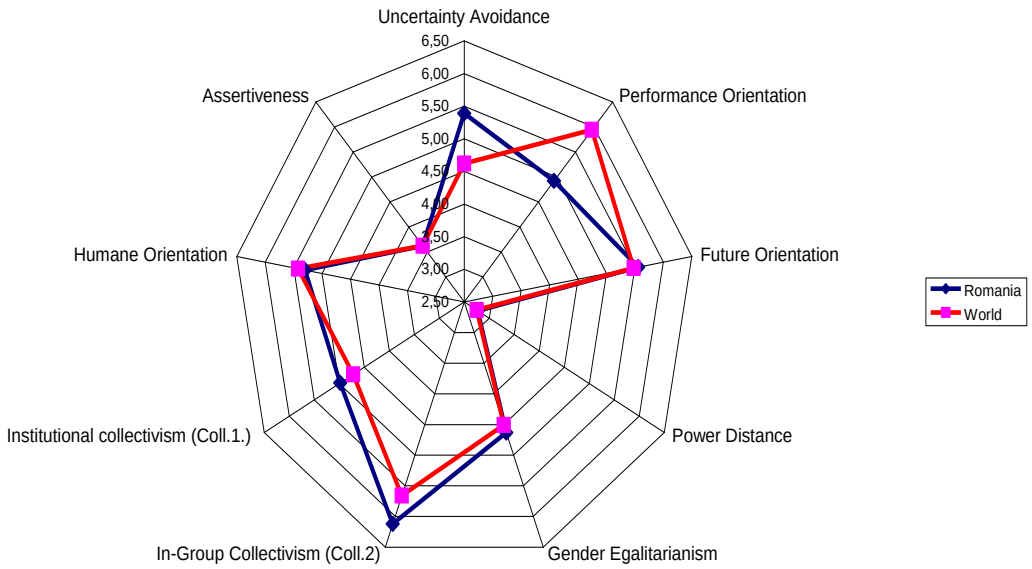
6) referring to human orientation
- Romanian middle managers seem to perceive their social environment as being relatively high human oriented;

7) concern performance orientation
- Romanian middle managers do not seem to perceive a social environment that encourages and rewards performance;

8) in terms of future orientation
- Romanian middle managers seem to perceive a society focusing rather on the present that planning for the future.

When we discuss the problem concern some leadership's pattern for the managers from Romania we have, also, to start from another kind of comparison. This time is about Romanian cultural profile in comparison with the world average (see figure 1.4).

Figure 1.4. **Comparison of Romanian cultural profile to the world average (societal values)[2]**



Source: Bakacsi-Catana-Catana et al., Globe Romania, Final report, 2006., p.19.

A conclusion could be made here: Romanian middle managers' expectations are pretty close to the world average, maybe less two variables: Romanian middle managers' tend for lower Performance orientation and also they want to avoid uncertainty even more than most of the people from all over the world.

If we look on the results on organisational culture we have to use a table that shows the ranks of the nine cultural variables at the organisational level, as it is practiced (see table 1.3).

[2] Please notice, that in order to make the differences more tangible the scale of web chart spreads from 2.5 to 6.5.

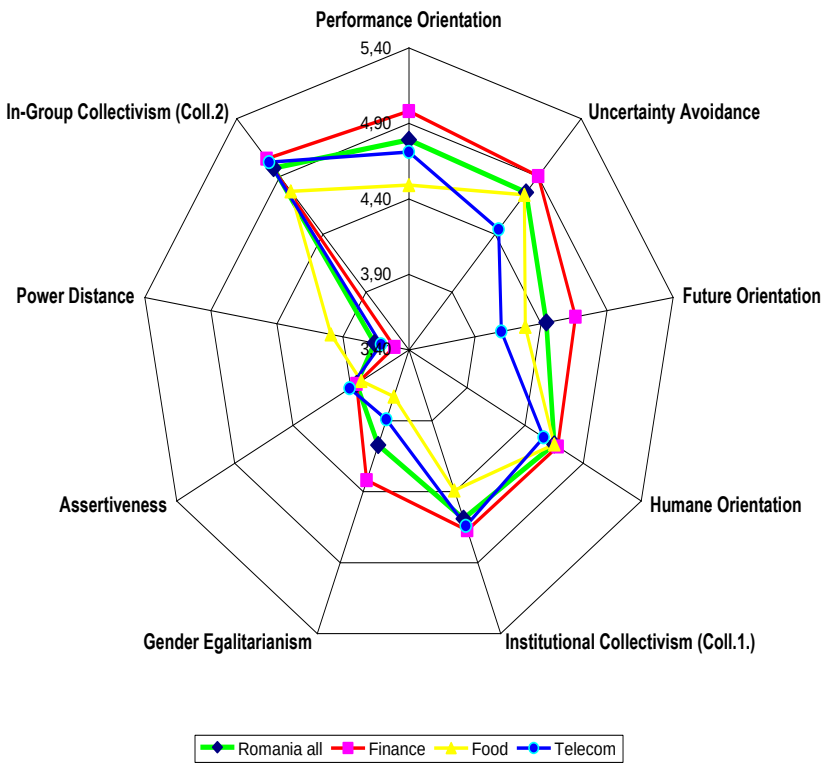
Table 1.3. **Rank of the nine organizational cultural practice variables at the organizational level**

	ALL INDUSTRIES		FINANCE		FOOD		TELECOM	
	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean
In-Group Collectivism (Coll.2)	1	4.97	1	5.05	1	4.77	1	5.02
Performance Orientation	2	4.79	2	4.98	4	4.49	2	4.71
Uncertainty Avoidance	3	4.76	3	4.9	2	4.74	5	4.44
Humane Orientation	4	4.65	4	4.68	3	4.65	4	4.56
Institutional Collectivism (Coll.1.)	5	4.59	5	4.67	5	4.39	3	4.64
Future Orientation	6	4.44	6	4.66	6	4.28	6	4.1
Gender Egalitarianism	7	4.07	7	4.32	9	3.73	8	3.89
Assertiveness	8	3.85	8	3.85	8	3.81	7	3.91
Power Distance	9	3.66	9	3.51	7	3.99	9	3.61

Source: Bakacsi-Catana-Catana et al., Globe Romania, Final report, 2006., p.26

What is important from the table 1.2 and is referring to the paper subject is that financial sector tends to score highest with at least seven from all nine dimensions (more than 4 for the mean). As is suggested in the final Globe Romania report these values are explained by the fact that commercial finance industry was the first fully restructured sector in Romania (figure 1.5).

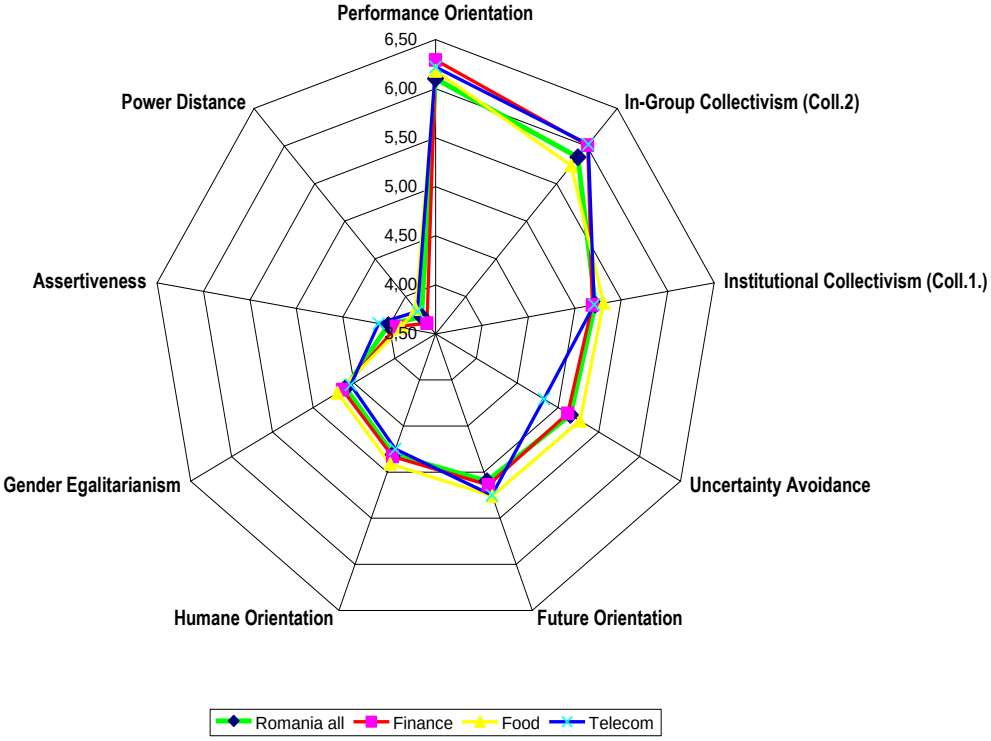
Figure 1.5. **Organizational practice profile of Finance, Food, and Telecommunication industries, compared to the grand-mean of Romania**



Source: Bakacsi-Catana-Catana et al., Globe Romania, Final report, 2006., p.26

Again is necessary to present the organizational values profile (for what as should be) in order to have the possibility to compare the two types of organizational culture given by organizational cultural practice variables at the organization level and organizational cultural values variables at the organizational level (figure 1.6).

Figure 1.6. **Organizational values profile of Finance, Food, and Telecommunication industries, compared to the grand-mean of Romania**



Source: Bakacsi-Catana-Catana et al., Globe Romania, Final report, 2006., p.28

Why is so important to make these comparisons? Because is compulsory to build a final general comparison between organisational and societal culture in order to identify some patterns of leadership that characterized middle managers from Romania. As is mentioned in the Globe Romania - Final report, 2006 (p.28), Romania is the field of cultural development in which cultural pragmatism of the organizations evolves on the enough humanist foundation of the Romanian societal culture.

In order to explain much better how the leadership of the companies from Romania, especially from the banks and finance institutions could be supervised, developed and improved we have to present some approaches concern the leadership concept. According to Bass, leadership has been conceived as the focus of group processes, as a matter of personality, as a matter of inducing compliance, as the exercise of influence, as particular behaviors, as a form of persuasion, as a power relation, as an instrument to achieve goals, as an effect of interaction, as a differentiated role, as an initiation of structure, and as many combinations of these definitions. In Globe research there is another definition: leadership is the ability of an individual to influence, motivate, and enable others to contribute toward the effectiveness and success of the organizations of which they are members (the Globe Romania -Final report, 2006, p.44 and House et al, 2004, p.15).

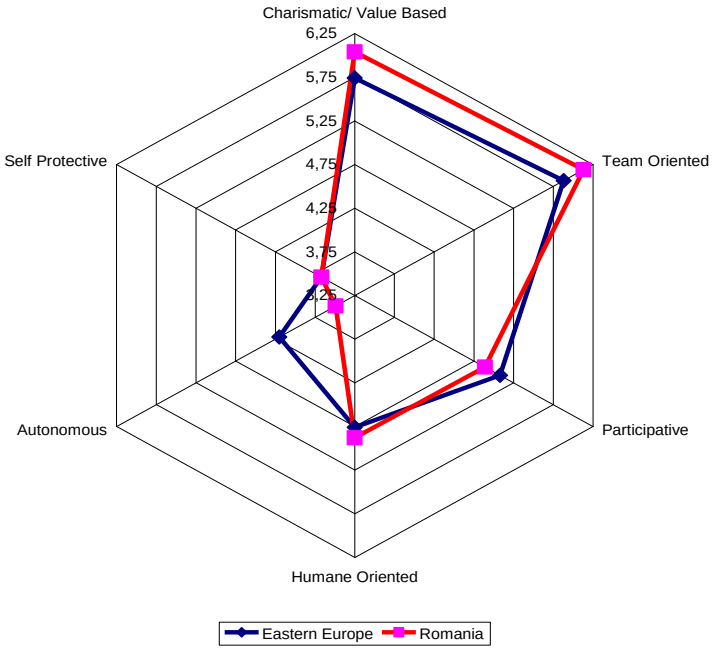
Although the research literature has not generally supported the development of a singular robust leader model, the popular management literature continues to advance sets of traits and behaviors as nearly universally applicable. A recent version of the model leader literature focuses on analyzing significant trends in organizations and in the broader society to identify the leadership skills and traits that are most conducive to success within emerging forms of organization and evolving societal expectations (Hesselbein et al. 1996).

On the Globe Romania research the leadership has been measured by 112 items. As is mentioned in the final report at page 44, conceptually the leadership construct of Globe is normative, reflecting the expected behaviour, traits and attributes of outstanding leadership in different cultures, rather that measuring how the leadership actually looks like.

Looking distinctive to the leadership problem the research evidence shows, which the most valued expected leadership characteristics in Romania are the following: being

performance oriented, benevolent, team integrator, inspirational charismatic, administratively competent, decisive, holding integrity and visionary charismatic. As a second group of leadership characteristics are being diplomatic, collaborative team oriented, self –sacrificial charismatic, modest, and non-autocratic. A third group seems to be more or less neutrally evaluated, being status conscious, participative, humane oriented, conflict inducer, procedural, autonomous and face saver. In the attempting to create some profile patterns for the middle managers from the banks from Romania, we could say that Romania shows quite similarity to the Eastern –European profile. For a better comparison and also confirmation let's take a look on the outstanding leadership profile of Romania and to the Eastern European cluster profile:

Figure 1.7. **Comparison of Romanian outstanding leadership profile to the Eastern-European cluster average (societal values)**[3]



Source: Bakacsi-Catana-Catana et al., Globe Romania, Final report, 2006., p.68

Looking to present trends from EU and especially what is happen in west European countries is necessary to identify what could be used, transferred or changed from west European companies for Romanian organizations.

Organizations tend to become more internally complex in order to respond to the external complexity (Lawrence and Lorsch 1967), and one way to deal with the demands of increased internal and external complexity is to organize around teams (Galbraith 1994). Teams then conduct the basic work of the organization. Teams are defined and staffed with varying levels of permanence and typically bridge historic line organizations. This organizational pattern is particularly relevant to science and technology based organizations, given the complexity of the environments that these organizations face. The types of leadership skills that are necessary to operate this type of organization include functional or technical competence, broad-based knowledge of the organization, interpersonal and conflict resolution skills, decision-making skills, learning skills, communication, meeting management, and interpersonal influence (Mohrman et al. 1995). When we speak about commercial finance industry, even it could be considered the most advanced domain in terms of leadership and management we have to cope with EU requirements. We have to take in account that Kotter defines the essence of leadership as "coping with change", and management as "coping with complexity." Also, we need to know that the management activities include planning and budgeting, organizing and staffing, controlling and problem

[3] Please notice, that in order to make the differences more tangible the scale of web chart spreads from 3 to 6.5.

solving. In contrast, Kotter describes the key leadership activities as setting a direction, aligning people (with the direction), and motivating and inspiring. Thus, management is more administrative, leadership more interpersonal.

In order to respond to current requirements and developments that refer to banking and finance domain, we need to develop some leadership's patterns within banks and financial organisations from Romania. To do this, we extend the research from GLOBE Romania with another questionnaire which is based on questions related with leadership styles and power types. The questionnaire was delivered to 30 important banks that operate on Ploiesti's banking and financing market (the total number of distributed questionnaires was 150). The respondents were, most of them, people from different levels of management within banks. Finally, we received back 58 questionnaires (from 12 banks). In design of our questionnaire we were inspired by a paper[4] which present a complex survey on 560 managers (here were included also CEOs and non-CEOs) from Queensland, Australia. The main aim of the survey was to identify the patterns across the main behavioural dimensions of leadership.

After we process all the responses to this questionnaire we identify the top four most common leadership style patterns:

Table 1.4: **Top 4 most common leadership style patterns concern banks and financial organisations from Ploieşti, Romania**

Pattern Rank No.	No.	%	Decision-Making Style	Commun--ication Style	Managerial Style: Task	Managerial Style: Relationship	Motivational Style: Inspiration	Motivational Style: Exchange	Conflict Style: Assert-iveness	Conflict Style: Cooperat--iveness
1	14	24	Autocratic	Closed	High	Low	Low	Low	High	Low
2	11	19	Collaborative	Open	High	High	High	Low	Low	High
3	9	15,5	Collaborative	Open	High	High	High	Low	High	Low
4	7	12	Collaborative	Open	High	Low	Low	Low	High	Low
Total	41	70,5								

Observing table 1.4 we can't find a style pattern that could be considered as an overall leadership style for banks or financial organisations in Ploiesti and also for Romania. If we try to find a reason for this, we could say that there is diversity for this financial domain: we could find here in Romania public and private banks, domestic and foreign banks, small and big banks. Anyway, we identified that concern leadership styles named *managerial style: task* and *motivational style: exchange* we have similar opinions expressed by the respondents to the questionnaire, and for this we have some explanations such as:

- managers from banks are very focused on task achievement and on achieving results;
- managers have a behaviour directed in a very task-oriented manner;
- usual managers provide rewards in exchange for extensive or additional work;
- managers give subordinates what they want in exchange for their cooperation.

In order to design a proper leadership within banks, managers from Romania need to take into account some ideas and opinions gathered from people involved for many years in financial domain especially in foreign institutions, banks or financial organisations.

Therefore, we have to improve leadership skills for the middle managers, we need to improve the communications within people working in banks through managers, we need to develop much more teamwork and team skills, is necessary a better education and self-education for any bank's employee. Also for an increased commitment and for a proper behaviour in terms of leadership within banks, to develop a modern leadership is necessary always to adapt the any containing of job description, especially for positions of middle managers.

[4] Prof. Andrew Hede, University of Sunshine Coast, Queensland, Australia. *Pattern of Power and Leadership: Understanding Total Behaviour Leadership*, White Paper, The Australian Institute of Management – Qld & NT, june 2005

1.6. FIRST STEP TO FIRST JOB - Innovative methods leading Youth to a solid career Project

The financial and economic crisis has reached various levels of intensity throughout different economies, a fact that led to the design of several solutions to overcome it as well as to balance the labour market. The most successful actions seem to be those that have been taken, for instance, by Austria, a country whose economy apparently faced no significant changes in structure and intensity, and thus managed to secure a more balanced labour market, including in what regards the young labour force.

It is well known fact that even through young people are a minority in the EU countries, the latter being characterized by an ageing population, young people as a group have paid the highest price during the global crisis; they are particularly disadvantaged relative to adults when it comes to their prospects of being absorbed into labour markets.

In order to have a complete image of the phenomenon is important to list some indicators from recent years:

- youth unemployment rate is more than twice as high as the adult one, i.e. 23,3% against 9,3% in the fourth quarter of 2012;
- the chances for a young unemployed person of finding a job are low; for instance only 29,7% of those aged 15-24 and unemployed in 2010 found a job in 2011;
- early leavers from education and training are a high-risk group, i.e. 55,5% of them are not employed and within this group about 70% want to work;
- resignation is an increasing concern; for instance 12,6% of inactive youth wanted to work but were not searching for employment in the third quarter of 2012;
- there are significant skills mismatches on Europe's labour market;
- despite the crisis, there are over 2 million unfilled vacancies in the EU.

The idea behind the project "First Step to First Job" was created while observing a reality that EU Member States have been facing in the last years, that is a huge and fast increase of youth unemployment rate accompanied by a difficult transition of young people from school to work.

Following this idea, a partnership was formed with experts from Austria, Italy, Portugal, Spain and Romania. The consortium is aiming at analysing and bringing together different models that have been experienced by the five partnering countries when dealing with the issue of facilitating youth transition from education to labour market in order to identify common solutions with great transferability potential at EU level and to ensure an efficient transfer of innovative know-how among different EU Member States.

Therefore, the goal of the project is to come up with innovative methods for a more qualitatively appropriate youth employment, thus answering both the latter's expectations as well as the needs of the society as a whole.

Project "First Step to First Job – Innovative methods leading YOUTH to a solid career", Ref.no.VS/2012/0017, was financed by a grant of the European Union, under the Community Programme for Employment and Social Solidarity PROGRESS 2007-2013, which is run by the European Commission through DG Employment and Social Affairs.

The project was developed under the 2nd domain of the Call for proposals "Youth on the Move", which was setting as its general objective the improvement of the first transition of young persons from education to the labour market by promoting good practices exchanges and generating new approaches for youth insertion at European level. Specifically, the objectives of the project were:

- to stimulate the debate between different stakeholders on innovative methods for youth transition to labour market, particularly on the innovative approach of the " Simulated Enterprise";

  Actually this project was developed on the basis of the experience of previous projects such as: "Simulated Enterprises" within Project "From theory to practice through simulated enterprise" (POSDRU 90/2.1/S/58123) or "Academic staff and students training in using modern information tools in academic education domain" Project (POSDRU 86/1.2/S/62689).

- to disseminate the concept of the “Simulated Enterprise” as an innovative tool for preparing the students in accumulating practical skills for their future professional careers;
- to draft recommendations for decision-makers in order to develop adequate employment and social policies to ensure a smooth transition from school to work.

The project ensured the transfer of innovative know-how on facilitating first transition of youth from education to the labour market in different EU Member States, namely Romania, Italy, Spain, Portugal and Austria. Therefore, a series of tools and activities was developed and carried out throughout the project implementation period. One of these innovative tools, having a great transferability potential at EU level, was the “Simulated Enterprise”, aiming at developing the students’ skills in two directions: increasing employability and strengthening entrepreneurship skills.

The main target group of the project comprised decision-makers and policy implementers from Education and Labour Ministries, public employment services, tertiary education institutions, social partners, NGOs, professional bodies and business associations from all project partners’ countries of origin.

The project duration was 7 months (January – July 2013). The partners within the project were: The National Scientific Research Institute for Labour and Social Protection (INCSMPS) – Romania, as applicant organization and coordinator, OSB Consulting GmbH – Austria, Labour Market Strategies Consulting SRL – Romania, The Ministry of Labour, Family, Social Protection and Elderly (MMFPSPV) – Romania, The Research Centre of Peoples and Culture – Portugal, Expert for Europe SRL – Italy, RONSEL Foundation – Spain, The Petroleum and Gas University from Ploiesti – Romania, The Valahia University from Targoviste – Romania.

Chapter 2. SCIENTIFIC, PROFESSIONAL AND ACADEMIC ACHIEVEMENTS INCLUDED IN DIFFERENT PUBLICATIONS

2.1. Researches regarding some sustainable solutions for environmental protection and conservation through the use of clean fuels and technologies; researches regarding public services and sustainable development approach related to urban communities

Related with this subject will be mentioned some of the most important contributions:

2.1.1 **Cătălin Popescu**, Luminita Ion, Tatiana Cucu, Jean-Marie Boussier, Augustin Mitu, Daniela Uta*, Inter-cities transfer of a transportation project,* **Environmental Engineering and Management Journal***, November/December 2009, volume 8, issue 6, pg.1433-1438 (http://omicron.ch.tuiasi.ro/EEMJ/pdfs/vol8/no6/26_127_Popescu.pdf)*

This paper proposes a method to evaluate the environmental efficiency of a project by using a hybrid approach based on utility theory and data mining techniques. Transferability principle is applied to show the environmental efficiency of an access controlled area in the hyper centre of two different cities. COPERT III technology is used in order to compute saved fuel and emissions by using experimental measurements of traffic characteristics or traffic simulation tools.

1. Introduction

Transferability analysis in the transport domain is strongly promoted in European Demonstrative Programs. Its main aim is to identify those transportation projects which could be implemented successfully in different European cities in order to encourage the transfer of good practices (Fig. 2.1). A project may be proved successful in one city (emitter city), the same measure (project) may not be proved successful elsewhere (receiver city) because there are no cities with exactly the same conditions. Cities can be different from each other in many aspects: traffic conditions (demand, infrastructure, traffic management etc), demographic, socio-economic, cultural backgrounds, and institutional and legal frameworks.

Few researches were done to study all aspects of the transferability but specially focused on the demand models (Kumarage et al., 1995; Wilmot et al., 2001). These studies are generally based on the expansion of a project in a city or treat about transportation services between cities (neglecting the complexity of the infrastructure and urban topology of an urban area).

This study is carried out in the framework of SUCCESS (Smaller Urban Communities in CIVITAS for Environmentally Sustainable Solutions, February 2005–January 2009) a European project funded by the European Commission under the CIVITAS program. There are three cities (Ploiesti-Romania, Preston-UK, La Rochelle-France) where particular actions were implemented and evaluated (CIVITAS, 2004).

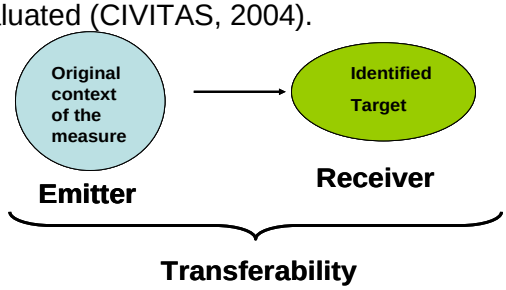


Figure 2.1. **Transferability principle**

Key CIVITAS objective is to encourage European cities to adopt measures resulting in cleaner and better transport. Successful measures are more attractive for implementation in other cities. That's why our proposal to transfer a measure presents two steps:

- evaluation of the efficiency of a measure in the emitter city;
- simulation of the impacts of the measure in the receiver city.

2. Steps of transferability

2.1. Evaluation of the efficiency of a measure (project) in the emitter city

Environmental efficiency of a transportation project can be illustrated by several criteria such as pollutants concentration and fuel consumption.

COPERT III methodology can be applied for the calculation of traffic emission estimates at a relatively high aggregation level, both temporally and spatially. However, it has been shown that the methodology can also be used with a sufficient degree of certainty at a higher resolution too, for the compilation of urban emission inventories with a spatial resolution of 1x1 km^2 and a temporal resolution of 1 hour. The development of COPERT III (Ntziachristos, 2000) was financed by the European Environment Agency (EEA), in the framework of the activities of the European Topic Centre on Air Emissions. It is proposed to be used by EEA member countries for the compilation of CORINAIR emission inventories.

COPERT III estimates emissions of all regulated air pollutants (CO, NO_x, VOC, PM and more) produced by different vehicle categories (passenger cars, light duty vehicles, heavy duty vehicles, motorcycles) as well as CO_2 emissions on the basis of fuel composition, the characteristics of the motors and the characteristics of the infrastructure (Fig. 2.2). COPERT III allows us to estimate the fuel consumption based on chemical laws and to realize the global energy analysis by using the characteristics of the national fleet. For it, a traffic data base must be exploited (experimental measurements or simulation).

The process evaluation contains 2 steps:

1) Evaluation of each criterion “before” the implementation of the project and “after” the implementation;

2) Evaluation of project environmental efficiency by comparison of two global indicators computed for each phase of the project (a “score” associated to each phase).

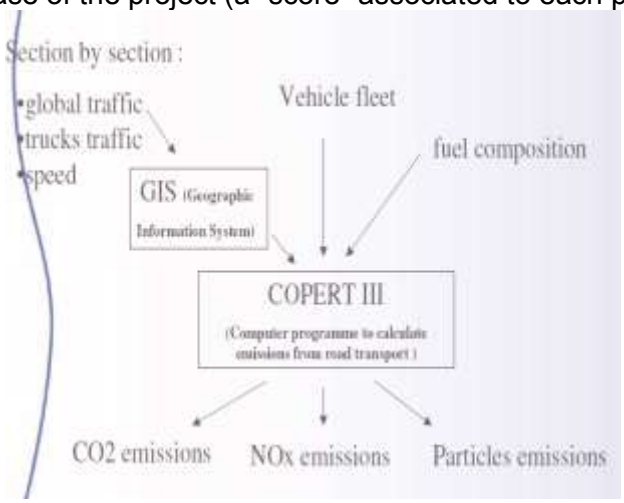


Figure 2.2. **COPERT inputs and outputs**

Evaluation of each criterion

In order to integrate strong variations of each criteria during a given period (1 month, for example), a frequentist method based on transferable belief theory has been retained (Smets, 1992). The Transferable belief model represents quantified beliefs based on beliefs functions. Let θ be a finite set of mutually exclusive and exhaustive hypotheses H_i, called the frame of discernment.

$$\theta = \{H_1, \quad H_2, ...\} \tag{1}$$

In our cause Ω is the frame of discernment such as: Ω = {H_1, H_2,…,H_p} where H_i represents the evaluation levels (like Small, Medium and High).

The power set 2^θ contains singletons hypothesis as well as disjunctions of singletons. A Basic Belief Assignment (BBA) is a function called mass (m) from 2^θ to $[0,1]$ verifying:

$$m : 2^{\Theta} \rightarrow [0,1]; \qquad \sum_{A \in 2^{\Theta}} m(A) = 1 \tag{2}$$

It represents the belief exactly associated to the hypothesis A. The subsets A of θ, such that $m(A) > 0$, are called the focal elements. In fact, if the power set contains only the singletons, the mass is the classic probability. For environmental criteria such as fuel consumption and emissions, classes are defined by applying the “k-means” method. Then a Decision-Rule known by “If-Then” is applied in order to obtain the mass allowed to each evaluation level.

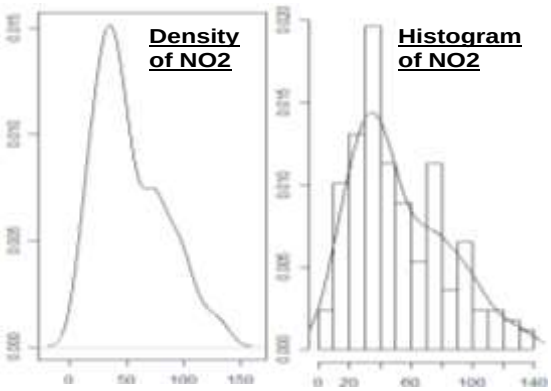


Figure 2.3. **Density of probability for NO_2**

Figure 2.3 shows how the estimation of the density of probability of NO_2 is done (gaussien estimator ker) (left) and superposition with its histogram (right).

For this example, the distribution is done as follow: if (NO_2 in 9-35) then the level is «Good», if (NO_2 in 35-69) then the level is «Acceptable», if (NO_2 in 69-135) then the level is «Poor». The corresponding masses given by the frequency to appear of the values are: m(Good)=0.232, m(Acceptable)=0.428, m(Poor)= 0.339.

The beliefs are transformed into a probability named BetP (Smets et al, 1994). The function that converts this probability is called the "pignistic" transformation and it is defined as:

$$BetP(A) = \sum_{B \subseteq \Omega} \frac{|A \cap B|}{|B|} \times \frac{m(B)}{1 - m(\varnothing)}, \quad \forall A \subseteq \Omega \tag{3}$$

where |B| denotes the number of elements in the set B and m(Ø) is the mass allowed to the conflict between opinions.

The results are in numerical form starting from the computation of an indicator called utility (u_i) for the criterion (C_i):

$$u_i = \sum_{k=1}^{p} u(H_k) \times BetP(H_k) \tag{4}$$

where: $u(H_k)$ is the utility of an evaluation level H_k, $u(H_{k+1}) \geq u(H_k)$ if H_{k+1} is preferred to H_k, and $BetP(H_k)$ is the "pignistic" probability related to H_k.

Evaluation of the environmental efficiency of the project

For a global evaluation, a simple method of aggregation is generally applied based on the multi-attribute utility theory (MAUT) techniques. But the utility function is not necessarily additive and also, as in our application, criteria set can have different weights and can be in interaction (in synergy or in redundancy). For these reasons, a method of aggregation based on the Choquet integral (Omrani, 2006) is applied in order to take into account the interaction (correlation) between criteria (e.g. NO_x concentration and NO_2 concentration or fuel consumption and concentration of pollutants). This method of aggregation takes into account at the same time the weight of each criterion and the interaction between them and illustrates, in a comprehensible way, redundancy and complementarities of criteria.

The criteria aggregation by the 2-additive form (bi-interaction) is written as follow:

$$u = \sum_{i=1}^{n} \omega_i \times u_i - \frac{1}{2} \sum_{s=1}^{n} \sum_{t=s+1}^{n} I_{st} \times \left| u_s - u_t \right| \tag{5}$$

with: u is the general utility (score associated to a given phase- “before” pr “after” project) ω_i is the weight of the criterion C_i; u_i is the utility of a criterion defined by equation (4) and I_{st} is the weight of the interaction between two criteria C_s and C_t.

The method, to estimate criteria and interaction weights, is based on the judgement of the evaluators and the belief theory. Let {Ei, i=1,…,p} represent a group of experts and {Ck, k=1,..,n} be a group of criteria whose weight we want to determine {wk, k=1,…,n}. We define a set of pertinence degrees that the evaluators use for giving their opinion with respect to the pertinence for each criterion. This set of ‘pertinence degree’ can be defined using 4 levels. Let Ω = {Not Pertinent (1), Less Pertinent (2), Pertinent (3), Very Pertinent (4)} be this set of ‘pertinence degree’. This granularity number can vary from 4 levels to 6 levels (see more).

In a similar way we defined a set of interaction importance degrees that the evaluators use for giving their opinion. This set of interaction importance degrees can be defined using 5 levels as follow: Ω = {High Negative Interaction (-2), Less positive Interaction (-1), Not Interaction (0), Less positive Interaction (+1), High positive Interaction (+2)}.

As the estimation of criteria and interaction weights, we deal with the indecision and the ignorance relative to the judgement of the evaluators.

The estimation of the weights of criteria and interaction is given by the following equations (this part is detailed in our previous work (Omrani et al., 2008) for an exhaustive presentation):

$$\begin{cases} \omega_i = \sum_{i=1}^{4} BetP(i) \times V(i) \\ BetP(i) = Freq(i) + \sum_{j \neq i, |j| \geq 2}^{4} \frac{Freq(j)}{|j|} \end{cases}$$

$$\begin{cases} I_{ij} = \sum_{k=1}^{5} BetP_{i,j}(k) \times V(k) \\ BetP_{i,j}(k) = Freq(k) + \sum_{l \neq k, |l| \geq 2}^{5} \frac{Freq(l)}{|l|} \end{cases} \tag{6}$$

where:

- *V (i)*: Level of degree of importance (linear function);
- i∈ Ω = {1, 2, 3, 4}={Not Pertinent, Less Pertinent, Pertinent, Very Pertinent} the set of pertinent degrees;
- Freq(i): frequency of appearance of pertinence degrees i, with i varies from 1 to 4;
- | j |: cardinality of the set “*j*”;
- BetP(i): the “pignistic probability”, it consists to manage the indecision;
- *V (k)*: Level of interaction degree (linear function);
- k∈ Ω = {-2,-1,0,+1,+2}= {high negative interaction, less negative interaction, no interaction, less positive interaction, high positive interaction};
- Freq(k): frequency of appearance of importance degrees of interaction, “k∈ Ω”;
- | l |: cardinality of the set “*l*”;
- BetP(k): the “pignistic probability” related to the interaction degree k∈ Ω.

The utility of each criterion is computed for each phase of the project (“before” the project and “after” the project) in agreement with eq. (4). The global utilities for “before” and “after” phases (eq. 5) allow us the compute the environmental efficiency of a measure:

$$Efficiency = \frac{u_j^{after} - u_j^{before}}{u_j^{before}} (\%) \tag{7}$$

The result allows us to estimate how the action in transport field had globally positive or negative impacts in environmental category.

2.2. Simulation of the impacts of the measure in the receiver city

What will change for another city desiring to implement a similar project are utility of each criterion, weights of criteria and interaction between criteria.
There are two cases:

a) the receiver city is unknown
In this case, utilities can not be previously estimated because of the specificities of “receiver” city (land use, mentalities, socio-demographic characteristics etc.).

However, it is possible to simulate which would be the efficiency of this project in the “emitter” city if the constraints of “receiver” city would be present.

In this hypothesis, weights of criteria and interaction are estimated for the “receiver” city by their experts.

The indicator called global utility associated to each phase (before and after) is computed using the utilities u_i of the “emitter” city.

The comparison between the two scores will show us if the project would be efficient.

b) the receiver city is known
In this case weights of criteria and interaction can be estimated by using eq. (6) and utilities corresponding to fuel consumption and emissions can be estimated by modelling and traffic simulation.

Traffic characteristics can be simulated by one microsimulator called F-VIS-SIM and that we have adapted by our team in our previous works (Teng, 2008).

Each component in a traffic network can be modelled by one object that specifies its behaviour and interaction rules. Some examples of objects that occur in a road network are vehicles, roads, junctions and traffic lights (Fig. 2.4a).

The simulation is an aggregation of all the interactions that occur at the moment when all these different objects are conjointly applied to the same environment. Traffic characteristics, fuel consumption and pollutants concentration are the outputs of this simulation (Fig. 2.4b).

3. Case study

3.1. Access controlled area in Ploiesti-emitter city

In the framework of SUCCESS project, Ploiesti City Hall promoted and sustained the design and implementation of pedestrian areas within the city. By implementation of the access controlled zone, it was desired to:

- create a friendly environment for pedestrians so they could move freely and safe in the city centre;
- reduce the pollution in the hyper centre of Ploiesti.

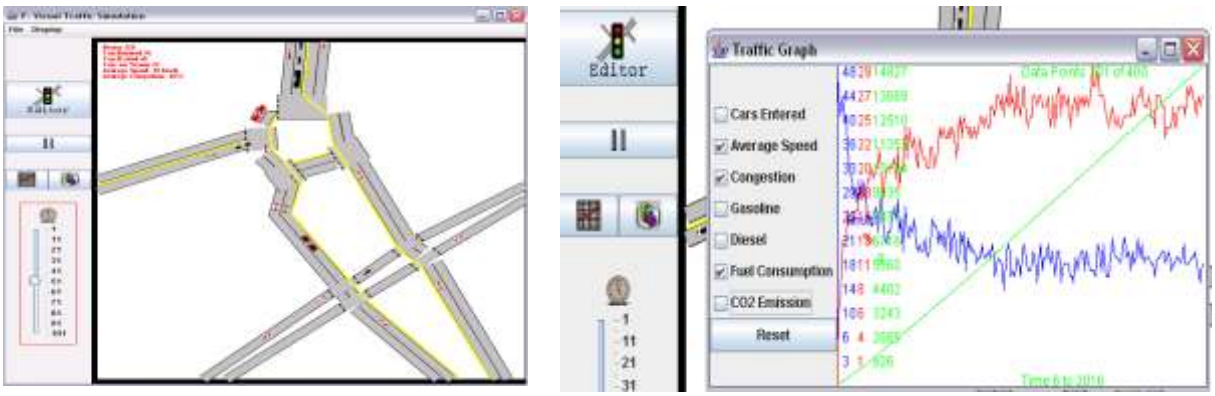
In transforming Ploiesti central area several actions were undertaken (Fig.2.5):

- creating new bands and parking spaces at the limit of access controlled zone;
- the access controlled zone was appropriately signalized and lighted.

The bollards and barriers are set at the entering and exit points of access controlled area.

When considering the environmental impact of measure we need to exclude all other pollution factors, especial the industrial one. Measurements, in the city centre, showed variation between 2005 and 2008 (project CIVITAS – SUCCESS lifetime) but can not determine exactly the percentage of pollution reduction due to the new traffic regulations.

The monitored street were the ones limiting the access controlled zone, considering as well the old traffic in now closed Mihail Kogalniceanu Street and the number of cars with daily access in the access controlled zone.



(a) (b)

Figure 2.4. **F- VIS-SIM: a) inputs (infrastructure, traffic flows); b) outputs (velocity, fuel, pollutants)**

Figure 2.5. **Map of Ploiesti hyper centre**

Table 2.1. **Emission modelling for Ploiesti central area (Unit measure tons/year)**

Year	*Street*	*Fuel consumption*		*CO*	*NO_x*	*N_2O*	*SO_2*	*CO_2*	*COV*	*PM*	*PM_{10}*	*$PM_{2.5}$*	*PM_1*	*Benzene*
		Gasoline	*Diesel*											
2005	G.D. Gherea	298.185	447.09	21.13	6.08	0.287	0.402	2308.95	2.461	0.859	0.73	0.606	0.470	0.068
	Gh. Lazar	312.967	496.347	20.12	6.69	0.375	0.441	2511.28	2.751	0.933	0.771	0.622	0.458	0.070
	St. Greceanu	274.135	414.789	19.2	5.63	0.274	0.373	2135.55	2.285	0.793	0.671	0,555	0,426	0.062
	Mihail Kogalniceanu	108.042	66.948	4.25	0.93	0.033	0.079	545.67	0.4	0.135	0.119	0.102	0.084	0.013
	Republicii Boulevard	421.943	669.175	27.13	9.02	0.506	0.595	3385.71	3.709	1.257	1.04	0.838	0.618	0.094
	TOTAL	**1415.503**	**2094.35**	**91.84**	**28.35**	**1.474**	**1.891**	**10887.18**	**11.61**	**3.977**	**3.331**	**2.723**	**2.056**	**0.307**
2008	G.D. Gherea	103.054	154.516	7.3	2.1	0.099	0.139	797.98	1.593	0.54	0.447	0.210	0.162	0.023
	Gh. Lazar	181.217	287.4	11.65	3.88	0.217	0.256	1454.11	1.593	1.294	1.095	0.360	0.265	0.040
	St. Greceanu	447.679	676.808	31.33	9.18	0.447	0.608	3484.57	3.729	1.294	1.095	0.905	0.696	0.101
	Mihail Kogalniceanu	0.041	0.025	0.002	0	0	0	0.205	0	0	0	0.000	0.000	0.000
	Republicii Boulevard	460.39	730.151	29.6	9.85	0.552	0.649	3694.22	4.046	1.372	1.135	0.914	0.674	0.103
	TOTAL	**1192.38**	**1848.89**	**79.89**	**25.01**	**1.315**	**1.652**	**9431.08**	**10.21**	**3.503**	**2.928**	**2.389**	**1.797**	**0.26**
Decrease of total emissions, in percentage				12,63	13.37	11.95	11.91	12.08	12.26	12.57	12.57	11.8	10.79	12.63

In order to determine the emission level, traffic measurements were made in 2005 (before phase) and 2008 (after phase). See table 2.1 for evolution of fuel consumption and emissions obtained by COPERT application.

3.2. Access controlled area in La Rochelle – receiver city

A similar project has been implemented in La Rochelle. Weights of criteria and interactions have been established by experts and the efficiency computed with formula (7) showed the possibility to obtain a beneficed project. After it, the simulation of environmental impacts is simulated in order to check if the transfer could be successfully done. The main COPERT inputs are velocity and traffic level. For the scenario BEFORE, no database is available to inform about the number of cars/hour on the roads situated in this area or about the average value of the speed/hour (inputs for COPERT software).

For it:

- the average value of flows/hour for the light cars have been evaluated by interviewing people working or living in this area. These interviews have been done twice (on 2 different days) and the average value has been used;
- the average speed has been evaluated by using traffic simulations with F-VIS-SIM.

Fig. 2.6 shows the frame of the traffic simulation for the pedestrian zone in the hyper centre (in red).

Figure 2.6. **Design of roads, junctions, pedestrian crossings, car park with F-Vis-Sim**

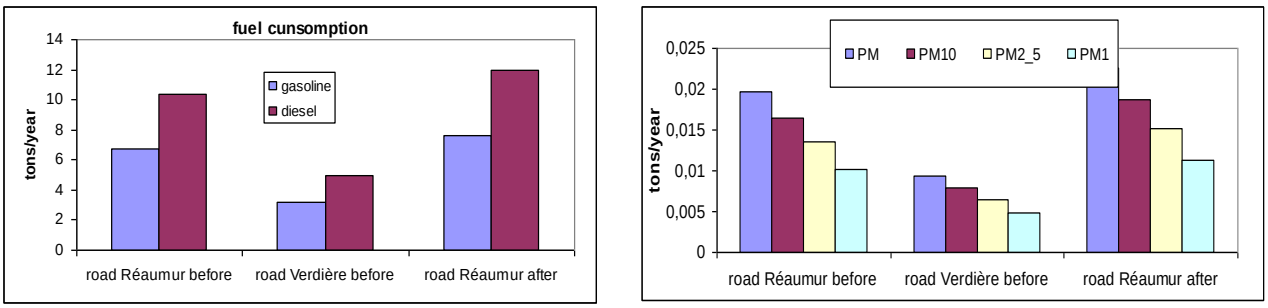


Figure 2.7. **Fuel consumption and PM emissions for scenario BEFORE and scenario AFTER**

For the scenario AFTER, Verdière road (in red) was blocked during the simulation. Junctions with two roads were also deleted. The results about fuel economy and emissions saved were computed taking into account the length of the roads. Finally the results for scenario BEFORE and the scenario AFTER have been compared in order to evaluate potential gains in emissions (tons/year) in this urban area. The main conclusions are:

- By introducing the pedestrian zone, the fuel consumption in Coursive zone could decrease around 15% for the gasoline and 13% for the diesel. Similar evolutions are simulated for emissions (Fig. 2.7). The explanation is the increase of the velocity (essentially because of the delete of the junctions).
- We can observe that even if the infrastructure changes seem to be insignificant (only 200 m), the results obtained by simulation strongly encourage the transfer of this type of project in the historical hyper centre of La Rochelle.

- Looking the results obtained by the emitter city and the receiver city (sections 3 and 4) we can precise that any similitude about the infrastructure changes and behavioural aspects exists between 2 projects. Nobody would be able to predict that the gains in fuel and emissions could be similar.

4. Original contributions and conclusions

The efficiency of an innovative project in the transport field is difficult to prove. Local authorities are reticent to implement transportation projects because of financial constraints or because of the lack of a method to estimate potential impacts. This paper proposes a methodology for testing the transferability process in transportation domain before the implementation. Criteria such as saved energy and emissions are computed using experimental measurements of traffic characteristics that alimented software based on COPERT III technology. Traffic characteristics are measured for the emitter city and simulated by a software tool for the receiver city. The interest of our approach is that a project manager will be able to test firstly if the project would be efficient in the same conditions (via the weights of selected criteria and interactions). The study case shows that one solution could be to combine tools for simulation and real database for analyzing transferability process. The tools used to compute and to simulate the environmental impacts of a pedestrian area are: a micro-simulator traffic and a software for computing the fuel and energy emissions. The example presented in these works shows that in completely different conditions (infrastructure, behaviours) the efficiency of the same project implemented at different spatial scale could be similar.

Acknowledgements
Authors gratefully thank to Agnès Hulin (ATMO Poitou-Charentes La Rochelle), Fei Teng (IMS-LAPS Bordeaux) for the work done on the development and adaptation of the simulation tools.

2.1.2 **Cătălin Popescu**, Tatiana Cucu, Luminita Ion, Jean-Marie Boussier, Augustin Mitu, *Methodology to evaluate the quality of public services,* **Revista Amfiteatru Economic**, vol. XI, nr. 26: Quality Management in services, iunie 2009, pg.260-269 (http://www.amfiteatrueconomic.ro/ArticolRO.aspx?CodArticol=865)

We propose a global methodology that will join two methods. With the method of fractional array to obtain a very low number of questions, we can pattern the relationship between the tested variables (price, security, etc.) and the characteristic of the wanted performance (such as the quality of the service). Interviewed people can be classified into socio-demographic categories by the tool user. Afterwards, the Analysis of Variance gives significant variables. A reduced model illustrating a “mean” behaviour is designed for all hypothetical situations. The proposed methodology is tested for the category “student” in two case studies: to evaluate the teaching quality at Faculty of Economic Sciences (FSE) within Oil and Gas University from Ploiesti (Romania) and to estimate the quality of using car parks in La Rochelle (France).

1. Introduction
The necessity to generate only qualitative public services is imposed on the one hand, by the need to respond appropriately to activities of general interest which are required by the demands, increasingly diverse and complex, of the citizens, and on the other hand, in order to improve the quality of life in a country, the standard of living of the population for that country.
Influenced by the specific historical period, the European Community identified the decisive factor of integration, namely integration through education, or better said through an educational system, the most organized form of shaping human personality.
In this context building, a unique European vital space means to raise it on a unitary European educational space that has the purpose of shaping the European citizen, capable

of a successful socio – professional integration in the most competitive economy in the world. The beneficiaries of this unique educational space are the students, the teachers and the educational institution as well as the entire community.

In order to cooperate in the European research and teachers or students mobility projects and for the international recognition of study certificates, universities need to adjust their offer, standards, criteria and evaluation procedures. Ensuring the quality of the Academic Education implies that:

- There exist organisms, standards (models) and institutional procedures for internal and external evaluation;
- The educational institution is capable of presenting evidence regarding the conformity of the internal Quality Management System with standards or models agreed.

The fundamental purpose of any university is excellence in research and academic education. Universities challenge themselves to obtain excellence via an internal intellectual and simulative environment for the students as well as for the teachers, environment that is sensitive both to national and international needs. Universities admit the need for an efficient management for all resources available.

Consequently, each university tries to achieve its didactic and research planned objectives through the promotion of certain targets, standards and procedures, which are introduced in the Quality Manual and are according to the principles included in Bologna Process documents. Quality insurance in academic education consists in the sum of all organizational mechanisms and procedures through which maintenance and permanent improvement of academic standards are confirmed at the institution level. In the academic educational space, quality issues involve specified quality requests: competent teachers, students prepared according to the followed specialization, a segmented and flexible study programs offer, according to the European universities study programs, the opportunity to cover, through academic education, a part of the working force market, etc.

The hereby paper is organised as follows: firstly, we describe the methodology to design the questionnaire and the statistical treatment of the database, in order to analyse the quality of different kind of public services. Secondly, two studies are performed to validate this approach: the first one refers to the quality of teaching in Faculty of Economic Sciences within Oil – Gas University (Ploiesti-Romania) and the second one analyses the quality of the infrastructure at Ecole d'Ingénieurs en Génie des Systèmes Industriels (La Rochelle-France). Finally, discussions are performed on the efficiency of this methodology as well as on potential extensions.

2. Methodology

The quality of a service perceived by people is always difficult to be quantified; the classical questionnaire, based on observed preferences, shows a lot of inconveniences. The most delicate aspect of this kind of questionnaire is the subjectivity of the given answers, because the respondents are frequently influenced by different parameters that have no connections with the tested factors. A classical example is the evaluation of the teaching quality; even if the test parameters are carefully chosen in agreement with the tested values (quality of documents, communication degree,…), it is well known that the preferences of students are influenced by other intangible parameters which are the consequence of the individual interactions teacher-student.

On the other hand, this kind of questionnaire is always carried out at the end of the teacher exhibition and it is not possible to correct some dysfunctional aspects. Out of these reasons, we suggest the use of the technique of declared preferences: the respondents are placed in hypothetical scenarios and must indicate their evaluation for each one. In order to build such a questionnaire, we will use the Design of experiments method (DOE) coupled with a Vigier's model [4].

Our approach is based on the belief that people with similar socio-demographic characteristics have similar preferences. Consequently, for the various categories of students (age, gender) we propose to design for each one a model describing the "mean" behaviour based on a similar perception of effects of factors changes. The main steps of the approach are schematically presented in figure 2.8.

Step 1: The choice of factors and of response to analyse

The *factors* are the parameters under study which can be controlled and which are independent. The *levels (modalities)* of a factor refer to the number of values of the variable. The quality characteristic to be optimised is the *response* to be observed. The response to optimise is the quality of a service and for it we can use a crisp value (a score) as well as a semantic evaluation (very well, bad,…). Several responses can be jointly studied with the same questionnaire.

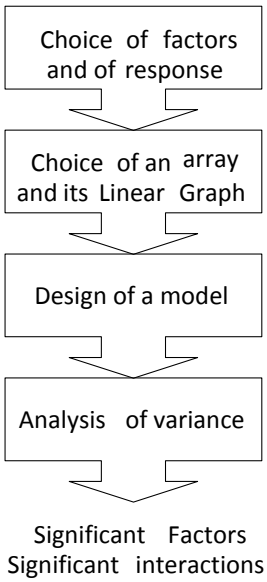


Figure 2.8. **Steps of our approach**

Step 2: The choice of an array and its Linear Graph

In order to obtain the maximum information with such a questionnaire, a full matrix with all possible combinations of factors and levels is necessary. Let us suppose a questionnaire in order to test the effects of the variation of 11 factors, each one having 2 levels. A full factorial array using 2 048 questions will be strongly inadequate for this kind of analysis.

The Taguchi's method [3] uses an orthogonal factorial array which is a subset of a complete array. Figure 2.9 shows an example where A, B,…are the tested factors, the values 1 and 2 are the levels of the factors and a horizontal line of the array is a hypothetical scenario to be evaluated. In a scenario (or question), one or more variables are deliberately changed at the same time. Varying several factors simultaneously may have interactive effects on the studied response (when the effect of a factor depends on the level of another, an interaction exists). Taguchi provides many standard orthogonal arrays and corresponding linear graphs for this purpose (in order to affect columns for factors and interactions). The fractional arrays reduce the number of necessary combinations and are obtained by using orthogonality theories after the “sacrifice” of several interaction effects. The columns of the array presented in figure 2 could be used as follow: A, B, D, G for factors and C, F, E for interactions.

Factors and interactions

Test	A	B	C	D	E	F	G
1	1	1	1	1	1	1	1
2	1	1	1	2	2	2	2
3	1	2	2	1	1	2	2
4	1	2	2	2	2	1	1
5	2	1	2	1	2	1	2
6	2	1	2	2	1	2	1
7	2	2	1	1	2	2	1
8	2	2	1	2	1	1	2

Linear graph

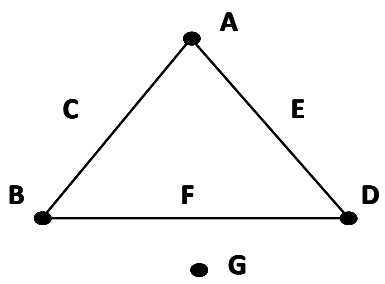


Figure 2.9 **$L_8(2)^7$ array and one of its linear graph**

Step 3: Design of model

We have adopted a model based on the Analysis of Means (ANOM) proposed by Vigier [4]. When the evaluation is done with crisp values, the determinist part of the model can be schematically represented as follows:

$$S = S_{mean} + (a_1 \quad a_2)A + (b_1 \quad b_2)B + \ldots \begin{pmatrix} a_1b_1 & a_1b_2 \\ a_2b_1 & a_2b_2 \end{pmatrix} \ldots \tag{8}$$

where a_i - matrix elements representing the mean effect of factor A at level *i*;

a_ib_j - matrix elements for the mean effect of the AB interaction when A is at level *i* and B at level *j*.

$$a_i = S_{mean}\left(A_i\right) - S_{mean}$$
$$a_i b_j = S_{mean}\left(A_i, B_j\right) - S_{mean} - a_i - b_j \tag{9}$$

with S_{mean} - mean value of all scores;

$S_{mean}(A_i)$ - mean value of the scores for the combinations where A is at level *i;*

$S_{mean}(A_i, B_j)$ - mean value of the scores when A is at level *i* and B at level *j.*

Step 4: Analysis of Variance (ANOVA)

The aspects of interest of our work are to establish the main factors which affect the quality of a service. We have used the approach proposed by Vigier (Vigier, 1988), consisting in comparing the variance of the mean effects of the actions (factors and interactions) with the residual variance. Ignoring higher-order interactions, there are three levels of significance which are established with the Fischer and Snedecor test: not significant (NS) for $F_{resp} < F_{0.05}$; significant (S) for $F_{0.05} < F_{resp} < F_{0.01}$; very significant (VS) associated to $F_{resp} > F_{0.01}$.

Analysis of Variance table

Table 2.2

Action	Variance	F_{resp}
Factor A	$V_A = \frac{N}{n_A(n_A-1)}\sum_i a_i^2$	$\frac{V_A}{V_r}$
Interaction AB	$V_{AB} = \frac{N}{n_A n_B(n_A-1)(n_B-1)}\sum_i\sum_j a_i b_j^2$	$\frac{V_{AB}}{V_r}$
Residual	$V_r = \frac{1}{\gamma_r}\sum_i\sum_j\left(Y_{ij\,exp} - Y_{ij\,th}\right)^2$	

The significations of the variables inscribed in this table are:

N - number of tests; n_A, n_B - number of levels for the factors; γ_r - residual degree of liberty; $Y_{ij}exp$, $Y_{ij}th$ - the calculated and theoretical value of the response (scores); F_{resp} - Fischer coefficients).

The analysis of variance (ANOVA) allows reducing the model, taking into account only the very significant factors and interactions. The designed model can be used to evaluate the score for questions without response (all combinations not included in the factorial array).

Applications of the questionnaire with declared preferences

1) quality of teaching – Oil-Gas University - UPG, Ploiesti, Romania

In order to observe the quality issues, our University organized a research study called "Student satisfaction investigation" which tries to establish the most significant factors for a quality academic education in Economic Sciences. After various discussions and analyses,

five characteristics were taken into consideration, characteristics that represented the questionnaire base for students. Those characteristics concern: the teacher's patience in explaining to students, his ability to communicate, his authority during the teaching process, his experience and the knowledge of using soft, innovative teaching methods. Combining this characteristics, a questionnaire was designed using the $L_8(2)^7$ array. In the table 2.3 is presented this questionnaire.
The affectation of the columns was changed by adding a new factor at the place of the interaction E (because we estimated that the interaction between the patience to explain and the authority of the teacher does not exist). The interactions which are evaluated are: patience to explain-ability to communicate and capacity to communicate-authority during the teaching process).

Questionnaire to evaluate the quality of academic

Table 2.3

question	patience to explain (A)	ability to communicate (B)	autority (D)	innovante means to teach E	experience (G)
1	no	no	no	no	no
2	no	no	yes	yes	yes
3	no	yes	no	no	yes
4	no	yes	yes	yes	no
5	yes	no	no	yes	yes
6	yes	no	yes	no	no
7	yes	yes	no	yes	no
8	yes	yes	yes	no	yes

The potential responses are presented in table 2.4.

Responses and associated scores

Table 2.4

Response	Value
Extremely bad	0
Very bad	20
Bed	40
Good	60
Very Good	80
Excellent	100

The number of responses treated is 1208 (151*8) and after the elimination of aberrant answers (out of a Gaussian distribution) and the ANOVA application, the reduced model obtained was:

$$Y = 49.21 + (-11.11 \quad 11.1)A + (-9.45 \quad 9.45)B + (-7.58 \quad 7.58)G \qquad (10)$$

We can remark that for all students, an average "perception" of the quality of academic education, in order of the weight, is done by: a great the patience to explain, a great the ability to communicate and a great experience. The other factors, as well as the interactions, are non-significant.

A study by gender and age range was done: the preferences are the same, but the males consider that the ability to communicate is the most important factor to ensure a high-quality teaching process. Only young persons (<25 years) granted an important weight to the innovative methods; for the same category, a strong interaction between the patience to explain and the capacity to communicate was pointed out.

2) the quality of infrastructure-EIGSI, La Rochelle, France

It is well known that the quality of an academic education is strongly linked with the quality of the infrastructure. For the small cities (such as La Rochelle) with academic institutions, a problem occurs concerning the possibility of timekeeping for the university courses in the peak periods of the urban traffic. One of these causes is the difficulty to find a vacant place to park the car. In order to estimate the potential measures to improve this problem, we were firstly interested in the preferences of students and teachers who must park their cars and the behaviour of students if no place is available.

Potential Responses and Factors to be tested

Table 2.5

Response	Value
Very rarely	0
Rarely	20
Occasionally	40
Sometimes	60
Frequently	80
Very frequently	100

Input variables	Mark	Level 1	Level 2
Price of the parking	A	Cheap	Expansive
Distance to University	B	Near	Far
Walking speed	C	Fast	Slow
Parking duration	D	Short	Long
Number of persons	E	1	> 1
Type of activity	F	Urgent	Not urgent
Accessibility of area	G	Easy	Difficult

According to the tangible factors such as walking time, distance, duration, price … frequently chosen as input variables (Shoup, 1999), we added intangible factors such as the activity to carry out (urgently or not), the facility to get access into the University (easy or not).

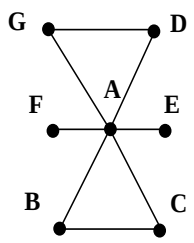
The response to be studied is the "quality" of the car park; the potential evaluations and the modalities of the factors are presented in table 2.5.
A questionnaire based on L_{16} $(2)^{15}$ array was sent to students and teachers (table 2.6).

Questionnaire Used and Interactions to be Estimated

Table 2.6

Scenario	A	B	C	D	E	F	G
1	Cheap	Near	Fast	Short	1	Urgent	Easy
2	Cheap	Near	Fast	Long	>1	Not urgent	Difficult
….	….	….	….	….	….	….	….
15	Expensive	Far	Slow	Short	>1	Not urgent	Difficult
16	Expensive	Far	Slow	Long	1	Urgent	Easy

Linear graph



parameter: ●
interaction: ——

For a rigorous statistical analysis, the same questionnaire was sent to a significant number of people belonging to the same category. The preliminary feedback of respondents showed that the number of choices of responses must be low (4 or 6).

We treated 1728 responses (108*16) of students and 608 (39*16) responses of teachers. In agreement with the linear graph, eight interactions could be evaluated. A model was designed for each category and the Analysis of Variance was performed.

1. For students, the determinist part of the reduced model is:

$$Y = 39.98 + (12.7 \quad -12.7)A + (7.64 \quad -7.64)B + (4.5 \quad -4.5)C + (6.77 \quad -6.77)G + \begin{pmatrix} 4.36 & -4.36 \\ -4.36 & 4.36 \end{pmatrix} AG \qquad (11)$$

2. For teachers, the determinist part of the reduced model is:

$$Y = 39.85 + (12.6 \quad -12.6)A + (11.75 \quad -11.75)B + (3.47 \quad -3.47)F + (6.5 \quad -6.5)G + \begin{pmatrix} 4.04 & -4.04 \\ -4.04 & 4.04 \end{pmatrix} AG \qquad (12)$$

It is interesting to find a very similar behaviour for the two categories about the price and accessibility. In contrast with the model for students, the walking speed is non-significant for teachers, but the activity type affects their choice. For both models, the number of people and the parking duration are non-significant parameters. The only important interaction is between the price and the distance car park-university (AG).
Now, suppose that a student selected a car park but cannot find a vacant place to park; the potential scenarios are schematically presented in figure 2.10.
Four potential alternatives are proposed for each scenario: to do loops to search a place, to go to the second car park (with the second score), to park on an illicit place or to defer the activity in University.

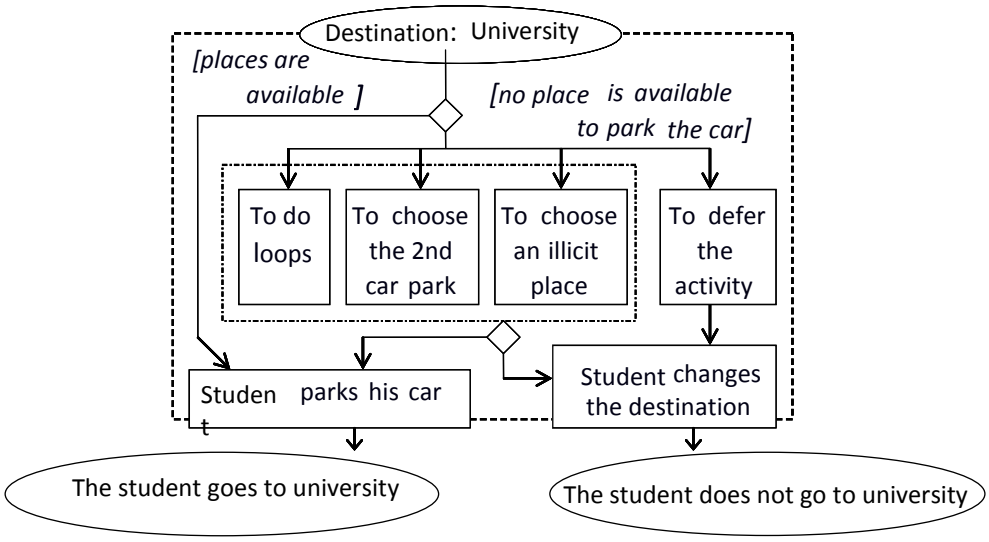


Figure 2.10. **Choice between potential alternatives**

Only very significant factors preliminarily established (Price of the parking, Distance to University, Walking speed, Accessibility of area) are tested in $L_8(2)^7$ array and the response to the analysis is the frequency of choice. The scores are computed after the fusion of information of the students. The discernment framework contains the four alternatives:

Θ = { to do loops, to choose the second park, to choose illicit place, to defer the activity }

For each alternative, the respondents have four possibilities: "very rarely" (VR), "rarely" (R), "frequently" (F) and "very frequently" (VF). These evaluations are converted into scores.
The scores are also computed for all alternatives and for eight scenarios of the L_8 array. For example, in the case of scenario 1, the choice is "to do loops" and in the case of scenario 5, the choice is "to choose an illicit place". The reduced model is elaborated for each alternative. For example, in the case of the alternative "to do loops", only the weather, the activity duration and the importance of activity are significant. For the case "to choose an illicit place", the distance and the duration are significant.

Conclusions

Quality control implies the use of management procedures that verify and guarantee the standards of the academic activity (teaching, learning and research). On the other hand, the infrastructure quality significantly contributes to the insurance of the best conditions in this field.

We proposed a methodology which is able, using a low number of questions, to distinguish among the factors and the interactions which are perceived to be significant for the quality of a service (in our case, the teaching process and the car park quality). It is the first interest of this method but, using the Vigier's model, we are able to quantify and classify the impact factors per social categories, gender and age range. Another point of interest is that this kind of questionnaire can be done before the implementation of a service, in order to estimate the potential consequences and to correct actions in agreement with the preferences of students. We will use this method to evaluate the quality of different services, such as the equipment of laboratories or the evaluation systems of teaching activities in universities. These works will be done simultaneously in both schools (Ploiesti and La Rochelle) in order to compare the preferences of our students. In order to cooperate in the European research, to ensure high performance during the academic exchanges or for the international recognition of study certificates, Universities need to adjust and to find common points in their offer, standards, criteria and evaluation procedures.

2.1.3 Augustin Mitu, **Cătălin Popescu**, Daniela Uta, *Public Management and Local Policy regarding city environment,* **Environmental Engineering and Management Journal**, November/December 2009, volume 8, issue 6, pg.1479-1484 (http://omicron.ch.tuiasi.ro/EEMJ/pdfs/vol8/no6/34_082_Mitu.pdf)

In the last decades human society came to realize that pollution and irrational use of resources diminish the capacities for future generations to satisfy their needs. That is why policies regarding environment protection start being implemented at city level with the participation of local authorities and the support of citizens. Moreover, such policies are beginning to have results, at environmental level. The example of the city of Ploiesti is commented upon in this paper. The city under scrutiny here is a Romanian medium size city, a new member of the European Community that starts showing the results of the projects implemented by local authorities.

1. Introduction

European Environment Agency (EEA) elaborated in July 2008, the Annual European Community LRTAP Convention emission inventory report 1990-2006, in which there are numbered the main sources of air pollution in UE between 1990 and 2006. According to this report the road transport remained the main cause of pollution with sulphur dioxide and carbon monoxide, and a second source of pollution with small particles matters, at least for the European Community (European Environment Agency website, 2009).

The report describes the evolution of air pollution in UE since 1990 until 2006, showing that the great majority of the member states reduced air polluting substances in the last decade. Road transport, production sector, constructions and agriculture are the main air polluting sources in Europe Community (European Environment Agency website, 2009).

Exposure to air pollution can seriously harm one's health on short and long term, can affect natural ecosystems and contribute to corrosion of buildings. Particulate matters, from car smoke and buildings heating systems can affect the lungs and harm people of all ages; this represents a higher risk for persons who already have heart and respiratory problems. Air pollution also contributes to forests and water ecosystems acidification, to soil and water atrophy, phenomena that limit the oxygen reserves from rivers and lakes Community.

In Romania, a new member of the European Union, the local territory administrations try to keep up with European environmental policy in order to assure to its inhabitants better air, water and soil quality. There are still few economical and social particularities that make this kind of policies more difficult to implement.

Romania, is also trying to recover the economic and industrial gap that separates them from the developed, already member countries of the European Union. The citizens are, as well, keen to reach living standard from the EU member states.

The social principles are relatively simple to explain: social status is given by wealth and this is shown in properties (house, car, real estates) and service acquisitions. For example, the main explanation for increased traffic jams and as a result, pollution is the increased numbers of vehicles purchased by Romanians as well as the development of distribution system.

The economic growth is not only demanded by the country status of being a new member, but it is also required and busted up by citizens.

Until 2000, the main pollution factor for the Romanian cities was the production sector, now, in 2009, the road transport became as polluting if not more polluting as the production sector. Here opinions are divided, not even measurements at city level can show the real picture because in most of the cases factors merge and the measurements show only combined results Community (National Agency of Environmental Protection website, 2009).

2. Case study presentation

In 1992, at the Earth Summit that took place in Rio de Janeiro – at the United Nations for Environment and Development Conference – there was presented the concept of sustainable development at the level of state presidents and governments (140 countries) and a specific plan named “Agenda 21”. “Local Agenda 21” was also adopted, that allows local administrations around the world to define their own sustainable development on medium and long term Community (UN Department of Economic and Social Affairs, website, 2009).

As a result of Rio de Janeiro Conference, numerous local communities started elaborating their own plans for sustainable development and, at this moment in Europe, there are over 300 cities that already implemented Local Agenda 21.

In 2001, the European Parliament adopted decision number 1411/2001/EC in order to create a cooperation frame for promoting a sustainable development in the cities. This decision is addressed to all European countries, regardless of their membership of EU Community (Decision No. 1411/2001/EC of the European Parliament).

In a particular case, in this paper it is presented the situation of Ploiesti, a medium size city, placed in South-East Romania, one of the most industrialized cities in the country. In this city, the local administration invested in the last decade in sustaining city development and reduces pollution at city level Community (City Hall Ploiesti website, European Integration Department – European Projects, 2009).

In Ploiesti, the programme Local Agenda 21 was implemented between 2001 and 2003 and established the following objectives:

- Economic development;
- Environment protection;
- Increased life standard;
- Preservation of local traditions and equal access to education;
- Public participation to the process of making decision.

The programme Local Agenda 21 implemented, at Ploiesti level, tries to establish a balance between economic development, social equity and environment protection. The concept of sustainable development imposes a permanent re-evaluation of the relation between people and nature as well as solidarity between generations, as the only viable option for development on long term (City Hall Ploiesti website- Local Agenda 21, 2009).

United Nation Development Program, through its office in Romania actively promoted sustainable development by its support for this project, not only in Ploiesti but in other 8 Romanian cities.

The concept of sustainable development definition for Ploiesti underlined aspects of local politics, involving different categories of stakeholders. Following the Agenda, until 2015 this strategy will allow the decision correlation linked to the progress of the community, strengthening the needed future steps to a sustainable development (City Hall Ploiesti website - Capacity 21 Program, 2009). At this point, 2008, the local administration is involved

in 3 major programs that intend to reduce what has become one of the city's main pollution factors: traffic jams which results in traffic pollution.

The programs are named UMPIDU, SUCCESS and SPICYCLES.

UMPIDU is The Integrated Plan for Urban Development that has established the following main activities:

- rehabilitation of main local roads, including passages and bridges;
- developing an inter-modal traffic system;
- extensive development and use of non-polluting traffic ways;
- increase green surfaces: parks and gardens;
- assuring healthy infrastructure available for citizens of the growth pole;
- encouraging and cooperating with private companies for sustainable social services;
- increase capacity for social and health services;
- improve infrastructure for research and university education as well as lower levels of education etc.

SUCCESS is the acronym for Smaller Urban Communities in Civitas for Environmentally Sustainable Solutions. All research and demonstration of SUCCESS activities are organized in the different work packages. Some of these are presented below:

- Clean and energy efficient vehicles – In Ploiesti 30 buses were transformed from diesel engines buses into LPG engine buses;
- Access management – Creation of a controlled access area within the city centre;
- Stimulation of collective transport ways – Improve infrastructure for collective transport ways;
- New concepts for the distribution of goods;
- Innovative soft measures – Implementation of new infrastructures for walking and cycling;
- Telematics – Implementation of a GPS system for the PT Company fleet in order to monitor it and supply real time information to users.

The share of cycling in the world is increasing. SPICYCLES is one of the Intelligent Energy Europe STEER projects that aim to demonstrate that the share of cycling can be increased even more. Colleague projects in Europe's STEER are Bypad and Astute; many other projects work in parallel to strengthen the efforts.

Front Runner Cities in Spicycles are: Barcelona, Berlin, Bucharest, Göteborg, Ploiesti and Rome. They address issues such as:

- Introduction of bike-sharing schemes;
- Implementation of communication and awareness raising campaigns;
- Integration of cycling planning in the overall spatial and transport planning;
- Building local partnerships.

These front runner cities will also lead in the "Benchmarking" and "City Characteristics Reporting" of Spicycles in which 60 more cities can also choose to participate.

All 3 projects have as one of the main objective to increase air quality by reducing traffic pollution mainly by: encouraging alternative transport ways and implementing measures to restrict or limit traffic access. They are all co-financed by the European Community and many of the numbered measures have already been implemented.

Between 2005 and 2008, the numbers of vehicles in use increased from 1.6 cars per person to 3.2 cars per person, according to Local Administration Finance. This number includes all cars registered in Ploiesti, regardless of its ownership: citizens or companies.

In September 2006, a local administration decision regulated traffic for heavy duty vehicles: routes and taxes. In the central area of the city, no over 3.5 tons vehicles are allowed. As much as possible, vehicles over 7.5 tons were deviated in the outside of the city, towards the interchange points.

Within city center between the beginnings of 2006 and beginning of 2007 a controlled access area was created and traffic was deviated in order to achieve minimum level of pollution, without restricting too many inhabitants.

The Environmental Agency of Ploiesti monitors air quality, measuring this way, from the environmental point of view, the results of the implemented measures Community (the Environmental County Agency of Prahova website, 2009).

With all efforts of Local Administration the air samples do not show a significant improvement of air quality for Ploiesti city, as it is shown in the following tables, for the last 3 years (tables 2.7, 2.8 and 2.9).

Table 2.7. **2005 Environmental agency readings on air pollution**
(http://www.deveffect.ro/anpm/st_med_2005.html)

Station	*Pollution factor*	*Number of samples over the limit*	*Maximum registered concentration (mg/m^3)*	*Average accepted value (mg/m^3)*	*Average concentration registered (mg/m^3)*	*Average trend*
The west side	HCHO	5	0.028	0.012	0.00239	1.4938
	NH_3	3	0.114	0.100	0.0298	0.805
	NO_2	2	0.108	0.100	0.0214	1.0542
	SO_2	0	0.05	0.250	0.0157	0.05
	H_2S	0	0.0046	0.008	0.0013	2.167
	SO_4^{2-} + ae. H_2SO_4	0	0.0118	0.012	0.0102	1.00
	PM 10	62	0.156	0.150	0.1462	0.9973
	CO	0	5.81	6.000	3.63	1.0168
North east side	HCHO	3	0.017	0.012	0.00222	
	NH_3	3	0.119	0.100	0.0285	0.812
	NO_2	0	0.083	0.100	0.0212	1.071
	SO_2	0	0.025	0.250	0.0157	0.929
	PM 10	63	0.155	0.150	0.146	1
East side	HCHO	0	0.015	0.012	0,0018	1.125
	NH_3	0	0.096	0.100	0.027	0.831
	SO_2	0	0.032	0.250	0.0156	0.907
	H_2S	0	0.0033	0.008	0.0015	1.667
	SO_4^{2-} + ae. H_2SO_4	1	0.0122	0.012	0.014	0.981
	PM 10	48	0.154	0.150	0.1456	1
South side	HCHO	0	0.019	0.012	0,00184	1.129
	NH_3	0	0.096	0.100	0.0257	0.924
	SO_2	0	0.0247	0.250	0,0153	0.879
	H_2S	2	0.005	0.008	0.00157	1.57
	SO_4^{2-} + ae. H_2SO_4	0	0.0123	0.012	0.01057	1.007
	PM 10	36	0.154	0.150	0.1457	1.002
North side	HCHO	0	0.003	0.012	0,00168	1.084
	NH_3	1	0.112	0.100	0.0271	0.909
	NO_2	0	0.053	0.100	0.01889	0.999
	SO_2	0	0.163	0.250	0.0161	0.953
	SO_4^{2-} + ae. H_2SO_4	0	0.0118	0.012	0.01018	0.998
	PM 10	74	0.157	0.150	0.1463	0.997
City center	HCHO	6	0.028	0.012	0.00252	1.615
	NH3	0	0.086	0.100	0.0256	0.891
	NO_2	2	0.12	0.100	0.0228	1.086
	SO_2	0	0.0208	0.250	0,0156	0.916
	H_2S	0	0.0042	0.008	0.00146	1.973
	SO_4^{2-} + ae. H_2SO_4	0	0.0119	0.012	0,0103	1.016
	PM 10	84	0.157	0.150	0,1459	0.999

Table 2.8. **2006 Environmental agency readings on air pollution**
(http://www.deveffect.ro/anpm/st_med_2006.html)

Station	*Pollution factor*	*Number of samples over the limit*	*Maximum registered concentration (mg/m^3)*	*Average accepted value (mg/m^3)*	*Average concentration (mg/m^3)*	*Average trend*
The west side	HCHO	3	0.013	0.012	0.0023	0.946
	NH_3	11	0.163	0.100	0.038	1.282
	NO_2	55	0.189	0.100	0.0511	2.388
	SO_2	0	0.191	0.250	0.0204	1.299
	H_2S	0	0.0072	0.008	0.0021	1.615
	SO_4^{2-} + ae. H_2SO_4	1	0.0122	0.012	0.0104	1.02
	PM 10	99	0.159	0.150	0.1472	1.007
	CO	0	5.76	6.000	3.7103	1.022
The north east side	HCHO	1	0.013	0.012	0.0022	0.995
	NH_3	4	0.14	0.100	0.0298	1.046
	NO_2	1	0.162	0.100	0.022	1.038
	SO_2	0	0.161	0.250	0.0198	1.261
	PM 10	89	0.16	0.150	0.1462	1.001
The east side	HCHO	0	0.0037	0.012	0.002	1.111
	NH_3	0	0.075	0.100	0.0274	1.015
	SO_2	0	0.196	0.250	0.0184	1.179

	H_2S	0	0.0072	0.008	0.002	1.333
	SO_4^{2-} + ae. H_2SO_4	0	0.012	0.012	0.0141	1.007
	PM 10	64	0.157	0.150	0.1464	1.005
The south side	HCHO	0	0.0037	0.012	0.002	1.087
	NH_3	2	0.14	0.100	0.0029	1.128
	SO_2	0	0.196	0.250	0.0177	1.157
	H_2S	1	0.0088	0.008	0.0021	1.338
	SO_4^{2-} + ae. H_2SO_4	0	0.012	0.012	0.0104	0.984
	PM 10	70	0.158	0.150	0.1465	1.005
The north side	HCHO	0	0.0037	0.012	0.002	1.19
	NH_3	12	0.135	0.100	0.0328	1.21
	NO_2	10	0.149	0.100	0.0328	1.736
	SO_2	0	0.148	0.250	0.0184	1.143
	SO_4^{2-} + ae. H_2SO_4	0	0.012	0.012	0.0103	1.012
	PM 10	98	0.16	0.150	0.1471	1.005
City center	HCHO	5	0.018	0.012	0.0029	1.151
	NH_3	0	0.097	0.100	0.0279	1.090
	NO_2	13	0.186	0.100	0.0368	1.614
	SO_2	0	0.122	0.250	0.0194	1.244
	H_2S	4	0.0092	0.008	0.0023	1.575
	SO_4^{2-} + ae. H_2SO_4	1	0.0125	0.012	0.0103	1.000
	PM 10	97	0.16	0.150	0.1470	1.008

Table 2.9. **2007 Environmental agency readings on air pollution**
(http://www.deveffect.ro/anpm/st_med_2007.html)

Station	***Pollution factor***	***Number of samples over the limit***	***Maximum registered concentration (mg/m^3)***	***Average accepted value (mg/m^3)***	***Average concentration (mg/m^3)***	***Average trend***
The west side	HCHO	4	0.0177	0.012	0.0022	0.9861
	NH_3	6	0.109	0.100	0.0343	0.9032
	NO_2	92	0.195	0.100	0.0776	1.5177
	SO_2	0	0.12	0.250	0.0168	0.8245
	H_2S	2	0.0086	0.008	0.0022	1.0334
	SO_4^{2-} + ae. H_2SO_4	0		0.012		
	PM 10	63	0.165	0.150	0.1462	0.9932
	CO	7	8.109	6.000	3.5727	0.963
The north east side	HCHO	5	0.18	0.012	0.0024	1.200
	NH_3	4	0.146	0.100	0.03011	1.0104
	NO_2	3	0.122	0.100	0.0323	1.4682
	SO_2	0	0.23	0.250	0.01808	0.9132
	PM 10	54	0.157	0.150	0.1457	0.9966
The east side	HCHO	0	0.009	0.012	0.0021	1.05
	NH_3	6	0.127	0.100	0.0277	1.0095
	SO_2	0	0.089	0.250	0.0157	0.8549
	H_2S	1	0.0081	0.008	0.00191	0.955
	SO_4^{2-} + ae. H_2SO_4	0	0.012	0.012	0.00995	0.7057
	PM 10	31	0.155	0.150	0.1455	0.9939
The south side	HCHO	0	0.0056	0.012	0.00209	1.045
	NH_3	11	0.147	0.100	0.0336	1.149
	SO_2	0	0.106	0.250	0.01414	0.7989
	H_2S	2	0.0088	0.008	0.0018	0.8334
	SO_4^{2-} + ae. H_2SO_4	0	0.0115	0.012	0.0097	0.9337
	PM 10	36	0.158	0.150	0.1454	0.9925
The north side	HCHO	0	0.0089	0.012	0.00217	1.085
	NH_3	4	0.127	0.100	0.0307	0.936
	NO_2	14	0.17	0.100	0.0352	1.0735
	SO_2	0	0.076	0.250	0.01463	0.7951
	SO_4^{2-} + ae. H_2SO_4	0	0.012	0.012	0.00973	0.9447
	PM 10	66	0.16	0.150	0.14626	0.9943
City center	HCHO	6	0.0178	0.012	0.0028	0.962
	NH3	0	0.0674	0.100	0.0256	0.9162
	NO_2	34	0.185	0.100	0.0442	1.2019
	SO_2	0	0.075	0.250	0.0149	0.772
	H2S	4	0.0092	0.008	0.0022	0.09435
	SO_4^{2-} + ae. H_2SO_4	0	0.012	0.012	0.0093	0.901
	PM 10	57	0.165	0.150	0.146	0.993

Table 2.10. **Traffic level for the surrounding access controlled area**

Area	***Streets***	***Average vehicle number Vehicles/hour June 2005***	***Average vehicle number Vehicles/hour March 2008***
The only street passing through the clear area	C.D. Gherea	978	338
The southern street limiting the area	Gheorghe Lazar	1278	740
The northern street limiting the area	Street closed and transformed, before CIVITAS in Parking Space	Parking space	Parking space
The east side of clear area	Nicolae Balcescu	934	1524
		111	
The west side of the clear area	Republicii Boulevard	1723	1880
Total number of cars passing in the surrounding of controlled access area		5024	4482

In order to evaluate the impact of implemented measures it is necessary to take under consideration the evolution of traffic levels within the city (table 2.10).

The number of vehicles decreased for C.D. Gherea Street because the street has been reorganized and instead of an extra band, there were built sideway parking spaces.

When considering heavy traffic vehicles, buses were not included. It is considered that the number of buses passing daily through the city has not changed significantly since 2005 to date.

The variation in traffic levels and pollution is considered to be given by the increased number of supply transport vehicles.

The data for traffic levels for heavy vehicles were collected at the entering points of each side of the city.

Before stating conclusions we have to mention that all measuring points of Environmental Agency are situated within the city, at around 3 to 5 km from the entering point of the city and heavy vehicles are allowed to travel only in the last interior ring of roads inside the side the city, connected to the highway and roads of Prahova County.

Table 2.11. **Traffic levels for heavy vehicles, compared measurements**

City area	***Average number of heavy vehicles per hour June 2005***	***Average number of vehicles per hour March 2008***
The west side	62	110
The north east side	35	80
The east side	20	72
The south side	43	86
The north side	77	93
The city center	0	0

3. Conclusions

The Ploiesti Environmental Agency has no technologies to measure NO_X emissions, the most important traffic pollution factor; still measurements cover other significant pollution factors: NO_2, NH_3, SO_2, PM 10 (particulate concentration) etc. (tables 2.7, 2.8 and 2.9).

The annual average concentration registered for all years and pollution factors never exceeded the average accepted value, still, for particulate concentration of the average registered value is very close to the accepted one.

The main pollution factors with PM 10 are petroleum industry (very developed in Ploiesti, but with a decreasing activity in the last five years) and traffic increase. Comparing 2005 readings (table 2.7) with 2006 readings (table 2.8), it reveals an increase of average concentration for all areas and all indicators considered, especially for the pollution factors connected to traffic increase: NO_2, NH_3, SO_2 and PM 10.

For example, in the west side, NO_2 more than 100% in concentration and 53 more samples over the limit in the entire year compared to 2 samples from 2005. For NH_3, the average concentration increases with 27.5%, and 11 instead of 3 samples were registered

over the limit. For particulate concentration we have a similar situation. This example shows the trend for all regions of the city.

In the beginning of 2007, when the controlled access area was implemented and the restrictions for heavy duty vehicles were already functional, the measurements showed a decrease in traffic pollution close to the levels registered in 2005, even if traffic measurements show (table 2.11) increase traffic of heavy vehicles at the city extremities.

The impact of the controlled access area implementation is shown in measurements made for the city centre. When comparing results for measurements in the city centre for all 3 years, it can be noticed that NH_3 average concentration reached the level from 2005, SO_2 annual concentration decreased more than for 2005 and PM 10 annual concentration even if it registered the same level as in 2005, the number of samples over the limit decreased to 57 compared to the 84 samples over the limit in 2005.

The same trend can be noticed for all traffic pollution factors. The only abnormality showed by the measurements in the central area is the significant increase of NO_2 with a doubled average concentration compared with 2005 and 34 samples over the limit instead of only 2 in 2005. Many suppositions can be made: from the existence of another pollution source, to the composition of used fuel.

The existence of another pollution source only for NO_2, in the city centre, was rejected by University specialists. An interview with top 6 professors in chemistry and engineering showed as the main possible of such NO_2 concentration, the construction of cars exhaustion filters. Apparently, cars with EURO 2, 3 and 4 engines, are equipped with exhaustion filters that are rapidly deteriorating, and if not changed at recommended periods, release more NO_X in the atmosphere.

The theory is plausible because in the last two years an important mass of second hand cars with EURO 2, 3 or 4 engines were bought by Ploiesti population from the European Union.

2.1.4 **Cătălin Popescu**, Augustin Mitu, Daniela Uta, *Design and implementation of methodologies for transport (CIVITAS SUCCESS) project(s) impact measurements,* **WSEAS TRANSACTIONS on ENVIRONMENT AND DEVELOPMENT**, E-ISSN: 2224-3496, Issue 1, Volume 8, January 2012, pag. 1-12, http://www.wseas.us/e-library/transactions/environment/2012/54-736.pdf.

In order to assess the impact a European project has at the European Community level, specific methodologies should to be developed and implemented according to the specifics of the evaluated project. A framework for this methodology is available within the projects' sector but every program and every project through its implementation team has to build its own instruments and adapt the European guidelines into a new methodology. In CIVITAS SUCCESS project, by definition, a transport and mobility project, a European organism (GUARD) was assigned to monitor the design, implementation and actual evaluation of the developed methodology. The evaluation and dissemination of the projects is based on how well the methodology is realized. In the case of CIVITAS SUCCESS project the methodological instruments used, led to results that changed the partners cities life.

1. Introduction

We called **transport measure** all innovations made concerning transport problems which improve urban mobility in terms of: introduction the hydride or electrical vehicles design and building of park and ride services or other new services, create the special areas with controlled access for pedestrians etc. Each measure is related with the potential impacts which could be associated with four main impact categories: economics, environment, societal and transport. In order to assess amplitudes for the impacts, we will use one index list and the help given by modelling, experimental assessment and some public investigations made by experts.

SUCCESS (Smaller Urban Communities in Civitas for Environmentally Sustainable Solutions) was a 4-year project, within the CIVITAS II Program, with partners from La Rochelle, Preston and Ploiesti. As an integrated project, SUCCESS has been implemented

thanks to an extensive investment in the participating cities, a large range of stakeholders and integrated packages of demonstration measures.

The SUCCESS proposal was submitted by the "Urban Community" of La Rochelle (France) supported by Preston (UK) and Ploiesti (Romania) in response to the European Commission's call for proposals for indirect RTD (Research and Technological Development Programme) actions under the specific program for research, technological development and demonstration: 'Integrating and Strengthening the European Research Area' and the thematic priority areas: 'Sustainable Energy Systems' and 'Sustainable Surface Transport'. Specifically it responded to Section 6.1.3.1.3 of 'Sustainable Energy Systems': alternative motor fuels: Testing implementation and transition strategies for clean urban transport – CIVITAS II; and to Objective 1: new technologies and concepts for all surface transport modes (road, rail and waterborne) testing implementation and transition strategies for clean urban transport – CIVITAS II under 'Sustainable Surface Transport'.

The general objectives of SUCCESS were to:

- Demonstrate that alternative fuels could be an efficient choice for urban transport matters; the target for all vehicle fleets was a decrease of 20% in the use of fossil fuels and a decrease of 10% in energy consumption, CO2 emissions, particulates, NOx and NO2 emissions;
- Demonstrate that, with an ambitious package of mobility and traffic management measures, significant results can be provided regarding sustainable transport and energy policy;
- Demonstrate that cities in candidate countries can avoid the mistakes made in Western Europe, and contribute to the development of their collective transport systems;
- Support related research and assessment activities including new, all-inclusive training initiatives and communication initiatives to disseminate the results and encourage transferability in the concerned areas.

The local demonstrations included the implementation of biodiesel hybrid vehicles (buses, vans and taxis), backed up with a range of initiatives including access control schemes, Integrated Pricing Systems, deployment of a car sharing fleet, innovative transport information systems and new concepts for city logistics. A characteristic of CIVITAS-SUCCESS was to address medium size cities challenges for a sustainable urban mobility. The impact of a project has different levels that need to be considered and evaluated: from the smallest measure implemented to the whole project and city level impact. One impact that has to be considered is also a project impact on local and European policies as well as the support and recommendations offered by the project to other cities. A form of the impact overview is showed in figure 2.11.

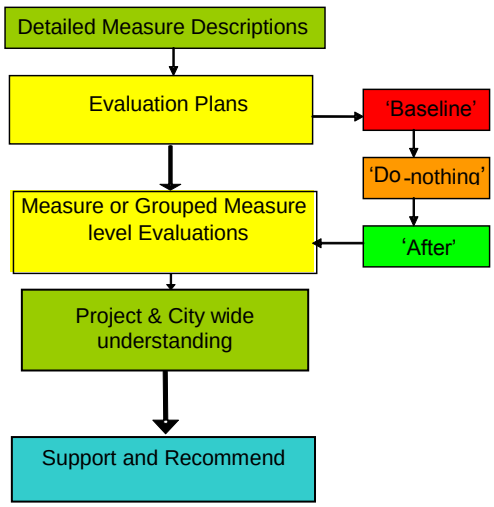


Figure 2.11. **Outline of Impact Evaluation Framework**

For any cross-site impact evaluation, it is necessary to define a set of common indicators and to determine those indicators in a comparable way at different sites. This enables a cross-site comparison or a generalization of the results provided by the individual

projects/sites. Two basic requirements have to be taken into account when defining indicators: they must be able to clearly reflect the related performance or impact; and they must be capable of reliable assessment using the experimental tools and measurement methods chosen. In selecting common indicators, the main criteria to follow include relevance, completeness, availability, measurability, reliability, familiarity and independence.

Common indicators in CIVITAS-GUARD were based on those developed by METEOR in conjunction with the project *evaluation* objectives in CIVITAS II (fig. 2.12).

NO.	EVALUATION CATEGORY	EVALUATION SUB - CATEGORY	IMPACT	INDICATOR
	ECONOMY			
1		**Benefits**	Operating Revenues	Operatin g revenues
2		**Costs**	Operating Costs	Operating costs
	ENERGY			
3		**Energy Consumption**	Fuel Consumption	Vehicle fuel ef ficiency
4				Fuel mix
	ENVIRONMENT			
5		**Pollution/Nuisance**	Air Quality	CO levels
6				NOx levels
7				Particulate levels
8			Emissions	CO2 emissions
9				CO emissions
10				NOx emissions
11				Small particulate emissions
12			Noise	Nois e perception
	SOCIETY			
13		**Acceptance**	Awareness	Awareness level
14			Acceptance	Accept ance level
15		**Accessibility**	Spatial Accessibility	Perception of PT accessibility
16			Economic Accessibility	PT services relative cost
17		**Security**	Security	Perception of PT security
	TRANSPORT			
18		**Quality of Service**	Service reliability	A ccuracy of PT timekeeping
19			Quality of service	Qu ality of PT service
20		**Safety**	Transport Safety	No. of injuries and deaths caused by accidents
21		**Transport System**	Traffic Levels	Vkm by vehicle type - peak
22				Vkm by vehicle type -off peak
23			Congestion Levels	Average vehicle speed - peak
24				Average vehicle speed - off peak
25			Freight Movements	Total no. of goods vehicles moving in demo areas
26			Modal split	Average modal split -PAX
27				Average modal split -vehicles
28			Vehicle Occupancy	Average occupancy

Figure 2.12. **List of indicators**

The indicators and methods used in METEOR were developed with the CIVITAS I projects and cities and formed a basis for those to be used in CIVITAS SUCCESS. METEOR has considered 5 evaluation areas (economy, energy, environment, society and transport) and 28 indicators, divided into 12 subcategories: benefits, costs, energy consumption,

pollution/nuisance, resource consumption, acceptance, equity, health and security, quality of service, safety and transport system. A number of methods are available to evaluate emissions and energy impacts from the CIVITAS II measures. Each method has varied in cost, ease of collection and how representative it reflects the reality. Key pollutants which are often measured in emissions studies are CO, HC, NO_x, PM_{10}, CO_2 and fuel consumption. The chosen approach can range from direct measurement of vehicle tailpipe exhausts either on-road or in the laboratory, use off records collected by the parties involved with a particular application or use of specific vehicle parameters which are then feed into the model. Local evaluation managers are best placed to understand the likely impact of such measures and so choose the appropriate tool. Most important however, is that the reasons for the chosen approach and explicit description of the methodology used, is presented with the final results. No approach is perfect and limitations of each approach need to be considered when drawing conclusions from the result.

For a few years, all demonstrative projects proposed by the European Commission have contained a short part discussing about the transferability: Crash [1], Priscilla [2], Niches [3], SUCCESS [4].

But in these projects, the transferability is concerned with understanding those factors which are important to the success of a measure and whether they can be transferred/ replicated in another city.

The receiver city will be just informed which are the barriers and will not have the possibility to estimate potential impacts of a project in the city, in agreement with specific urban and socio-demographic conditions.

In CIVITAS SUCCESS project the adaptation and detailing of the indicators and the wider evaluation framework has been reported in Local Evaluation Plans (LEP) for each site, setting out what, how and when measures will be evaluated. The final presentation of indicators and assessment methods were set out in the Measure Results Templates (MRT), which contain the main results of the CIVITAS SUCCESS project. Data have been collected for each measure in accordance with the scale of that measure. For most measures implementation there will be a much smaller scale than corresponds to the full scale of the city, and therefore measure-level evaluation has been appropriate. Impact evaluation of measures has also been considered at other scales, where appropriate:

- clustered measures (where similar actions are implemented in the same area);
- city level impacts (where analysis has been done on wider impacts).

In addition, through up-scaling, an analysis has been carried out regarding the potential impacts and if the measure should be implemented on a larger scale. This has assisted the cities to forecast future impacts, as many measures will continue to be expanded in line with current policies for integrated mobility practices.

It was anticipated that the success of the CIVITAS-SUCCESS measures would be influenced not only by the technical solutions themselves, but also by optimising the process of planning and implementation including accompanying activities such as information, communication and engagement of stakeholders. This was in fact the case, and the influence of such activities has been recorded throughout the project via the process evaluation activities (fig. 2.13).

Process evaluation data have been collected and presented in two main ways:

- Via the collection of information on-site for activity reporting and process evaluation in a Project Management Tool based on MS Access. This has provided detailed time-series input to GUARD's analysis of process evaluation;
- Inside the measure results templates under a key section on 'Lessons Learned'.

An important output from the process evaluation has been for those involved in measure implementation (the measure managers) as they had to rate the importance of various drivers and barriers experienced during the implementation process, and highlight if these issues are likely to be relevant to other cities that will consider the implementation of the same measure. A common reporting framework in the form of templates (fig. 2.14) has been developed in CIVITAS II that this forming the building blocks for impact evaluation analysis in the CIVITAS-SUCCESS project.

The domains in which new knowledge was acquired by partners during SUCCESS are classified into 4 types:

- Clean vehicles;
- Urban mobility improvements;
- New services;
- Information and ticketing systems.

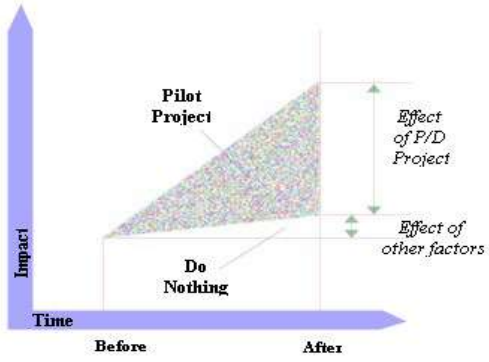


Figure 2.13. **From the Final Evaluation Report: Before (Baseline), Do-nothing (Business-as-Usual) and After (Ex-post) scenarios (from MAESTRO, 1999)**

MEASURE-LEVEL RESULTS	
Measure title: Measure number:	Project: City:
The Measure – what is it about?	
M1: Measure objectives: M2: Measure description:	
The Implementation – how was the measure implemented?	
M3: Innovative aspects: M4: Situation before CIVITAS: M5: Design of the measure: M6: Actual implementation: M7: Deviations from the plan:	
The Evaluation – how was it done and what are the results?	
M8: Method of measurement: M9: Achievement of quantifiable targets: M10: Achievement of evaluation-related milestones: M11: Report on the measure results:	
Lessons Learned – what do other cities, other actors and the EC have to consider?	
M12: Barriers and drivers of the measure implementation / Process evaluation M13: Interrelationships with other measures M14: Lessons learned	

Figure 2.14. **MRT – Measure level Result Template**

Apart from the knowledge linked to the design and implementation of technical equipment, this paper stresses also the importance of several key factors which must not be neglected by cities wishing to implement sustainable mobility policies. These are:

- the 3 pillars for mobility projects: political decisions, technical coherence and involvement of stakeholders are the foundations of such projects. The management of urban mobility projects must take into account the influence of these pillars, and although there may be strong similarities between projects, the management of each one must be adapted to the domain concerned, to the specific challenges linked to its success and of course to the city in which it is situated.

- **project management**: mobility improvements are always complex projects. The variety of stakeholders implied and the different technical solutions which have to be integrated to meet the objectives require a global approach within the domain tackled by each project (e.g. cycling, vehicle sharing, and bus network), a good view on interfaces with other domains and a strong and efficient project management.

- **project construction**: As for project management, the construction of Mobility projects resembles other kinds of project, although specificities will of course arise when detailing technical solutions. Therefore the following steps will be found in each mobility project: concept development, baseline analysis, design of technical solutions, implementation and adjustment.

The SUCCESS partners will continue to exploit the knowledge gained during the project to motivate other politicians and transport managers to implement similar policies, measures and tools in their own projects. The exploitation activities and instruments were devoted to the stakeholders more involved in the investment decision making process or in supporting it.

The main target groups are: politicians from all levels of government, managers of transport authorities, implementers of policies and initiatives, multipliers (experts, journalists), business associations, manufacturers of vehicles, equipments, information systems or any products who can benefit from the achievements and findings of SUCCESS. Many project deliverables are already and will be in the near future directly exploited by SUCCESS partners at the local level in each city.

Various technologies have been implemented during the 4 years of the project. The impacts of these introductions have been analyzed through the project evaluation in order to measure the feedbacks and the progresses in urban mobility in the 3 cities and in other cities. This was one of the bases to build the exploitation plan.

With over 50 measures developed during the CIVITAS-SUCCESS project and accompanying evaluation activities undertaken over a number of years there are abundant results available at a detailed level. GUARD [8] have been given full access to these results in order to draw cross site and cross project conclusions about the relative impact and importance of CIVITAS measures. The full sets of results from CIVITAS-SUCCESS are contained in the Final Evaluation Report. Some illustrative results are presented here as examples of key findings from each of the main demonstration themes.

2. Clean vehicles and alternative fuels

In La Rochelle, a diester fuelling station was created for buses and fleets using vegetable oil and/or recycled cooking oil from a treatment unit which was implemented as part of the project. Apart from the process itself which does not use any chemical additives, a complete new organization had to be set up in order to collect cooked oil from "producers" and specific arrangements had to be established with legal authorities.

Buses in Ploiesti were converted to run on Liquid Petroleum Gas, which was a major step towards environmental improvement in the city. Apart from the retrofit itself, which lead to buses looking like new ones, the utilization in to day service allowed the operator to determine how to optimize performance and maintenance costs.

EEV buses demonstration in La Rochelle proved reliability, had reasonable maintenance costs and produced reduced pollution comparing with previous standards of bus: the main findings of the exhaust gas analysis comparing Euro 3 buses and EEV buses showed a strong drop in favour of EEV buses in carbon monoxide (-98%), hydrocarbons (-98%), nitrogen oxides (-68%) as well as in particulate matters (-89%)[4].

However, hybrid buses were tested in La Rochelle alongside with electric buses of a similar size and duties and hybrid bus and their performance was disappointing, with low levels of reliability/availability and frequent maintenance required. Despite this, the public view was positive when they were using the vehicles due to the interest and support for a clean urban public transport. Preston had difficulty obtaining suitable and cost-effective hybrid buses for their planned demonstrations, and used biodiesel in order to reduce CO2 emissions from public transport.

LPG buses in Ploiesti met their objectives of reducing pollution of (CO) emissions and reduced fuel costs. On the other hand, the maintenance costs of these buses were not reduced however (as had been as hoped), and there are some concerns about long-term robustness of retrofitting this equipment to older buses. The public reaction to the overall refurbishment has been very favourable.

3. Access Management

The main development of new knowledge concerned:

- **access controlled zones and dedicated bus lanes:** each has been extensively implemented during the project by the 3 partners. Design and implementation methodologies as well as the use of adapted technology were demonstrated in various situations;
- **car park management**: optimization of space, improvement of footpaths, integration with soft modes, car park design, lighting, information about local bus and rail links are the ingredients which must be cleverly mixed in order to have efficient and well integrated car parks;
- **optimization of bus networks**: the design and management of bus networks using new information technologies was one of the developments in SUCCESS. The knowledge gained was so important that the networks in all three cities were substantially changed at the end of SUCCESS. This included the specificities of seasonal adaptation and the integration of external coaches in the network (tourist coaches in La Rochelle).

Romania follows the trend set out by the European Community in improving air quality and city mobility by encouraging alternative transport modes and Public Transport instead of self car use. In these conditions, even without CIVITAS, traffic restriction would have been imposed for the city central area.

Ploiesti City Hall, in the spirit of sustainable development, promotes and sustains the design and implementation of pedestrian areas within the city, not only for the central area. The project CIVITAS SUCCESS came as an answer to the Municipality efforts in the modernization of Ploiesti Central Area.

Implementation of such measure was actually an objective on the Local Agenda 21, Ploiesti Plan for Sustainable Development.

The necessity of clear zone development in the city centre came from:

- Concerns regarding a sustainable traffic system in the city in the context of an increasing traffic congestion and air pollution;
- The need of coordinating - at a future urban development level - the high density zones and pedestrian facilities needed for traffic safety and increased recreation facilities;
- The important number of inhabitants with no access to a car and for whom daily walking is a must;
- Increased number of elderly people for whom walking is important and beneficial. What should be also mentioned here is that the implementation of a pedestrian area in the city centre, was programmed by the end of 2010, and the CIVITAS – SUCCESS project offered at least 2 years advantage. More, the design of the access controlled area included not only traffic restrictions but a strategy to develop the area.

Since 1971, several streets in the city centre of La Rochelle have been pedestrian areas. Although the shopkeepers were first divided on this subject, the initiative finally proved to be popular. These pedestrian streets were then equipped with rising bollards in order to restrict access to the residents' cars and to delivery vehicles. With the support of the inhabitants in favour of reducing traffic flows, La Rochelle has spread access control zones in other parts of the city and it became an example on how access control should be managed. In CIVITAS SUCCESS project, by developing access control zones, La Rochelle aimed at restricting the access of the private car in the historical centre of the city. Furthermore,

access control zones constitute secure areas for bikes and pedestrians. In some area, such zones make deliveries easier; combined with the creation of dedicated bus lane – they give priority to Public Transport comparing with the private cars access in these areas. Such actions were accompanied by a major overhaul of the city's traffic flow plan. They implied preliminary tasks including a wide range of local actors: in-depth studies on the potential impacts, a consultation phase with all the stakeholders (residents, businesses, car drivers association), an efficient cooperation between the local authorities (City and Urban Community of La Rochelle) and above all a strong political involvement, as it constitutes a tricky issue, notably among businesses and car drivers.

From the city-wide evaluation done in Preston and La Rochelle on air quality and traffic a clear result showing impacts of this scale (magnitude and geographical coverage) cannot be attributed to CIVITAS measures, and probably has not been achieved.

What has been learned from the evaluation of the CIVITAS-SUCCESS project is that significant city-wide impacts are nearly impossible to achieve from a series of demonstrations that are linked thematically and integrated across mobility topics, but which are dispersed in the city so there is a more limited scope for geographical overlap. There is a choice between choosing to focus all measures on one area or corridor (which is then untypical and perhaps undermined by the behaviour of travellers in other areas of the city) or spreading measures across a range of areas to create a stronger foundation for whole-scale mobility transformation. The latter strategy can also take longer to produce results than is available in the CIVITAS project timescales, to a sufficient degree that they overcome the trends that are operating in the reverse direction and with some force.

However, what has also been learned from the evaluation of the CIVITAS-SUCCESS project is that measures are available and have been implemented and that they are working towards improved mobility and reduction in negative impacts from transport. Indications are that citizens are keen on them both in theory principle and practice; therefore this momentum must be maintained to develop a steady change in opinion and then behaviour about what are acceptable standard and mode(s) of urban mobility.

4. Integrated pricing strategies

Different software and telematic systems have been implemented and tested in the cities:

- **real time information systems**: such systems have been set up in all three cities. In this domain again, the most significant knowledge concerns the NAS countries. Through the comparison between implementations, specific deployment methodology may be designed for these countries;
- **integrated ticketing**: projects made during SUCCESS lead to the demonstration that the integration of several transport modes is possible in medium sized cities, both on the multi modality aspects and the integration of ticketing. In La Rochelle and Preston multi-service travel smartcards have been set up allowing customers to use the same card in different transport modes with different tariffs;
- **interoperability**: the integration of ticketing is based on the interoperability of information systems and coordination of organizations. So the development of common data bases between several transport operators was the basis of the learning.

The implementation of integrated ticketing products in La Rochelle has been a success, when measured against the core selected and monitored indicators. The seven-day pass was the most popular and accounted for a little over half of the sales over a four-year period. On the other hand, the numbers of trips in public transport using 'Pass Rochelais' between 2005 and 2008 had also increased. Virtually all users were satisfied with the practical information provided in the Pass Rochelle's brochure concerning activities and prices.

Test versions of the interoperable Smartcard in Preston were trialled generating useful results on performance and usability. Feedback from users was that instructions on how to use the Smartcard were clear and the roll-out strategy was refined with a feedback.

Smartcard recharge should take place on board the bus. Paying by Smartcard was the preferred method of payment amongst respondents across all bus routes.

5. New concepts for goods distribution

The Transport Act (2000) requires Local Transport Authorities to prepare a 5 year Local Transport Plan setting out a transport vision and priorities for its area, the second Local Transport Plan covers the period from years 2006/07 to 2010/11.

As part of the plan, one of the aims was to improve the rural and urban areas by promoting new transport ideas for Preston and South Ribble through the Civitas project; by re-inventing transport in Preston and demonstrating a new standard of best practice.

A draft of Lancashire's first proposed freight strategy was produced based on the advice of the FQP. This would set a framework for addressing a wide range of transport related issues across the county of Lancashire.

It would illustrate the problems which were currently faced locally, whilst relating them to a regional and national context. This strategy would also look to potential challenges in the future, and a range of related actions.

In order to reduce the traffic congestion inside Ploiesti, in particular in the city centre and to reduce the air pollution in this area it was an absolute necessity to set up a City Logistics Strategic Plan.

Specific routes for freight transport were established in this way and an organized framework for transporters was created, respectively the Freight Forum.

As a result, the access of heavy duty vehicles was totally restricted in the city centre, and heavy traffic was directed to the city periphery. Levels of congestion, pollution and noise inside the city were lower than at the periphery of the city, where freight vehicles traffic had been re-directed. The Local Administration found that based on the Logistics Scheme elaboration and goods distribution activity increased.

6. Innovative soft measures

Key results from implementing student travel plans in La Rochelle along with the 'Pass Etudiant17' were that the number of Pass subscribers increased over a period of two years. The level of awareness regarding the Pass had increased and Pass subscribers were relatively satisfied or very satisfied with the Pass.

By implementing cycling and walking infrastructure in Ploiesti, facilities, accessibility and connectivity were improved. New cycle lanes and walking routes were created and this contributed to lower pollution and traffic congestion.

According to a survey which inhabitants were asked to mention measures implemented within project CIVITAS – SUCCESS, 42.2% mentioned the cycling tracks.

Also the results showed that implementing this measure:

- was considered, by 70% of the respondents, to be helpful for stimulating alternative/ ecologic transport modes;
- 69% of the respondents considered that the measure increases the safety of bicyclist;
- 69 % considered that the measure has the potential to reduce in a big measure the level of pollution.

In the same manner, 68% of the adult population considers that the measure also increases the pedestrians' safety.

7. Telematics

Around 80% of respondents surveyed in Preston found the MARIO (mapping and travel information) website is easy to use. For the majority of information topics, respondents felt that such as GIS based information system is suitable for getting enough transport information.

The key result for the GPS system in Ploiesti was to reduce operational costs. In addition, public transport users knew about the real time information system and high levels of appreciation were recorded. Public transport users considered that the main improvement of the quality of bus stops was the installation of real time informational panels.

PT developed two surveys in order to quantify the implementation and the impact of such measures on Ploiesti citizens, particularly on public transport users.

Also, the efficiency of the system in terms of delays, period between departures and arrivals, as well as the seldom breakings of the public transport flow were monitored.

Inter-related measure 12.11 “Implementation of a GPS System for the PT fleet” and 12.13 “Implementation of a real time information system for PT”, were differently perceived by PT users. The awareness level was higher for “what they see” – the real time information system – than from what they benefit more – the GPS System.

With regards to real time information terminals in La Rochelle, the level of awareness, acceptance and satisfaction expressed by public transport users has increased. The same is also true of the real-time information service via SMS service. Six months after it was launched (July 2008), more than one in three users were aware of the SMS service.

The key results for the enhanced integration of the ticketing system in La Rochelle were that users who had used the smart card were generally satisfied. There was a very high rate of approval amongst bus users for developing a service to e-recharge travel passes.

8. City wide impacts

In order to evaluate the city wide impact, at every partner level as instrument was used a spreadsheet similar to MRT Report illustrated in figure 2.15. It was hoped that the measures implemented through CIVITAS-SUCCESS would have a positive impact on city wide traffic levels in La Rochelle, and thereby air quality. However, there was not a clear indication from the monitoring programme that overall city traffic levels had responded to the CIVITAS-SUCCESS measures.

CITY-LEVEL RESULTS	
Indicator title: Indicator number: Evaluation Area:	Project: City:
The Indicator – what is it about?	
C1: Local objectives and quantifiable targets:	
C2: Indicator description:	
C3: Context and relevance:	
The Evaluation –what are the results?	
C4: Method of measurement:	
C5: Achievement of quantifiable targets:	
C6: Report on results:	

Figure 2.15. **City level Result Template**

However, some individual measures have proved and explained some estimated reductions in car trips:

- Measure 9.2 Bike Sharing: in 2007 over 6,000 car trips were avoided;
- Measure 11.1 Implementation of new structure for alternative modes: 26% of respondents stated that they used the cycle path mainly for home-to-work or home-to-school travel and claimed that they changed their main mode of travel after the cycle paths were opened;
- Measure 11.2 Business Travel Plan: between 65,000 and 85,000 car trips could be avoided.

It would appear that collectively the CIVITAS-SUCCESS measures in La Rochelle have not had a measurable impact on traffic levels at the city level, and therefore air quality.

Impacts are difficult to prove and are likely to be dominated by population growth and seasonal variations.

For the Preston site an analysis of emissions and predicted air quality was carried out. Over the evaluation timescales for the CIVITAS-SUCCESS project the trend in air quality was one of general improvement, with emissions and subsequently concentrations of all pollutants seen to be decreasing. However, this decrease cannot be clearly and directly attributed to the measures.

The analysis of the impact of individual measures in Preston did show, however, that the actions undertaken within CIVITAS-SUCCESS are leading to a decrease in pollutant emissions and over a larger scale actions of this type could have a significant effect.

In the case of Ploiesti, all measures were demonstrative ones and the impacts are not easily separated from the other changes in the city, such as changes in land use and the reductions in emissions resulting from improvements in vehicle technology.

In Ploiesti major surveys were carried out to understand the changing perceptions of integrated mobility measures implemented during the CIVITAS experience. While a relatively small proportion of Ploiesti's population had heard of the CIVITAS-SUCCESS project (11% of survey respondents) a higher proportion are aware of the measure the project has delivered. The expectations of respondents are high and they believe that the measures implemented will have a positive and lasting impact on many aspects of life in Ploiesti.

9. Conclusions

As SUCCESS was a demonstration project, it was the place to experiment with innovative transport technologies and to measure changes in the transport behaviour of the users. In this sense, there were no "products" developed during the project but mainly new practices to use existing or innovative products or combination of several products. As a consequence, there was no need to set up specific arrangements for contractual ownership of results, or for potential industrial and intellectual rights.

In order to reach the mentioned objectives, the exploitation strategy was split in several types of actions:

- to extend the application area in SUCCESS cities (for instance to develop new access control zones);
- to transfer the knowledge on most efficient practices which have been developed during the project; this will be done through various dissemination and training channels;
- to help other cities to set up urban mobility projects.

The benefits of SUCCESS in the 3 cities will last for a long time and many of the successful demonstration projects will continue. However these successes generated new ideas and new projects as continuation of the already implemented or the brand new.

For La Rochelle Urban Community, the most significant future projects which are already in design phase are:

- concerning the vehicles: the extension of the EEV bus fleet, the introduction of electric vehicles in car sharing as soon as they will be available (in late 2010);
- the extension of the area of the cooked oil collection, to all the touristic towns of the Urban community and maybe as far as Rochefort;
- the development of BHNS (Bus à Haut Niveau de Service / Bus Rapid Transit) lines linking suburbs to city centre;
- the implementation of new circular bus lanes (2010) to match the requirements of the customers
- to experiment with a dedicated lane for automated electric vehicles in self service;
- the improvement of real time information systems using numeric nomad technologies;
- several research works have already started to develop the methodology and the prototypes of simulation software developed during the project. Two new PhD theses started in 2009 on urban mobility topics directly linked with SUCCESS results;
- a Masters course, specialized in Urban Mobility was launched in March 2010; designed in collaboration with the CNAM (Conservatoire des Arts et Metiers) it aims towards professional training for urban mobility specialists.

For Lancashire County Council and Preston:

- the development of demand responsive transport will be applied in as many new areas as can be identified with known demand. The projections are: Maximum 2009: 1 further area, assuming funding for new bus. Practicable 2015: 2 new dial-a-ride services operational;
- the extension of the car park approach to new sites based on public/private consortium the extension of cycle paths to the Lancaster / Morecambe area and if funding can be obtained, a roll-out to other towns in the East Lancashire area will be considered;

In Ploiesti, the projections concern:

- the development of real time information of passengers, particularly the installation of information panels;
- the creation of new access zones in the city centre;
- the extension of cycle paths and accessible infrastructure;
- the medium-longer term plans will focus on new bus purchase of the cleanest standard technologies, whether CNG or latest diesel.

Knowledge transfer relies mostly on dissemination and training activities. These are presented in the second part of this document and for each of them the "beyond SUCCESS" life is examined.

Apart from classical dissemination media (press, web sites,…), the main categories of actions are: **conferences and scientific articles** based on the exploitation at research level of SUCCESS achievements are and will be produced in the next coming years, either to promote new findings or to evaluate the results of the demonstration projects**, local study tours** will continue to give opportunities for companies to show implemented technical solutions on site, enhancing the networking process, and for other cities to benefit from the real-world demonstration of partner achievements.

The methodological guide as well as the Urban goods thematic brochure will be widely disseminated.

Training: several training sessions are already planned in the coming years to make available and to explain SUCCESS achievements to different target groups.

As a complement of the previous transfer activities, SUCCESS partners plan to be involved strongly in the development of future urban mobility projects, at European or national level, which will have the same global approach as the one developed in CIVITAS. The aim of this is to develop further knowledge or new practices according to the evolution of technologies or society requirements.

The specific actions which will be realised in the future are:

- **contribution to national CIVITAS task forces**; this was initiated during CIVITAS II in France and United Kingdom.

The French Taskforce will be continued through the CIVINET initiative (proposed by TTR and EPC working with Toulouse and GART). The UK / IE Network led by LCC with the support of TTR will also be continued through CIVINET.

The Romanian Taskforce composed of Ploiesti and Suceava (CIVITAS II), Bucarest (CIVITAS I) could gather the cities of Craiova and Iasi (CIVITAS Plus).

Through CIVINET, the concept will be extended to Spain, Italy and Slovenia, and promoted in other countries.

- **participation in new demonstration projects**: this was also initiated during SUCCESS and the 3 partners are already involved in other projects which are the continuation of SUCCESS measures, for instance BIOSIRE for CdA La Rochelle (Europe, best practices for tourism transport), and CIVITAS-ARCHIMEDES for TTR. Partners also helped other organizations to build projects like CdA La Rochelle for CdA Poitiers.
- **involvement in national urban mobility organizations**: although this existed for all partners before SUCCESS, the achievements and lessons learned during this project helped partners to take an expert role in national organizations dealing with urban mobility and to influence funding decisions and project orientations.

For instance: CdA La Rochelle or EIGSI through respective networks like Predit or Interop VLab (ex-European NoE); Ploiesti as a representative city for the NAS, will help to analyze the transferability of western technologies in neighbouring countries

- **development of new knowledge through PhD thesis and research works**.

Four PhD theses were launched during the SUCCESS project, in direct link with the improvements and innovative measures that were set up. Two are ended and the other two will end in the coming year; however, because SUCCESS, as well as other CIVITAS projects, was a real source of new urban transport practice, research partners will continue to investigate the rich material in order to propose new organizations or transport modes for the future.

2.2 Researches on the effectiveness of using exhaustible mineral resources and on Romanian mining industry potential by developing new management tools, for econometric assessment and multi-criteria analysis of certain exhaustible resources utilization (such as coal, mineral ores, oil and gas)

2.2.1 Marius Bulearcă, **Cătălin Popescu**, Mihai Sabin Muscalu, Constantin Ghiga *Resources management and rent theory in mining industry,* **Communications of the IBIMA Journal**, IBIMA Publishing, United States, *Volume 2012 (2012), Article ID 790264, Communications of the IBIMA, 11 pages,* DOI: 10.5171/2012.790264 http://www.ibimapublishing.com/journals/CIBIMA/2012/790264/790264.pdf

Presentation and evaluation of a variety of different contractual taxation systems usually used in developing countries depends on the variety of different economic and geological conditions, where of particular interest are the geological conditions that allow a low probability to discover new resources. As a result, the hypothesis was that some regularity should appear in effectiveness of the schemes themselves although current rates that are fixed in any given schema are designed to be sensitive to basic conditions.

To have a successful economic management of natural resources, the social importance of analyzing resources misuse based on both the social opportunity cost and the total economic value is thoroughly analyzed in this paper, whilst the types and sources of inefficiency of resource management along with the market and government failures in this respect are revealed at the end of this paper.

I. INTRODUCTION

Economic analysis of extractive industry is fundamentally different from the analysis of agriculture, manufacturing and services. The main reason is that the mineral resources are exhaustible resources. In other words, in mining industry an initial stock of reserves will exhaust in time. If we start from the premise that the owner of a resource, like any other owner, is seeking for maximum gain, then it must consider specific factors, unique in the mining industry.

In economic analysis in general, and especially that related to natural resources market, has been prevalent until now, the concept of their scarce character, in this respect, much of the methodological concepts being closely related to resources allocation problems at micro and macro-economic level.

Based on these considerations, it should be noted that in the economic literature, there has been often accredited to the idea of resource reserves depletion, due to the extent of economic and demographic development. But it must be taken into account that natural resources are not homogeneous in nature.

Therefore, the problem of modeling mining rents, put in simple terms, is to select policies for the contractual duty to provide sufficient incentives for foreign companies engaged in exploration and extraction of resources, by obtaining the broadest possible part of that resource rent. Although this issue has some elements of the problem of attracting foreign investors, it is different in many respects.

It has been also noticed that, in terms of economic management of natural resources, the social importance of analysis of resources misuse is facilitated by the study of two related concepts.

The first is the social opportunity cost of resource use. This cost is about the optimum level at which resources can be used. The second concept is that of the total economic value. This value expresses the largest parts of the conservation value of natural resources in a tolerable way. The analysis of both concepts is also extended at the end of this paper.

II. A NEW APPROACH OF RENT THEORY IN MINING INDUSTRY

In a perfect competition between owners of land with deposits of mineral resources, exhaustibility annuity/rent is the absolute rent ceiling [14]. Its existence does not exclude the emergence of monopoly rent, if conditions allow competition, the two being always limited by the price of the substitute. However, differences between interest rates received by landowners may lead to a greater supply of land with deposits of mineral resources, leased at a price lower than set by theory [19].

The main problem that arises consist in the results that are obtained by exploiting these deposits, because in reality, time to exhaustion T_0 is not known with certainty. So *from undisputable economic reasons, exhaustibility annuity growths in relation to interest rate "i" , but its level at time "t" can not be rigorously determined.*

In this respect, the essential problem in dealing with rent in the mining industry is to determine with some certainty the operating range up to exhaustion of a reservoir, because, economically, exhaustibility annuity/rent is to increase interest in certain fields with low useful elements and/or difficult conditions of extraction, but its level for a certain time horizon can not be practically determined.

For example, the debates which took place after the first OPEC oil crisis [5, 25], have proposed a new price formula called "Taïb", whereby the real price of oil would grow at the same pace with economic growth. But after the confrontation of interests and opinions concluded that, if one accepts a certain horizon of depletion of oil reserves (it was estimated that oil reserves at costs less than the substitute for coal will reach tens years of consumption) by applying this formula the oil price should be below the baseline [26].

Returning to the question of acquiring rents we must distinguish between rents that are obtained as a result of differences in quality of deposits, and those which are created by the "market" and which are the object of an open fight for acquiring them. In the first case can be found, for example, absolute rents created and acquired by tax measures imposed by the State as the sole owner of mineral resources (e.g., oil-producing states decide to create an additional duty on crude oil sales by 10%; in this case, oil prices could increase by up to 10%, which could cause that the absolute rent obtained to be taken by the State as a producer only from the consumers [42]).

In the second case is found differential rent, as well as the conjectural rent, a form of absolute rent, which is temporary and affects the level of various resources. When prices fall, mines with marginal revenues suffer losses, and traders exploiting mineral deposits with low content of useful elements acquire their differential rent and gain higher profits. These phenomena affect the raw materials and energy prices, which are thus subject to large fluctuations [33].

In fact, both differential and absolute rent is acquired by two categories of businesses: owners and those who exploit the deposit. If the State, as owner of a certain area, has been prospecting, exploiting and evaluating this area, and hence of the size of differential rents they can get, it may assume an auction for that exploitation deposit. If auction generates competition, the State may acquire fully differential rent.

In fact, the state owner of marginal deposits will not get a lease without his income to cover a minimum of operation exploration and evaluation expenses, so to ensure the ability to reconstitute, at least theoretically, a part of his efforts to attract deposits in the economic circuit, plus a large part of the absolute rent [1]. When the State takes on the exploitation of the deposit, including specific services, it fully endorses both, the absolute and differential rent, assuming, however, geological research and risks [2].

Consequences of sharing rents differ from one country to another, from one pool to another. In general, economic operators are not interested in the production cost of a field in itself, but what they gain by selling mining products and fossil fuel after tax debt payment. Thus, if producing countries have deposits with the best geological and mining conditions they will get different forms of rent, operation being made either by private companies or by public companies. If the governments of those countries are willing to capitalize the capital invested, will focus on areas with low tax, even though production costs are high and risks of exploiting such deposits are high.

Convincing example is the U.S. many wells drillings in the Middle East for the exploitation of oil reserves with low production costs but high risk. In this area the State retains for itself most part of the rent, because it assumes the risk of geological research whose intensity depends on its long-term development strategies and policies. In these circumstances it is assessed that *the division of rent by geographical area widely explains how to exploit the reserves of mineral resources which in turn will influence future supply structure.*

Thus, if producing states retain much of the rent without being reinvested in exploration, so without the research to cover infrastructure costs and risks incurred by land companies specializing in geological research, ***mining can not be self-financing.*** Without a capital infusion from outside the industry or government authorities, therefore of outside risk assumed by them, exploration activity will be insufficient funded from within the industry under the conditions of lack of capital, and the volume of proven reserves will diminish gradually leading to an increased scarcity of raw materials and energy, and thus, to the occurrence and/or increased economic imbalances.

For eliminating such imbalances, countries that have reserves of mineral resources practice a price called ***price for exploitation right*** that theoretically *is equal to the present value of future revenues that are expected to be given to investors, so the present value of rent.* But value of these rents is impossible to predict accurately, the actual cost of operating reflecting in reality the economic players' forecasts regarding price developments of minerals extracted, the fiscal policy developments and all the factors that can influence the size of future rent.

Hence, differential rents will always exist, but their way of sharing and ownership are influenced by microeconomic logic of political and geopolitical factors, as by the level of competition between manufacturing industries and landowners with mineral deposits. Geographically, rent sharing is influenced by industrial players, particularly by their exploration targets, so by the change in a given timeframe of the offer, which in turn depends on production of marginal mine, on their importance and place of location.

The economic and mining literature considers that in the price structure of raw materials and energy are found both forms of rent, especially when considering the discounted price structure. In fact, when it comes to organizing a system of economic management of natural resources, especially non-renewable, we rely on discounted pricing theory.

**** If given a geological reserve with one mineral resource***, the sum of the quantities extracted over a period of time "T" must satisfy the relationship:

$$\sum_{t=1}^{T} q_t \leq Q \tag{13}$$

At the same time, be prices $(p_1, p_2, ... p_n)$ associated with a program of rational management of mineral resources in question, $(q_1^+, q_2^+, ... q_T^+)$, where the price p_t and quantities q_t^+ are positive numbers. Assuming the cost of extraction is equal to 0, *discounted total net income for an extraction program* $(q_1, q_2, .. q_n)$ is then:

$$V_a = \sum_{t=1}^{T} p_t q_t$$

and will reach the maximum defined by equation (1) in points $(q_1^+, q_2^+, .. q_n^+)$.

In this case, there must be a constant $\lambda > 0$ that we call the ***absolute mining rent,*** for which***:***

$$P_t = \lambda \quad \text{if } q_t^+ > 0 \text{ and } P_t > 0 \text{ if } q_t^+ = 0 \tag{14}$$

Considering that the interest rate "p" is constant, the resource price will be π_t, while respecting the condition (14) constant will be determined according to the relationship:

$$\frac{\pi_t}{(1+p)^{t-1}} = \lambda \quad \text{for all} \quad q_t^+ = 0 \tag{15}$$

and resource price according to the relationship:

$$\pi_t = \lambda(1+p)^{t-1} \quad \text{for all} \quad q_t^+ = 0$$

Price π_t should thus increase exponentially with an average rate equal to the interest rate because the cost of extraction of natural resources can not be null, so the operation of a field can not be free of charge.

**** In the case of "n" different fields of mineral resources*** (when i = 1,2 ,..., n) existing in quantities Q_n, at the cost of extraction and preparation of each mining that equals a_i, the flow fields are attracted to production to the production costs as follows: $a_1 < a_2 <.....a_n$. In this case, the operating restrictions will be:

$$\sum_{t=1}^{T} q_{it} \leq Q_i \quad \text{for i = 1, 2, ..., n} \tag{16}$$

Be q_{it} a program of rational management of mineral resources where prices $(p_1, p_2,..., p_T)$ are positive real numbers, and then *discounted total net income* for an extraction program q_{it} will be:

$$V_a = \sum_{i=1}^{n} \sum_{t=1}^{T} (p_i - \beta a_i) q_{it} \tag{17}$$

where ″β″ is the discounting factor for prices at a time horizon "t".

In this case, the interest rate is constant and equal to:

$$\frac{1}{(1+p)^{t-1}}$$

and to maximize the relationship (17) actually means maximizing profits of each trader operating a certain deposit. It follows that for each deposit of mineral resources there is a number $\lambda_t > 0$ so that:

$$\pi_t - \beta_t a_t = l_i \quad \text{if} \quad q_{it}^+ > 0$$

and (18)

$$\pi_t - \beta_t \leq l_i \quad \text{if} \quad q_{it}^+ = 0$$

If the interest rate (18) is constant, the price π_t will be determined according to the relationship:

$$\pi_t = a_i + \lambda_i (1+p)^{t-1} \tag{19}$$

for all times when $q_{it}^+ > 0$.

We can consider, in this case, that for all mineral deposits "i", λ_i can be interpreted as ***absolute rent,*** and if $i < j$ (so $a_i < a_j$), difference $\lambda_i - \lambda_j$ constitutes ***the differential rent*** which may be obtained by exploiting deposit "i" against deposit "j".

Comparing the approach of the land rent and the mining rent can be pointed out the similarities and differences between how they are composed. In this respect, we have found out that highlighting both the problems of composing and acquiring mineral rent, and the procedures and forms in which the rent is reflected in the price of mining products and energy resources are basic premises to emerge specific methodological elements of economic management of mineral resources. As our researches revealed, contractual duties, further discussed, represent one of these elements.

III. CONTRACTUAL DUTIES

As the present is known with certainty, contract tax policy should be decided before the existence or the size of the resource. Formally, contracts for exploration and extraction are, of course, signed before you start exploring, and risk charge is often defined by these contracts. If you would not do so, the risk would be worse because there is a possibility in terms of taxation to be arbitrarily changed after the discovery of the resource [38].

Tolling system contract, according to which a foreign firm agrees to operate an area with natural resources, is a *"sharing-scheme for total revenue"* of the project. At the start of operation, they consist of the opportunity cost of capital which the company will invest, revenues for the risks assumed, and rent recognition that will appear in this area.
Hence, tolling system contract defines the default mode where each level of income (positive or negative) that is acquired after exploration and production will be split between companies and government. Different schemes have different effects in terms of firm choice about the path of development and production for a reserve that is discovered.
This means that they will provide a different structure of incentives for the contracting company. Instead, it affects both the total revenue from the project, and the annuities/rents that can be derived from it. *In economic terms, the problem is to select and/or design an efficient system of charging for obtaining contractual element in terms of resource rent uncertainty on the resource.*
In the process of exploring natural resources in a given perimeter, the possibility of changing the value that the firm and a government agree on the perimeter before and after its exploration is inherent. This source gives the possibility for one party to want to amend (explicitly or implicitly) the contractual terms after the exploration ends, where the penalties for such a situation are small. Expropriation should be included in this risk.
The issue of *Sovereign (Property) Risk* (Government changing contractual terms) is due to the particular relevance for less developed countries, and is very important as long as it affects both the risk perceived by foreign firms, and the contractual conditions that they are willing to grant.
The present analysis is intended to present and evaluate a variety of different systems for contractual taxation that might be used in developing countries. The idea is to determine this variety in different economic and geological conditions; of particular interest are the geological conditions that allow a low probability to discover new resources. The hypothesis was that, although current rates that are fixed in any given schema are designed to be sensitive to basic conditions, some regularity should appear in effectiveness of the schemes themselves.
Further analysis also explores how the contractual forms of taxation may reduce "the risk of property" and therefore increases profits (ex-ante) of both parties. An evaluation of various rules of tolling contract extension-system considered above, meets the derived analytic criteria of property risk reduction. Although our simulations were based on oil resources, there are general problems of charge assessments on the foreign companies involved in exploration and production of other exhaustible resources too.

IV. DIFFERENT SYSTEMS FOR CONTRACTUAL TAXATION

Studying different types of contractual duties led to highlighting the following contractual taxation systems that may be successfully applied in developing countries:
1. ***Property Tax (Royalties Tax***) seems to be the most inefficient rent system of extraction of natural resources rents. Such a system was sometimes justified on grounds where developing country governments have obtained a discount rate higher than the company (revenues that governments wanted to appear soon). We have found that, under these conditions, the property system is deteriorating faster than the others.
2. A simple ***Income Tax,*** commonly used for other production activities, including extracting mineral resources countries, although is not the best system is a reasonably effective system. For this purpose, the tax rate is a rate that should be fixed at a convenient value of geological prospecting and economic conditions.
3. A ***Production Share System,*** simplified to a single level instead of sharing multiple levels (as usual in these systems), have marginal results worse than the simple income tax system. With multiple levels, the efficiency of these systems falls dramatically, becoming more stupid than one level system.
4. A ***Resource Rent Tax System*** is considered as the most efficient system. Greater attention should be given not to fix the highest ***Accumulation Rates*** applicable in relation to the discount rate. The most effective accumulation rate depends also on income tax of the host government, and is directly linked to it. For example, we found out that with no income tax, but with an accumulation rate of 10% in connection with a discount rate of 6%, rent

resource tax system becomes the most inefficient system. An income tax rate of 15-30% of the host government is often effective.
On the other hand, it is interesting that the rent resource tax system is regarded as the most progressive system. In fact, other schemes mentioned above are all regressive type schema, meaning that the correlation between the host government share and the present value of the project is negative.
5. Tax on resource rent with multiple levels (***Resource Rent Taxation***), which is explicitly designed to increase the progressivity of this system, here does not have such an effect in the absence of an income tax. Setting a single, adequate resource rent tax is able to respond to level progressivity in a multi-level system. In the presence of domestic taxes on income, multiple levels can be used to improve progressivity.
We have found out that change in accumulation rates on rent resource tax system shows a relationship between efficiency and progressivity. If efficiency is negative then positive progressivity may be related to the accumulation rate. The relationship between them is characterized by two well-defined segments.
In the initial segment, because the rate of aggregation has values over the discount rate of the company, progressivity increases rapidly with only small loss of efficiency. In the second segment, using a critical aggregation rate, the position is reversed, resulting in a rapid decrease in efficiency and small gains in efficiency.
6. Separate theoretical analysis suggest that ***Sovereign Risk Nationalization*** can be mitigated by a system where the host government share increases with the size of proven reserves amount for the perimeters of very high values. So, progressive tax system on resource rent being the only one having these characteristics is not sufficient to reduce the risk of nationalization by a significant factor.
7. As multilevel systems of production sharing, ***Variable Profit Share*** and ***Variable Royalty Systems,*** which continuously have variable tax levels, seems to be very inefficient. Their effectiveness is often worse than the system with two levels of production sharing. At this point, a much clearer conclusion is not possible because the degree of progression rate is very important. These systems are also regressive.

With the exception of resource rent tax system with accumulation rates greater than the firm's discount rate, efficiency and progressivity are usually in positive relationship. Therefore, it is sufficient to consider only their efficiency properties.

In practice, a version of income tax applied to British Petroleum allows firms not to pay any tax on originally specified volume of production, thus being less efficient than property tax [29]. When the allowed volume is reduced to zero, the system improves considerably. As it is now built, one might say that this system will extract competitive rents only when the probability of reserves discovery is very small. For a better job of geological prospecting, all the additional revenue obtained will go to companies.

V. MANAGEMENT OF NATURAL RESOURCES AND TWO ORGANIZATIONAL PRINCIPLES

In terms of economic management of natural resources, the social importance of analysis of resources misuse is facilitated by the study of two related concepts.
The first is the social opportunity cost (SOC) of resource use. This cost is about the optimum level at which resources can be used. The optimum level of use (use optimal price) is found where resource use benefit minus the cost of social opportunity is maximized.
The second concept is that of the total economic value (TEV). This value expresses the largest parts of the conservation value of natural resources in a tolerable way. This concept includes the commercial or recreational use of resources, their values for future consumer and their value in a workable state for people who simply want the resources to continue people’s existence.
The analysis of both concepts is also extended here, at the end of this paper.

The Social Opportunity Cost (SOC) of resource use. The special feature of the social cost of resource use is that it covers all costs of natural resource use. These costs will tend to include three components:
1) Direct cost of extraction, harvest or use.

2) Any costs which current use of resources impose on their future uses, the so-called element "user cost". For a tolerable administration of renewable resources, such user costs are not usually significant as long as resources are regenerated (hence they are known as "stock effects").
However, if a resource is used irrationally (unbearable) the user cost will occur when the resource cannot be quickly regenerated in the future[15].
For mixed renewable resources - exhaustible, user costs can certainly occur, as well as soils are severely depleted. For lands that are non-renewable and are depleted under "their minimum safety standard" user cost always occur. For any future year, user cost is the difference between costs that are currently made by users and their costs that they otherwise would do if the resource is not used now. Total user cost is therefore the sum of these differences in discounted costs over time.
3) Any external costs associated with use; for example, any adverse effects on soil and water quality, etc., occasioned by the removal of protection forests, special use of water etc., effects that are not "internalized."
External costs will arise whether the resource is used bearable (rational) or not, but will be especially significant if the resource is used on an irrational basis. Essentially, the irrational (unbearable) use means that the stock of that resource is diminishing, and it allows an increase in external costs.
SOC concept can therefore be summarized as follows:

$$SOC = HarvestingCost(Ch) + UserCost(Cu) + ExternalCosts(Cs) \quad (20)$$

In symbolic terms we can rewrite the formula as follows:

$$SOC = Ch + Cu + Cs \quad (21)$$

The presence and importance of cost components are depicted in the following table (see table 2.12):

Table 2.12. **The social cost of resource use by its components and their importance**

Costs	Resource use	
	Bearable	Unbearable
Ch	*	*
Cu	Stock effects	* *
Cs	* *	* * *

Source: Authors' own evaluations

The Total Economic Value (TEV). A natural resource is worth using. Trees are assessed as raw materials, the soil is evaluated as an agent of plant growth, and water is valued for direct consumption, irrigation or other purposes. We call it the consumer value.
Additionally, many people will want to retain their ability to have an option for future use of the resource. This option can be maintained only if there is a resource in its natural state. This value is the optional value.
There is a third component of value, the existential value, which appears to people who want to preserve (keep) a resource in a rational way, as they assessed its existence without wanting to consume it (consumption value) or they reserve the choice right of using it (optional value).
These three components make up the total economic value (TEV), a concept that can therefore be summarized as follows:

$$TEV = Consumer\_Value\_(VC) + Optional\_Value\_(VO) + Existential\_Value\_(VE) \quad (22)$$

In symbolic terms we can rewrite the formula as follows:

$$TEV = VC + VO + VE \quad (23)$$

The relationship between SOC and TEV. If a renewable resource is rationally used, its SOC of use is determined by harvest costs and any external costs (we ignore the famous "stock effects", of convenience only). By definition, an exhaustible resource can not be rationally used because its within stock will decrease over time regardless of consumption rate.

For any exhaustible resource, the SOC includes three components of cost and its use is irrational. On the other hand, if a renewable resource is used irrationally, results that the harvest rate exceeds the natural or controlled resource efficiency, i.e. we always have costs Cu and Cs.

We can now identify the first source of inefficiency of resource management. If there is no incentive for taking into consideration of user costs (external costs), or they are inadequately considered, there will be a tendency to over-use.

This conclusion must be combined with property rights regime. We distinguish, for example, two statements: income in a free access regime (open access user rates will be inflated compared to an optimal rate of use in open access), or income in a solitary owner scheme. But the owners' unique arrangements will tend to use the resource less intensive than in open access, suggesting that "privatization" is a possible policy measure to conserve the resource.

Thus, the externalities in question are not those that arise from over-allocation of rights to an existing resource, but those rights that arise from activities that lead to resource use. How much of them can be taken into account by simply defining the rights over a source is difficult to answer, even if we believe that solutions will arise from negotiations between the user, like Coase says [9]. This is more than likely as long as literature till Coase has shown it [12].

Furthermore, it is unclear what source rights have to say about values as "existential value": are there any representative agencies, say government, to bid for them? In any case, the merely presentation of the situation as a matter of redefining rights, arises the question on a fair distribution of rights.

Policy relevance of the concept of TEV can be seen in context of non-marginal decisions development or maintenance of wildlife areas, say a place under water. The question is whether or not to drain the land for agricultural uses. Strictly, the decision must be based on a comparison of costs and benefits of drainage. For drainage to be socially necessary, then:

$$[Bd - Cd - Bp] > 0 \tag{24}$$

where: BD = agricultural benefit obtained by draining;

CD = cost of drainage;

Bp = benefit value set for the land under water (we ignored the cost of maintaining the land).

We note immediately that the requirement that drainage is needed is stricter than a purely private decision in terms of cost and benefit to the farmer, that's just comparing Bd to Cd. Bp is the effect of the external costs of development. As long as it will be ignored in most market conditions, we say that under free market conditions there will be a tendency to over-develop the environmentally valuable land held by private owners.

Now, Bp is measured in this formulation, in fact, by TEV. In short, we rewrite the equation as follows:

$$[Bd - Cd - TEV] > 0 \tag{25}$$

The important question here is that TEV may be considerably more comprehensive than the preservation (maintenance) value based on typical rates of recreational use. By ignoring or underrating of optional or existential components of TEV level, then development decisions will be directed to favor over-development of that land.

The same is true for the issue of preservation of specific areas; hence, too little land will be preserved. The analysis can be used for the cases of removal of hedges (natural green curtains); then, Bd would be the agricultural productivity gains claimed by their removal, while TEV would be the loss of both life and aesthetic value.

VI. TYPES OF INEFFICIENCY OF RESOURCES MANAGEMENT

TEV and SOC are related. We noted that if a resource is used rationally, the external cost of resource use is likely to be lower than if the resource should be used irrationally. If the resource is used irrationally, the stock will decline. As long as the threat exists, in general, over non-commercial uses - such as recreation, future use values (optional value) and non-use values (existential value) - TEV loss will occur. This means that TEV enters in SOC's formula as "observer" of external cost.

Another source of inefficiency in resource use may occur in the government market intervention [10]. Thus, subsidies may exist, accelerating non-optimal depletion of exhaustible resource or irrational use of renewable resources. At the inefficiency that may occur due to neglecting external environmental costs in a free market, we add these inefficiencies inspired by the government, even if the interaction of the two sources of inefficiency is not always cumulative.

Hence, the previous section can be synthesized in non-technical terms, as follows:

1) External costs and future user costs occur even when a resource is used rational or irrational, but they will be much higher in the second case.

2) Different property rights regimes (e.g., private property over common property) can be compared in terms of relative efficiency of use.

3) As long as a renewable resource is used irrationally, its stock will tend to diminish and perhaps it will cause losses occurrence in TEV.

4) Due to the large potential of market system in neglecting the preservation value (TEV of resource preservation) there is a clear tilt in favor of preserving ecologically valuable land for development purposes.

5) Government intervention in the market of natural resources often has the effect to increase the resources inefficiencies identified on private markets.

6) Redefining property rights provides clearly a more significant potential for minimizing conflicts costs for resource multi-use. Significantly, attempts may occur to adopt this solution that requires addressing the objective function towards strictly limited bureaucratic goals. This avoids the extending of fuzzy phenomenon that appears in the standard neoclassical definition of the objective function, but at the cost of possible significant potential for ignoring value components.

Assessing inefficiencies. It is therefore important to identify sources of inefficiency and, as far as possible, to see which are the most important. This action requires a methodology for evaluating the degree of inefficiency. As long as *externalities* are concerned, we may follow the *monetary evaluation* process as much as possible.

In the term *"government inefficiency",* OECD studies suggest that water pricing policy often fails to recover development costs and to reflect environmental costs of water supply, which is also true for forestry. This suggests a review of various incentive mechanisms for water and forest management in OECD countries.

The special case: Market and government failure. Despite the distinction made by some authors between market and government failure [23], it is advisable to use here this situation in organizational purposes only. The exact mode in which simultaneous existence of non-market accounts for externalities, on the one hand, and government intervention affecting resource use, on the other hand, can not be known with certainty.

This is because resource depletion may be less in an imperfect market, as with "monopolies", which means that we expect monopolist owners to restrict up to what level a resource is extracted or harvested. This situation occurs because monopolist owners can get profits from such activities.

In this respect, we must emphasize that the use by the host government of a credit system in place of taxing income deductions from external sources system makes no distinction between the effectiveness of different systems.

Our researches demonstrate that the largest possible part of the resource rent is taken by the host government in the case of credit system; under these circumstances we recommend that the host government should use an effective rate of income tax equal to the firm rate in order to obtain the maximum amount of rent.

In the light of these facts, we also recommend that this kind of system should be combined with the resource rent taxation, with a reasonably high accumulation rate to maintain efficiency.

For example, with an effective taxation rate of domestic income by 45%, an even effective income tax may also be combined with a resource rent tax system on an accumulation rate of less than 2.5 times the discount rate of the company.

VII. CONCLUSIONS

In conclusion, differential rents will always exist, but their way of sharing and ownership are influenced by microeconomic logic of political and geopolitical factors, as by the level of competition between manufacturing industries and landowners with mineral deposits.
Geographically, rent sharing is influenced by industrial players, particularly by their exploration targets; in other words, rent sharing is influenced by the change in a given timeframe of the offer, which in turn depends both on production of marginal mine, and on their importance and place of location.
The economic and mining literature considers that in the price structure of raw materials and energy are found both forms of rent, especially when considering the discounted price structure [22]. We say that, in fact, when it comes to organizing a system of economic management of natural resources, especially non-renewable, we have to rely on discounted pricing theory [21].
At the same time, economic literature has often argued with the idea of resource reserves depletion, due to the extent of economic and demographic development, hence, economic and population growth lead to increasing consumption of natural resources. Given that natural resources are limited, their stock volume must be known to determine the duration of their use until complete exhaustion, for non-renewable resources, or their decrease level of stocks per capita, beyond subsistence level assurance, for renewable resources.
Is noticeable that both methodological elements and modalities of to present these elements depend on the type of mineral resources also. For example, pricing mechanisms for delivery of mining products are different from those of energy resources. Thus, speaking of energy resources, the energetic coal pricing arrangements are different from those of oil or gas pricing. Going to analyze in more detail, there are big differences between energetic hard-coal pricing compared to those of lignite pricing.
Moreover, to broaden the analysis, a special problem is also the composing and acquiring of rent in case of forest resources (like land rent), as well as how this rent is reflected in the forest products price. Similar to mining industry, in fact, the existence of rent in forestry is given by the quality of forest resources and the geographical location of forests, and is influenced by the size of demand for timber.
In conclusion, as related to natural resources management seen through mining rent theory, we can really distinguish three potential sources of inefficiency in resource use, not acting in the same direction. These are:

1) *externalities:* over-failure costs neglect of resource use. This allows us to strive to current rates *too high* for use of resources.
2) *monopoly:* restrictions on production due to profit. This makes the current rates *too low* for use of resources.
3) *government intervention:* the use of subsidies and tax laws. This leads to *excessive* current rates of resources use only if they occur to correct the type (1) inefficiencies.

With this analysis we have made a perfect analogy to pollution situation, as we know, for example, that a pollutant load that takes into account only externalities can not produce optimal results if significant imperfections exist on pollutants producing market [7].

2.2.2 Marius Bulearcă, **Cătălin Popescu**, *Management models for pricing in mining industry*, **Proceedings of the 5th International Conference on Applied Economics, Business and Development** (AEBD ’13): “Recent Research in Applied Economics and Management, vol II, August 27-29, 2013, Chania, Crete Island, Greece, pag. 40-49.

Given that economic analysis of extractive industry is fundamentally different from the analysis of agriculture, manufacturing and services, this paper deals with finding and applying the political and economic principles of pricing in mining industry (in the first part), and with demonstrating the relationship between the level of extraction, depletion time and price trend resulted in time (in the second part).

1 Introduction

Economic analysis of extractive industry is fundamentally different from the analysis of agriculture, manufacturing and services. The main reason is that the mineral resources are

exhaustible resources. In other words, in mining industry an initial stock of reserves will exhaust in time. If we start from the premise that the owner of a resource, like any other owner, is seeking for maximum gain, then it must consider specific factors, unique in the mining industry.

One of the objectives of Hotelling's research was to examine the optimal level of extraction of non-renewable mineral resources in terms of government which wanted to maximize social welfare by exploiting these resources.

On the other hand, there must be emphasized that there are many factors affecting production and price trend in mining industry, the most important being: fluctuations in profit rates; fluctuations in extraction cost; taxes introduced by the Government. Some, such as taxation and the profit, can be treated as variable pricing policy by the government to influence the extraction of non-renewable mineral resources.

2 Political and economic principles of pricing in mining

Given the premise that the owner of a resource, like any other owner, is seeking for maximum gain, in other sectors, the profit will be maximized by operating at a level where the marginal cost of supply equals marginal revenue (see fig. 2.16).

Scholars in mining economics states that this type of curve policy was the base ground for "maximum recovery efficiency" programs widespread in actions of regulating the extraction of oil in the U.S., where production is recommended to be set at minimum average cost in the long term. As will be demonstrated below, this statement is valid only in the special case where the profit rate is zero.

On February 3, 1977, two years before the outbreak of the second energy crisis of the '70s, the *Wall Street Journal* front page article said: "The waiting game: natural gas reserves are not operated as producer expects profitable prices". A few weeks thereafter, U.S. Secretary of Interior had warned the companies that lease federal oil and gas that they must explain the reasons for not producing, if not, being forced to cancel their lease arrangements.

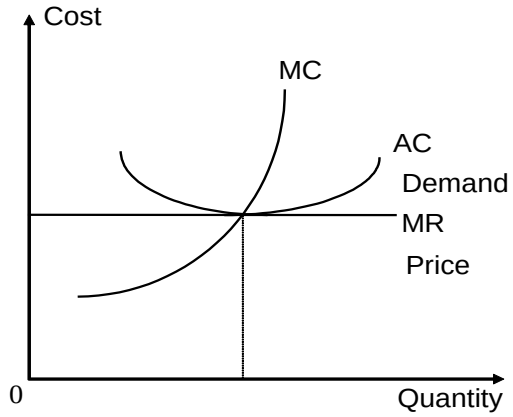


Figure 2.16. **The profit that maximizes non-extractive sectors production under competitive market conditions**

(MC = marginal cost, AC = average cost, MR = marginal reserve)

Mining economics claims that revenues that could arise from current extraction should be large enough to cover the marginal cost of extraction and the marginal cost of the user. This leads us to the law known as the "economic fundamental principle" of the mining industry stated by Hotelling. For extraction to be justified, it means that net resource market price (net cost of extraction) should grow in line with market rate of return.

This principle can easily be assimilated if we imagine two situations:

- Suppose the market price minus the cost of resource extraction has a value which is lower than the market rate of return. What will be the most appropriate action for the resource owner? If it seeks to maximize profit, ceteris paribus, he will extract and sell its stock as soon as possible, investing profits elsewhere, e.g. in term deposits.
- If we assume that the market price minus the cost of extraction has a value which is higher than the market rate of return, then the best decision of the owner of the

resource is that it does not exploit the reserves it held, having better returns in other investment alternatives.

Therefore, a net price which amounts to market profit rate is the equilibrium condition.

Formally, the economic fundamental principle can be obtained from a number of simplifying assumptions:

- resource owner has a fixed stock of non-renewable resources, say oil, and wants to deplete its reserves at a rate that renders maximum profit, i.e. the owner wants to maximize the present value of its income resulting from the extraction in time of its reserves;
- resource quality (here, oil) is uniform at all points of extraction;
- extraction cost is constant.

In these circumstances, the profit function to be maximized is of the form:

$$\pi = P(o)Q(o) - C + \left[P(1)Q(1) - C)\right](1+\gamma)^{-1} + \left[P(2)Q(2) - C\right](1+\gamma)^{-2} + \ldots + \left[P(T)Q(T) - C\right](1+\gamma)^{-T} \quad (26)$$

under a stock constraint:

$$Q(o) + Q(1) + \ldots + Q(T) = \bar{Q} \quad (27)$$

$$\max \sum_{t=0}^{T} \pi(1+\gamma)^{-T} = \sum_{t=0}^{T} \underbrace{\left[P(t)Q(t) - C \bullet Q(t)\right]}_{profit} \underbrace{(1+\gamma)^{-t}}_{\substack{discount \\ factor}} \quad (28)$$

under a stock constraint:

$$\sum_{t=0}^{T} Q(t) = \bar{Q} \quad (29)$$

where:

π = discounted profit function;
P (t) = resource price at time t;
C = cost of extraction, is constant;
Q (t) = amount extracted at time t;
t = time in years;
T = number of years of reserve service, for example, horizon provided or the depletion of the reserve period;
γ = rate of return;
$\bar{Q}$ - total stock (total reserve).

By using Lagrange multiplier method, the growth function becomes:

$$L = \sum_{t=0}^{T} \left[P(t)Q(t) - CQ(t)\right](1+\gamma)^{-t} + \lambda\left[\bar{Q} - \sum_{t=0}^{T} Q(t)\right] \quad (30)$$

Differentiating compared with Q (t) being zero, we obtain:

$$\frac{\delta L}{\delta Q(t)} = \left[P(t) - C\right](1+\gamma)^{-t} - \lambda = 0 \quad (31)$$

which means:

$$\left[P(t) - C\right](1+\gamma)^{-t} = \lambda \quad (32a)$$

or:

$$P(t) - C = \lambda(1+\gamma)^{t} \quad (32b)$$

The left side represents the net price of the reserve (net cost of extraction), and the right side is the resource rent. Equations (32a and 32b) shows that price minus extraction

cost increases linearly with the market rate of return, a truth we were seeking to demonstrate for the mining industry case.

3 Relationship between the level of extraction and price trend resulted in time

Now, suppose that the entire mining industry faces a linear demand curve downward (see fig. 2.17).

Obviously, with higher production of that industry, the production will lower the price at any time. One must underline some aspects of it.

First, the industry must reduce the amount extracted in each moment of time to secure to obtain higher prices implied by equation (31), i.e. the net price should increase over time in linear relationship with rate of return. This happens only when the extraction level decreases. Therefore, extracting the following year must be less than the production of this year to ensure that the price will rise sufficiently to satisfy equation (31).

Secondly, with this curve type there is a price level at which nobody wants to buy production. Called the cancellation price, this means that demand for these products is zero while reaching its level.

Thirdly, if there are other reserves remaining in the ground when its price reaches its critical level, in terms of mining, they represent losses as it sells at that price or below it. Obviously, these reserves can be stored at a reduced price, where the industry will get losses.

In light of these facts, resource owners want to make sure that the reserves they own will have full-time depletion before the cancellation price is reached, for which they will adopt a plan to decrease production levels at each time point, which in time will ensure a certain tendency in price. For this, the forecasting and production level need to be established simultaneously, situation presented in fig. 2.18.

Cancellation price on the left becomes ceiling for the right diagram, i.e. the price will reduce demand to zero. Therefore, the reserve will be exhausted even before it reaches this point. Justification for this claim is that when the price becomes prohibited, buyers will turn to a resource-alternative, which is a substitute.

The cost of extraction, which is constantly, is illustrated by the horizontal line "c"; "ab" is the price trend obtained by reducing production at every time point.

The difference between the price line (ab) and cost (c) is the resource rent that is growing at a rate equal to market profit in a perfectly competitive economy. If the demand curve slides left to right, then right ceiling is above, allowing resource owners to obtain a higher rent in time.

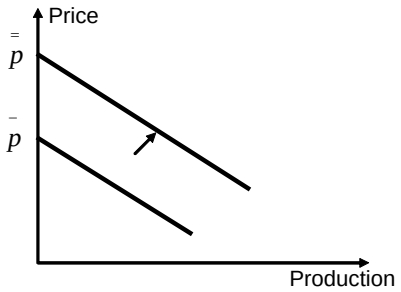


Figure 2.17. **Demand for mining production and the cancellation price**

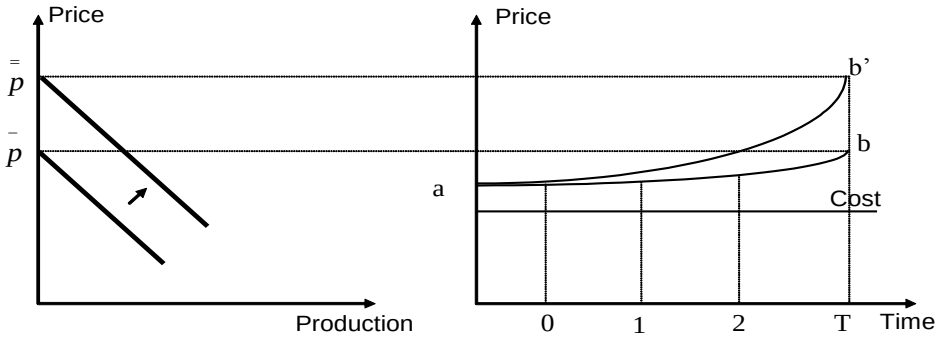


Figure 2.18. **Production-price trend in mining industry**

We emphasize that at a given value "ca", which is the original rent, it can be a similar pattern "ab" through a process with errors. If this trend reaches the cancellation price earlier than depleting reserves, then the objective is to have higher prices at each time point and the owners will get higher royalties. On the other hand, if some owners will still have grounded stocks while cancellation price is reached, then they will be forced to reduce royalties. In this way, a trend more or less consistent with "ab" is proving to be an iterative process.

Dynamic pricing efficiency of non-renewable resources

How high can the price be set at a non-renewable resource to ensure that our future demands will be met? Although a difficult question, we can isolate some of the problems by considering the following example.

Suppose we have a limited amount of metal that will be completely replaced within two years by a cheaper substitute of plastic of the same quality. In this case, the objective is to fully use the metal in the next two years in the most efficient manner (as cheaper plastics will become available when it is no longer necessary to store any quantity of metal after that date). How should we set the price in the following year so as to accomplish the objective? The answer is shown in fig. 2.19.

The rule of effective pricing requires that interval AB between prices in the two years to equal the rate of profit. Efficiency also requires that the amount of resources used (Q_1+Q_2) is equal to the total available quantity. Worth noting that there is no reason for D_1 and D_2 to be the same; in fact, they are almost different in situation shown fig. 2.20.

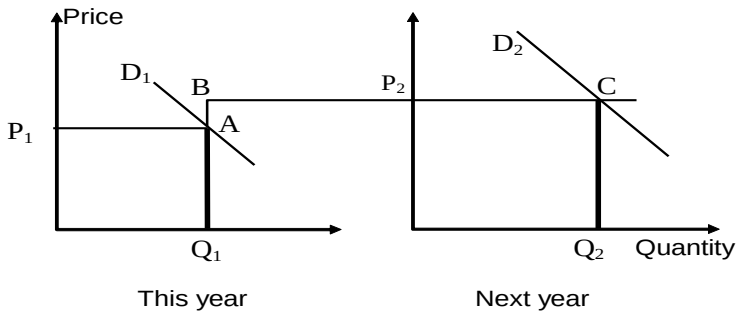


Figure 2.19. **Rule of effective pricing of a non-renewable resource for two years**

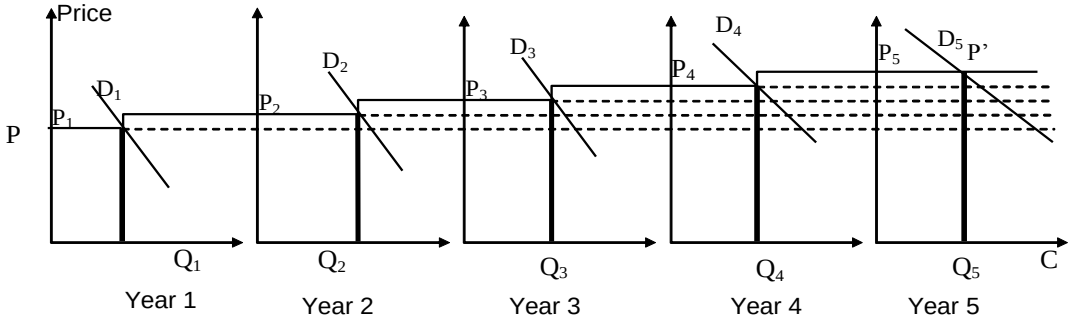


Figure 2.20. **Rule of effective pricing of a non-renewable resource for five years**

Situation shown in fig. 2.20 extends the analysis presented in fig. 2.19. Determination of rule of effective pricing and resource utilization in time can be viewed while fitting a “price level” PP' to demand curves with the restriction that $Q_1 + Q_2 + Q_3 + ...$ to equal the amount (C) of the total available resource. As before, the scale height of each step is the rate of return.

Let choose prices P_1 and P_2 in the two years so that the following conditions are met:

1. The quantities used in the two years to accumulate exactly as Q = total quantity available. That is:

$$Q_1 + Q_2 = Q \tag{33}$$

2. Price P_2 must be greater than P_1, by an interval AB equal to the rate of return. So if the profit rate is 5%, P_2 should be 5% higher than P_1.

Why this rule results in a price efficient allocation of the resources in time? Why, in particular, should the prices be lower this year and bigger next year? The answer is that there is an advantage to have assets or productive resources this year than next year. If we have productive resources this year, we can harness the capital and will allow us to produce more next year.

For example, we have the option (1) to use 100 tons of steel to produce cars, refrigerators and other consumer goods this year, or option (2) to use 100 tons of steel to produce machine tools and equipment that allow us to have 105 tons in the year. We can now choose between 100 tons and 105 tons next year. The profit rate is a measure of quantity (size) of additional assets that we have by waiting. In other words, is a measure of the advantage of having assets currently (now) than in the future. The most effective rule of pricing will reflect this advantage of the products now compared to future products. In the particular case shown in fig. 2.19, where the demand curves are the same this year and next year, is more efficient to use more this year (Q_1) then the following year (Q_2). In the general case, where demand curves do not vary from one year to another, the price should increase with the size of the profit rate in order to have an efficient allocation of resources over time.

To fix the message shown in fig. 2.19, a fixed quantity of this resource is efficiently allocated if we use Q_1 this year and Q_2 next year. This is the situation that occurs in competitive market economy where prices P_1 and P_2 are those of the two years. We will not pretend that this is the right price rule that should prevail; it might not be so.

For example, if the supply of this resource is controlled by a small number of producers, they can, like any other oligopolists, to use their market power to set prices above P_1 and P_2. In fact, using higher prices, some of these resources will be exhausted by the end of year 2, when they will be replaced by substitutes. However, oligopolists can still have maximized profits due to increased prices of the quantity that they really sell now.

The analysis shown in fig. 2.19 assumed that the resource will be completely substituted in two years, while the analysis shown in fig. 2.20 extends as if the resource is replaced in a longer period.

The situation presented in fig. 2.20 assumed that the resource is replaced by a substitute after four years. That does not mean that a substitution eliminates all demand in the coming years. In fact, there is still a demand for metal in year five, namely D_5. However, this demand is under the price of P_5 as the cheap substitute stopped the demand for this metal.

Of course, another reason for the demand to be stopped may be that the public feels no taste for this resource; so the use of these resources could be stopped for this reason too. An example is coal. Domestic ovens were converted from coal, about 50 years ago, not only because was developing its replacement by gas and oil, but because people no longer wanted to burn coal.

4 Factors affecting the reserve depletion level

Profit level fluctuations may have strong effects on production and price trend in mining industry. At the same time, the charging system may have strong effects on the policies used in the mining industry. Operating with the basic economic principle is restricted by many real world constraints.

For example, fluctuations in profit market rates; if it will increase, ceteris paribus, the extraction will increase, and conversely, if rates fall, then there will be a slowdown of mining extraction rhythm. It is well known that the profit market rate may increase or decrease quite rapidly in a short time. This type of uncertainty is always in the attention of resource owners when they set their depletion plan for their deposits.

Changes in profit rate

Profit level fluctuations may have strong effects on production and price trend in mining industry. First suppose that the profit market rate increases. This means that the revenue rate obtained from an alternative investment project, say term cash deposits, increases. If owners do not undertake any changes of the originally conceived plan, the reserves stock will lead to achieving sub-optimal rates of income over time.

The way to avoid these losses is to move production today. This means that the owners will extract and sell more now, which will lead to lower the price asked on the market. Therefore, less to extract, higher the net price of the remaining reserves may rise. This means that reserves would be exhausted in less time than it would increase profits.

Situation in fig. 2.21 illustrates this situation. The curve “ab” is the production and price trend before increasing profit. Immediately after the increase, owners should make an adjustment by increasing production, and then prices start to fall at moment t(0) to the “a” level. For the remaining time left the owners will extract less so that the annuity/rent of the reserves left would grow at a higher rate. It will short depletion time from “T” to “T' ”.

The new production and price trend "a'b” will be steeper than the previous one "ab". If the profit rate falls, opposite phenomenon will occur. Original price will increase as owners push their production into the future by reducing current extraction. This is because lowering profit rates make stocks return more attractive than current production. This is obvious also in that a lower profit rate would show a lower growth trend than in the previous case. This means that depletion time increases, as shown in fig. 2.22.

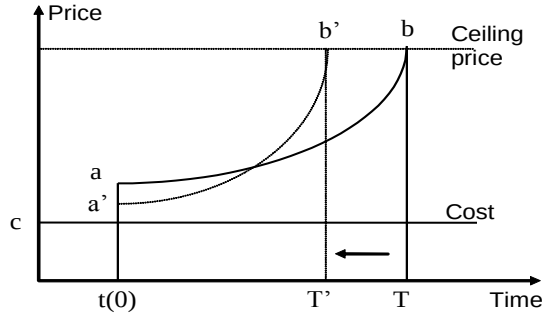


Figure 2.21. **Effect of profit rate growth on production and price trend, and on deposits depletion time**

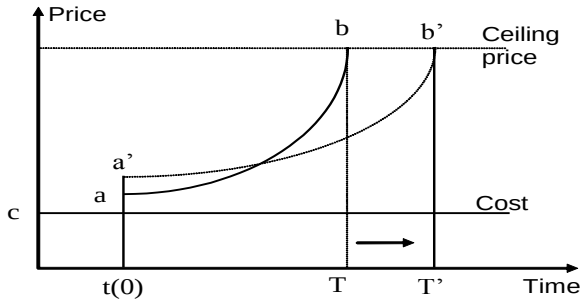


Figure 2.22. **Effect of profit rate falling on production and price trend, and on deposits depletion time**

Fluctuations in extraction cost

In the beginning let’s assume that extraction cost increased. This can happen for a variety of reasons such as lack of skilled labor, wage growth in mining industry and basic resources decline as owners start extraction from fields with difficult access.

An increase in mining costs will reduce the current production level and therefore will increase the starting price, but will reduce further prices. This situation, in turn, will reduce the amount required in the near future and will increase the future quantity. The net effect will be the increased depletion time.

The situation is shown in fig. 2.23. As the cost of extraction increases, the rent will be reduced. In response, the owners will reduce the current production and will increase, at moment t(0), the initial price “a” to the new price “a’”, so the new production and price trend will be "a'b'”.

On the other hand, a decrease in the extraction cost will have the opposite effect, by increasing the initial value of the rent. If no adjustment is made, it could lead to a situation in which the cancellation price would be reached faster than desired, leaving owners with unsold stocks. To avoid such a situation, the owners should lower the starting price. The gain

will be that when extraction costs fall, the immediate production level increase, which in turn will reduce the initial price and depletion time (as seen in fig. 2.24).

The charging system

The charging system may have strong effects on the policies used in the mining industry. In this respect we can mention several charges:

Excises

Taxing the value of mining production will increase costs, which will have an effect similar to that shown in fig. 2.23.

For a mine owner, a tax on income is a cost that will reduce the current extraction and enhance deposits depletion time. Moreover, this type of charge will cause mining companies to postpone extraction so as to delay (or suspend) payment of taxes. Thus, they prefer to keep reserves in deposits, where there are no taxes to be paid.

Ad-valorem tax

This is a fixed tax on the price of each unit of production, usually a certain percentage of the value of extracted production. The effect of this tax is to reduce the deposits depletion rate and increase their depletion time. Therefore, there is a difference between the effects of ad-valorem tax and excise tax, that the depletion rate reduction is lower in the first taxing case.

Suppose that the owners are proposing to postpone payment of taxes by lowering the rates of extraction. Where ad-valorem tax is chargeable, one will observe that as sales prices are higher, taxes paid on these sales will therefore be higher. Hence, in case of ad-valorem tax, the depletion rate reduction is not preferably as compared to excises.

The difference between specific and ad-valorem taxes can significantly influence decisions in the mining industry. If the government feels that the country's natural resource reserves are depleting too quickly, then a strong measure as excise tax may appear appropriate for a moderated depleting reduction of deposits.

One form of an action with lower impact is the use of ad-valorem tax, as an alternative opposite to imposing through excise tax. This is the main reason due to which conservatives tend for excise tax in the mining industry.

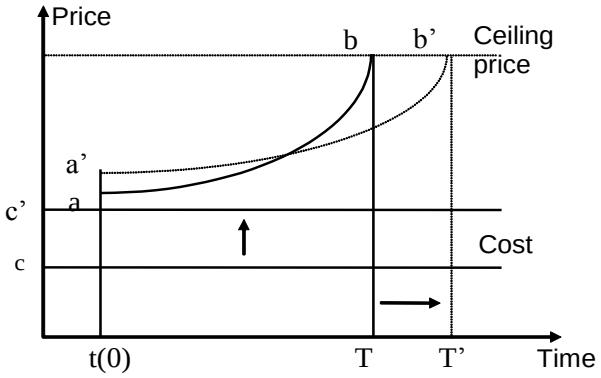


Figure 2.23. **Effect of extraction cost on production and price trend, and on deposits depletion time**

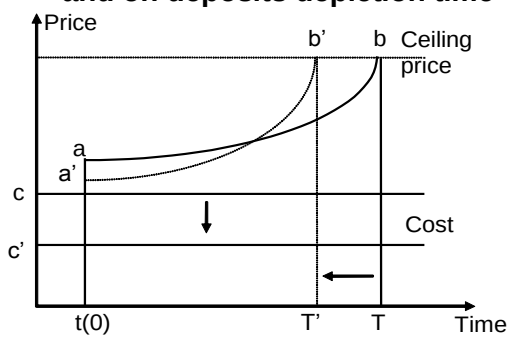


Figure 2.24. **Effect of extraction cost lowering on production and price trend, and on deposits depletion time**

Property Tax

This kind of tax will reduce the depletion time of deposits. From equation (34) inherently results that the stock's value on capital market is the present value of future net profits to be obtained by the extraction and sale of these stocks. This equilibrium value will increase in time at the level of profit market rate, thus providing incentives to owners to keep them.

$$\frac{\delta L}{\delta Q(t)} = \left[P(t) - C\right](1+\gamma)^{-t} - \lambda = 0 \qquad (34)$$

where: L = Lagrange multiplier;

Q (t) = amount extracted at time t;

P (t) = resource price at time t;

C = cost of extraction, is constant;

γ = rate of return;

t = time in years.

Ceteris paribus, an annual tax on the amount of resources will powerfully reduce this incentive because as the deposit is kept intact one more time, the greater the taxes to be paid on it. One way to avoid paying this tax on all future periods would be extracting as quickly as possible and investing money in areas where there is a charge similar to this.

5 Other economic considerations. A model for testing the basic economic principle applied to mining industry

Operating with the basic economic principle is restricted by many real world constraints. For example, fluctuations in profit market rates; if it will increase, ceteris paribus, the extraction will increase, and conversely, if rates fall, then there will be a slowdown of mining extraction rhythm. It is well known that the profit market rate may increase or decrease quite rapidly in a short time. In this case, do we expect an automatic adjustment of the output whenever the profit rate changes?

It seems to be quite unrealistic to expect from resource owners an automatic response to profit rate changes. Suppose the profit market rate increased sufficiently thus constraining owners to increase the extraction so that the accrued money would be invested in deposits with high interest. Normally, an increase of income production in mining, petroleum and natural gas extractive industries requires an expansion of production capacity, which takes more time. Moreover, the period with high profit rates may not be so long, leading resource owners to think twice before engaging in a costly action to extend the production capacity.

A similar problem may occur in connection with the tax system. Fiscal policies at national level in many countries change with the change in government leadership. Therefore, resource owners can not be sure on the time length of a particular fiscal policy. If production capacity and production levels in the extractive industries are based strictly on current tax law, when it suddenly changes, the resource owners may remain with excess capacity or inadequate structures with which they must operate in an optimal way.

Another important factor is the technological change related to natural resources. A change in technology can reduce dependency and hence the demand for a particular resource. For example, let's compare solar energy to fossil fuels. A rapid technological development of solar energy capture can result in substantial demand decrease for fossil fuels.

This type of uncertainty is always in the attention of resource owners when they set their depletion plan for their deposits. Besides the fundamental economic principle, resource owners are guided also by the rule which says: "Sell reserve stocks at the moment when the demand exists for them." When depletion time ("T" in our analysis) is high, it is necessary to develop a technological breakthrough.

Last but not least important issue is the time factor – that is impatience - which can exert a strong influence on depletion time for natural resources deposits. For various reasons, a resource owner can be crazy after money in cash, which may be obtained either by selling its property rights over resources, or by speeding up the extraction regardless the

fundamental economic principle rules. When fields are owned by the state, selling property rights may not be politically possible in most cases, and government remains with only one alternative: fast depletion obtaining immediate cash resources, what happens quite often nowadays.

The mining economic literature shows that prices of natural resources as raw materials for manufacturing industry has been declining for a long period of time. There were some exceptions, such as timber which presented an upward trend, or the oil price that has rapidly increased during 1973-1982, although after 1982 and until 1988 was in decline.

On the other hand, the economic fundamental principle shows very clearly that, ceteris paribus, the price of mined ore and fossil fuel should increase linearly with the market rate of return. This raises the question whether or not a contradiction between the economic theory of natural resources and the situation observed in the real world is manifested.

Once again we emphasize that in Hotelling model we considered the net increase of reserves of fossil fuels and mining products in time that is the market price less extraction costs, all expressed in real terms. However, it is known that, except short periods, the real rate of return was positive in many countries over time.

In this case, there was a sustained reduction in extraction costs that can explain the current trend of prices within the meaning of Hotelling's rule. This has been tested by Slade trying to reconcile the theoretical predictions of actual price increases in natural resources raw materials for manufacturing industry and empirical findings, mentioned above, of lowering prices.

Slade's model assumes exogenous technological improvements and endogenous changes in state deposits, parameters that are used to predict price trend for all metal mining products and fossil fuels in the U.S. If equation (9) is slightly amended in that it allows the extraction cost to change in time, then:

$$P(t) = C(t) + \lambda(1+r)^t \qquad (35)$$

Slade allow a reduction in price stating that, although $(1+r)^{t,}$ which is the resource rent, is normally growing, and if technological progressions are substantial, then C(t) that is the extraction cost, may decrease substantially and may induce a trend in resource price decline. In the early stages of research, a decline in cost may offset the increase in rent, but later its intensity decreases the getting of a U-shaped price trend.

However, Slade notes that his model is simple and naive, because it neglects the important issues facing mining industry as environmental regulations, tax policy, price controls and market structure.

6 Conclusions

Economic analysis of extractive industry is fundamentally different from the analysis of agriculture, manufacturing and services. The main reason is that the mineral resources are exhaustible resources. In other words, in mining industry an initial stock of reserves will exhaust in time.

If we start from the premise that the owner of a resource, like any other owner, is seeking for maximum gain, then it must consider specific factors, unique in the mining industry. And such factors have been both identified and developed in this research.

In conclusion, we have here three serious but unpredictable influences that may affect the rule of effective pricing in mining industry:

1. If the existing reserves of a resource appears to be lower than originally estimated, will result a smaller quantity Q to be distributed (shared) in time, and the entire PP' prices "scale" will shift up (as the occurrence of the phenomenon, worth noting how the amount used in each year shall be reduced "in line" with the reducing of total quantity Q). On the other hand, if new deposits are discovered, will be a larger available amount Q and the prices "scale" will shift down.
2. If an unexpected change in demand occurs, PP' prices "scale" will shift again. For example, if future demand will be higher than expected, the price "scale" will shift up.
3. If substitutes are developed faster (or less quickly) than expected, prices "scale" will shift up (or will shift down, respectively). It is very difficult to correctly predict the exact moment for appearance of substitutes.

Therefore, we consider that in practice is very difficult capturing the specific mode to set a rule for effective pricing and allocating of any resource.

2.3 Other important researches regarding different approaches about human assessment, companies' competitiveness and technology transfer

2.3.1 **Popescu Cătălin,** Boussier Jean-Marie, Boussier Ion Luminita, Mitu Augustin, Uta Daniela, *Modelling approach to estimate pertinent human criteria for a selection and orientation process of a technical profession,* ANNALS of DAAAM for 2007 & PROCEEDINGS of the 18th International DAAAM Symposium "Intelligent Manufacturing & Automation: Focus on creativity, responsability and ethics of Engineers", 24-27th October 2007, Zadar, Croatia, Vol. 18, no 1

What we are trying to accomplish may be considered a career "guide" for the graduating students of technical profiles. This methodology is a hybrid coupling between a marketing technique called "declared preferences" and an approach for process optimisation named "Design of Experiments". It is a flexible approach which allows testing conjointly the effects of various criteria and interactions between criteria in order to point out the abilities, skills or human values of a future engineer. We proposed to test it in two parallel universities: UPG, Ploiesti (Romania) and EIGSI, La Rochelle (France) with the complementary objective to compare and to support the efficient integration of students during international exchanges between technical universities.

1. ABOUT AN ENGINEER'S HUMAN VALUES

Except the technical competences of an young engineer, the objective judgment of an evaluator/ consultant is based on diverse criteria such as creativity, responsibility, efficacy, ethics: these values are frequently neglected in a teaching process or when there are pointed out, each one uses a "fuzzy" perception of these values which is unable to assist a student for his career orientation or to help an evaluator in the selection process of candidates (figure 2.25). Furthermore it is well known that the lack of a preliminary experience of students in R&D domain or in management field has drastic consequences in their orientation.

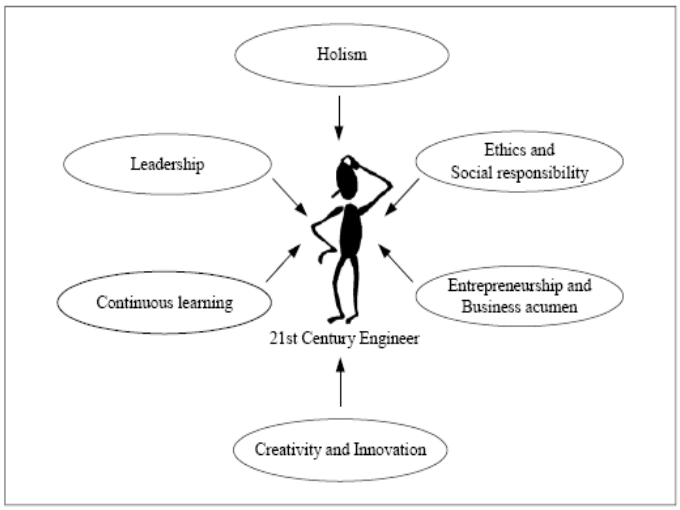


Figure 2.25 **Values of the twenty-first century engineer**

Specialists in sociology, in pedagogy or in psychology proposed interesting methods to evaluate human values of an engineer (Pais, 2004) which are frequently judged as being too "sophisticated" or not enough "scientist" by both partners as well in an academic formation (student and mentor) as in a negotiation process for integrating a company (young engineer

and manager). Generally this kind of problem is solved by an interview where the evaluator wants to “trap” a candidate, who carefully prepared “eligible” answers.

In response, approaches based on multi-criteria analysis were developed by specialists in operational research (Grabitch, 2003); (Roy, 2006) to conduct such kind of questionnaire, but two important problems were pointed out. Firstly, what kind of criteria must be included to define a quality of an engineer (such as creativity or responsibility)? Our point of view is not to search to design “universal” models, but to give a large flexibility to select particular criteria in agreement with specificities of each university or company.

Secondly, how to take into account possible dependences between criteria (Rico, 2005)? We do not speak about “structural” dependencies (such as the candidate is “young” and “without a great experience”, certainly correlated), but about dependencies between “preferences”, very difficult to perceive and to capture in a model. Just an example: two candidates must be classified for a job. A questionnaire step by step (each question tests only one criterion) shows the following evaluations (scores in range 1-5):

For technical competences $S_{T1} = S_{T2} = 2$;

For experience level $S_{E1} = 5$: $S_{E2} = 3$;

For facility to communicate $S_{C1} = 2$; $S_{C2} = 5$.

Now suppose that the evaluator preferred candidate 2. Who can conclude that if $S_{T1} = S_{T2} = 5$, the choice could be the same??? This means that the effect of a criterion is depending on the value of another criterion; in this case a dependence (interaction) exists having a positive or a harmful effect (sometimes more drastic than criteria!). The solution could be to test jointly several criteria at several levels (values) in order to capture the interaction effects.

2. COULD HUMAN VALUES BE “MODELLED”?

In order to obtain the maximum information with such a questionnaire, a full matrix with all possible combinations of criteria and levels is necessary. Let us suppose a questionnaire in order to test the effects of the variation of five criteria, each one having two levels. A full factorial array using 32 questions will be strongly inadequate for this kind of analysis. Design of Experiments method uses an orthogonal factorial array which is a subset of a complete array (Taguchi, 1987). Take an example conjointly studied in UPG (Ploieşti) and EIGSI (La Rochelle) where specialists in automatic and in computer sciences decided to elaborate a model for “creativity” in order to help students for orientation in R&D domain. Conjointly, the set of tested criteria was the same: N (Innovator character of a solution), C (critical analysis of existent solutions), F (feasibility degree), P (estimated cost). Two levels were affected to each criterion (low, high) and respondents placed in hypothetical scenarios done by L8 $(2)^7$ factorial array must give an answer on the range from 1 to 8. A part of this orthogonal array is presented in table 2.13 (8 questions for 16 possible scenarios).

Table 2.13. **Example of $L_8(2)^7$ array completed by an expert**

Test	N	C	F	P	Score
1	low	without	great	low	4
..	…	…..	…	…..	….
5	high/original	without	great	high	4

The columns affectation is done by a linear graph in order to capture the effects of expected interactions NC, NF, FC. The questionnaire is convivial and without “trap”. For the 5th scenario: if the idea is “original”, “without” critical analysis of literature, the feasibility degree is “great” and the cost is “high”, the score is “4”.

An additive matrix model based on ANOM (analysis of means [Vigier, 1988]) allows us to estimate the scores for all unobserved scenarios. Reduced models are obtained by Analysis of Variance and contain only effects of pertinent criteria and interactions. A 9th question (out L8 $(2)^7$ array) served to validate the models.

Models which are presented below show the teacher’s team perception for the creativity of an engineer:

For UPG Ploieşti:

$$S = 4.1 + (-1.6 \quad 1.6)N + (0.9 \quad -0.9)P + .\begin{pmatrix} 0.6 & -0.6 \\ -0.6 & 0.6 \end{pmatrix}.NC \tag{36}$$

For EIGSI La Rochelle:

$$S=4.2+(-0.9 \quad 0.9)N+(0.8 \quad -0.8)F+...\begin{pmatrix} -0.8 & 0.8 \\ 0.8 & -0.8 \end{pmatrix}NF \tag{37}$$

where $$a_i = S_{mean}\left(A_i\right) - S_{mean} \tag{38}$$

are matrix elements of mean effect of criteria A at level *i,*

$$a_i\, b_j = S_{mean}\left(A_i, B_j\right) - S_{mean} - a_i - b_j \tag{39}$$

are matrix elements for mean effect of AB interaction for A at level *i* and B at level *j* with S_{mean} - mean value of all scores; $S_{mean}(A_i)$ - mean value of scores if A is at level *i;* $S_{mean}(A_i, B_j)$ - mean value of scores if A is at level *i* and B at level *j.*

Similar models are in development: for ethics (criteria: conflicts of interests, confidentiality, professional probity) and for responsibility (criteria: responsibility assuming, loyalty and collegiality, respect for the authorities, procedures and rules).

During the training period, this kind of models offers a possibility to compare the mentor's exigencies with the student's perception for a possible orientation (R&D, production etc.) or for corrective actions. It is also possible to compare education exigencies for similar technical education systems. Presented examples show drastic differences: if the "originality of the idea" is the most pertinent criterion for both, the points of view are completely different concerning the second one and the interactions weights. To integrate students during international programs exchanges professors have to realise a supplementary work; the solution is not to find a "middle" way (model), but to develop sensibilities satisfying both the "cost" perception and the "feasibility degree" of a technical project.

3. HOW COULD HUMAN VALUES BE "SOLD"?

Within a negotiation process between employer and the candidate each side expresses requirements and/or preferences which in many cases are opposite. The search of an optimal solution in this problem consists in defining a combination of levels of variables for better satisfying the requirements and constraints of the ones (recruiters) and the preferences of the others (candidates). Doehlert (Doehlert, 1970) proposed an original construction of plans which consists in uniformly covering the experimental framework. The design of the matrix is based on the definition of an initial simplex. The operation of coding consists in transforming value v_i corresponding to the variable V into a coded value x_i:

$$x_i = \frac{v_i - \left(\dfrac{v_{max} + v_{min}}{2}\right)}{\left(\dfrac{v_{max} - v_{min}}{2}\right)} \tag{40}$$

Levels tested are: 7 levels for salary $\in [1000 \div 3000]$ euros; 5 levels for time frame/day $\in [8 \div 12]$ hours; 3 levels for benefits $\in [5\% \div 15\%]$; 3 levels for career management $\in [2 \div 5]$ years. Thanks to a regression model, we can estimate the coefficients of a score function and residue value.

$$S = b_0 + \sum_{i=1}^{n} a_i x_i + \sum_{i=1}^{n-1} \sum_{j=i+1}^{n} c_{ij}\, x_i x_j + \sum_{i=1}^{n} e_{ii} x_i^{\,2} \tag{41}$$

Each answer S_i (range 1-8) is transformed starting from a function of individual desirability d_i whose nature depends on the objectives to research (to maximize the score for each negotiation partner).

$$d_i = \frac{s_{max} - s_i}{s_{max} - s_{min}} \tag{42}$$

Global desirability (d_{ig}) is designed for each scenario *i* by using geometric means of individual desirability. The model of desirability makes it possible to identify the levels of the variables which make it possible to research the maximum value of global desirability.

Virtual negotiation was tested at EIGSI: the compromise solution, in agreement with evaluator exigencies and candidate desires, is: 2500 euros, 9 h, 7% benefits and career promotion after 3 years. It is also possible to imagine a weighted geometric mean (weights of partners are different) but is it an "ethic" attitude?

4. DISCUSSIONS AND PERSPECTIVES

This work proposes a methodology to evaluate human qualities or values (creativity, responsibility and so on) of young engineers preparing a career in technical fields. A convivial questionnaire based on orthogonal arrays can capture the effects of criteria and the interactions and can be used for several objectives: to orientate students for a particular option (R&D, production etc.), to compare the points of view of students and mentors from different universities which are concerned by programs such as Socrates or Erasmus, to negotiate the professional insertion for a better exploitation of technical and human qualities. At this moment, an algorithm based on Fuzzy Logic is designed in order to model the "affinity" for a job, by including creativity, responsibility and technical competences.

2.3.2 Felix Cuesta, **Cătălin Popescu**, *Identifying the companies' competitiveness through their structural profile: Romanian case,* ANNALS of DAAAM for 2009 & PROCEEDINGS of the 20th International DAAAM Symposium "Intelligent Manufacturing & Automation: Theory, Practice & Education", 25-28th november 2009, Vienna, Austria, Vol. 20, no 1

The objective of the investigation is to identify the company´s profile from trade, retailing and finance sector in Romania, to identify their level of potential efficiency, according to the company structure coherence. To do so, we will use the Business Coherence Matrix® developed by Professor Cuesta during its investigation for his doctoral thesis. Investigation about company profile is giving us the level of alignment of the different variables which compound a company structure, then the company coherence and finally the level of efficiency. Once the profile is identified, it gives us the possibility to do the appropriate recommendations to increase the company efficiency.

1. INTRODUCTION

Prof. Cuesta defined, in his doctoral thesis, what a company structure is and must be as base for competitiveness and after done several studies in Spain, the idea is to expand the study to other countries starting by Romania with the help of Prof. Popescu.

2. ABOUT THE COMPANY STRUCTURE

According to the doctoral thesis of Prof. Cuesta, starting a with a simple definition we can say that a company is "an institution typical of the freedom market, set to do economical activity, within the environment", the key of this definition where we want to emphasize is the business environment dependency.

Then the managers have to understand that to properly manage a company means that it is fundamental to understand the every time environment and then to adapt the company according to it. Professor Norbert Thom (Thom, 2000) mentioned that companies are always immersed in crisis situations, but we have three different types of crisis, Strategic crisis, Result crisis and Cash-Flow crisis. Let's focus on the first one, the strategic crisis, which occurs when there are significant changes in the environment. The companies must to be ready to manage the situation because otherwise the end of this type of crisis is the Result crisis, when there are significant differences between the achieved results and the expected ones and again, a mismanagement of a results crisis concludes in a Cash-Flow crisis and in most cases the company bankrupt.

To avoid this process and this undesirable end, the companies must work with the first variable of the company structure, the Strategy, studying the environment and the internal resources in order to set the most appropriate one and the correspondent basic and global company objectives.

To achieve efficiently these global objectives, the company must works in the second variable, the Organization, organizing its resources in the best way possible, according to the strategy which is affected by the environment. Within the resources a special attention must be applied to the human resources and consequently another three variables must be set up according to the decide organization: Management System, Working Formal Organization and Compensation Policies. And then, in order to properly manage the structure, the information is a key and then the last variable of the company structure must be set, the Information System, supported by the Information Technology in order to manage the information in the most effective way possible. In the figure 2.26 we can see the company structure illustration, compounded by the different variables that we have discussed before.

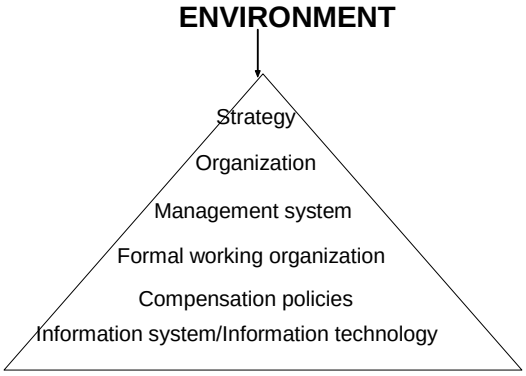


Figure 2.26. **Company Structure**

2. BUSINESS TRANSFORMATION PROCESS

Once we have the Company Structure, we are ready to adapt it according to the particular environment, that means that maintaining the same variables of the structure, but the values must change according to the particular environment, creating new company forms, aligned with such environment, within a transformation process to increase the company competitiveness (Cuesta, 2004), as we see in the figure 2.27.

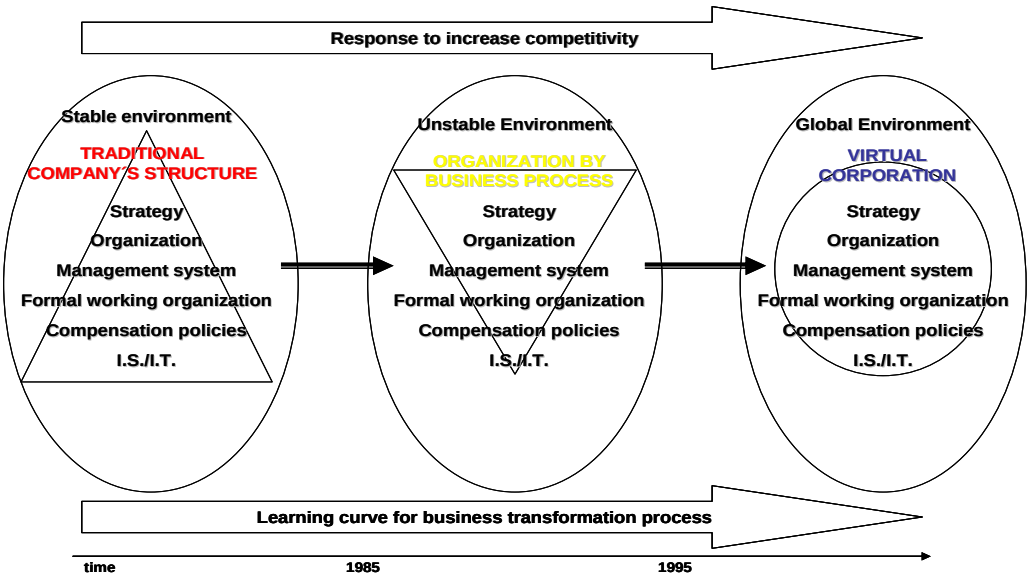


*Figure 2.27.***Transformation Process**

During the transformation process to adapt the company structure to the corresponding environment, some specific company forms are set, starting with the traditional structure typical of the stable environments, the organization by business process (a Kaizen base model) typical of a unstable environment and finally the Virtual Corporation, as the most suitable structure for global, fast and uncertain environments (Cuesta, 2006).

Within the process a two transition models appears to give continuity to the transformation process, as we can see in the coherence matrix®, where the different structures are defined by the value of the structural variables.

3. INVESTIGATION IN ROMANIAN MARKET

In order to design the profile for Romanian companies it was delivered a questionnaire composed by 7 questions. These questions are mainly focused on some subjects such as: organizational model, organizational structure, and management system style, type of work concern the employees, compensation policies and information system.

Period	1900		1985		1995
Company structure	TRADITIONAL	TRANSITION A	BUSINESS PROCESS	TRANSITION B	VIRTUAL CORPORATION
STRATEGY	internal (corp-cl-comp)	external (comp-cl-corp)	external & competitive (comp-cl-corp)	external &competitive (comp-cl-corp)	external/internal competitive/global (cl-corp-comp)
ORGANIZATION MODEL	functional, specialized & global	functional, specialized by processes	internal processes	internal processes with partial outsourcing	virtual processes
ORGANIZATION STRUCTURE	vertical & rigid	vertical & flexible	inverted pyramid	inverted & lean pyramid	virtual corporation
MANAGEMENT SYSTEM	by presence	by presence + objectives, participative	based on leadership	situational leadership theory	leadership & distance
FORMAL WORKING ORGANIZATION	individual	individual within a vertical team	team	high performance team	high performance virtual team
COMPENSATION POLICIES	fixed salary	fixed salary + variable	based on motivation	based on motivation	loyalty-oriented
I.S./I.T.	centralized mainframe	decentralized minicomputer	distributed minicomputers network	personal PC networks	central-decentralized client-server

Figure 2,28. **Coherence Matrix®**

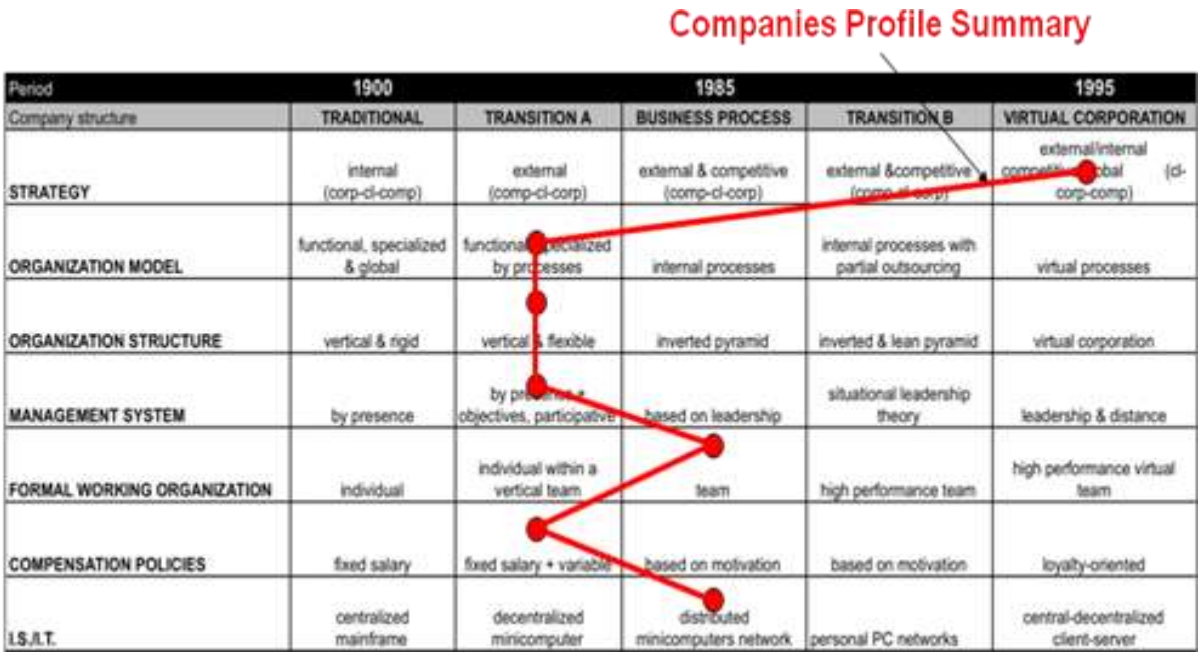


Figure 2.29. **Romanian Companies Profile Summary**

The Romanian companies included in the research are carrying out activities in areas such as: trade, retailing and finance. These domains were significant to the Romanian economy in the last 3-4 years. The questionnaire was distributed to a number of companies, mostly located in Prahova County and Ploiesti city, to their managers. After the questionnaires' processing stage the companies' profile line was drawn step by step and the result of this activity generate a diagram (fig. 2.29) which respect the framework of the coherence matrix® described above.

4. CONCLUSIONS

- First, to mention that this is the advance of a ambitious project, to follow the doctoral thesis of professor Cuesta, this has been a test to be followed by studies of specific sectors and countries to set a large benchmarking base of good practices;
- The immediate conclusion is that the wish/dream of all the companies reviewed is to set a client oriented strategy, but they have not changed the others structural variables to properly implement the client oriented strategy, so this creates a high level of inefficiency, due to a lack of coherence but also due to the difference between the clients expectations and the real companies possibilities to serve to adapt to them;
- With some differences, but mainly the profile of the companies reviewed is the typical old Industrial Era company profile, around the 80´s and probably the way in the one they are maintaining some competitive advantages it is due to the low labour cost;
- Considering that we are in the Information Era, the I.T. used by these companies is old fashion and then the competitive advantages are reduced as well as to properly implement a clients oriented strategy due to the lack of real clients knowledge;
- A typical error that it could happen and they must be prevented it is to invest in I.T. without changing the Human Resources related variables (organization, management systems, formal working organization and compensation policies), and then these companies could arrive to a profile in the one they will have Strategy and IT of century XXI and the rest of the variables typical of the middle of century XX, creating more inefficiency in the global structure;
- The recommendation would be to don´t do the same error that the old emblematic industrial companies typical of the century XX have done, thinking that changing the strategic approach an buying the last state-of-the-art in IT, the problems are solving, they have to adapt the organization, culture, etc. to properly implement the client oriented strategy and them to support it with the adequate IT.

5. FUTURE RESEARCH PLANS

The idea is to extend the research to specific sectors of activity and to different countries in order to progressively obtain a large data base of companies profile for benchmarking.

2.3.3 Omrani Hichem, **Popescu Cătălin**, Boussier Jean-Marie, Boussier Ion Luminiţa, Mitu Augustin, *Management of the acceptance degree for a technology transfer in automation field*, ANNALS of DAAAM for 2007 & PROCEEDINGS of the 18th International DAAAM Symposium "Intelligent Manufacturing & Automation: Focus on creativity, responsability and ethics of Engineers", 24-27th October 2007, Zadar, Croatia, Vol. 18, no 1

For technology transfer to be successful in automation field, it has to suit the culture of the end user. Managerial and organizational methods adopted in industrialized countries may face serious problems when applied in developing countries. The way people think, feel and react is a result of their traditional ideas and their attached values such as comfort, worries for losing their job. An approach based on the belief and utility theory proposes to quantify an indicator of acceptance degree that could help the manager to focus his/her dissemination work on pertinent criteria affecting the technology transfer and to follow its evolution before and during the implementation of the project.

1. A PROBLEM OF TECHNOLOGY TRANSFER

The different human, cultural, social and behavioural patterns of the people in developing countries demand that management systems of industrialized countries require prior adjustment or adaptation before they are transferred. Implementation of cultural calibration, however, is difficult due to the lack of relevant information on ethnic or cultural variability and the rather limited role that the Human Factors Engineering specialist is able to play during detailed engineering and short project time scales.

Several works exist, but they are generally focused on efficiency or effectiveness of implementation of an automation process (Hendrikse & McKinney, 2000). Studies of end user participation are limited or brought very late to the project with a simple evaluation for satisfaction that gives an indication of the acceptance of handling a device (Meister, 1985), without possibility to manage it.

However, define and quantify an indicator illustrating effects of several criteria causes many problems: how to take into account heterogeneous perceptions of criteria effects, which are the pertinent criteria, how to manage the indecision.

2. AVERAGE UTILITY OF HUMAN CRITERIA

Let us take an example of one criterion like “worry to lose a job” related to the installation of an automated chain in a company situated in a developing country (such as Romania). Let $\Omega=\{H_i, i=1,\ldots,p\}$ be the domain of criteria levels which represent a finite set of mutually exclusive and exhaustive hypotheses, called the frame of discernment. In our application Ω = *{Absolutely worried, Partly worried, Partly reassured, Absolutely reassured}={A.W, P.W, P.R, A.R}*. A questionnaire is submitted to workers concerned by these changes and responses can be as singletons (one of levels) or as disjunctions (between two successive levels). By applying belief theory (Demspter, 1968), the indecision (frequently observed before implementation of a project) or the ignorance can be taken into account. Mass assignment is done by using frequency analysis (Denoeux, 2006), as is shown in figure 2.30

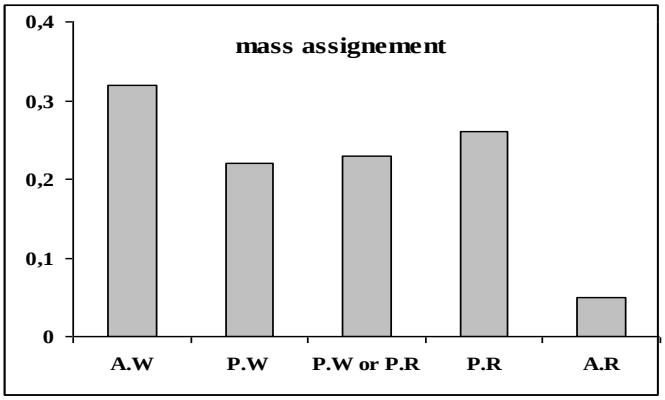


Figure 2.30. **Mass assignment for criterion “worry to lose a job”**

Beliefs can be transformed into a probability measure denoted by BetP (Smets, 1994):

$$BetP(A) = \sum_{B\subseteq\Omega} \frac{|A\cap B|}{|B|} \times \frac{m(B)}{1-m(\varnothing)}, \quad \forall A \subseteq \Omega \tag{43}$$

where |B| denotes the number of elements in the set B and m(Ø) is the mass allowed to the conflict between workers’ opinions. The results provided to the project manager are in numerical form starting from the computation of a utility (u_i) for the criterion (C_i):

$$u_i = \sum_{k=1}^{p} u(H_k) \times BetP(H_k) \tag{44}$$

where: $u(H_k)$ is the utility of an evaluation level H_k, $u(H_{k+1}) \geq u(H_k)$ if H_{k+1} is preferred to H_k, and $BetP(H_k)$ is the "pignistic" probability related to H_k. By using a linear function on the evaluation levels (e.g. *u(A.W, P.W, P.W or P.R, P.R, A.R)=(0.25, 0.5, 0.75,1)*), we obtain an utility (i.e. score) for “worry to lose the job” equal to *0.57*. We will show in section 4 how this

utility, which is an average value taking into account all workers responses will be exploited for acceptance level quantification.

3. CRITERIA CLASSIFICATION

The method for estimating criteria weights is based on the judgment of the evaluators and the belief theory. Let *{W_i, i=1,…,p}* represent a group of workers and *{C_k, k=1,..,n}* be a group of criteria whose weights we want to determine *{ω_k, k=1,…,n}*. In our application the set of 'pertinence degree' was defined using 4 levels. The estimation of the criteria weights is given by the following equation:

$$\begin{cases} \omega_i = \sum_{i=1}^{4} BetP(i) \times V(i) \\ BetP(i) = Freq(i) + \sum_{j \neq i, |j| \geq 2}^{4} \frac{Freq(j)}{|j|} \end{cases} \quad (45)$$

where: $i \in \Omega$={1,2,3,4}={Not Pertinent, Less Pertinent, Pertinent, Very Pertinent} is the set of pertinent degrees; *Freq(i)*: frequency of appearance of pertinence degrees *i*; | *j* |: cardinality of the set *j, V (i)* is level of degree of importance with a linear analytic form:

$$V(i) = (i-1)/(m-1) \quad (46)$$

with *m* levels of pertinence and $i \in [1; m]$

After weights computation (equation 43), normalisation is necessary. Now, we consider that two criteria are tested: "worry to lose a job" (J) and "time efficiency at work" (E). In our application the pertinence degree of the criteria was evaluate by 6 workers (noted by W_i). If a criterion is unknown, a respondent can reply by UNK "I do not know" (table 2.14).

Table 2.14. **Opinions of workers**

Workers / Criteria	**W_1**	**W_2**	**W_3**	**W_4**	**W_5**	**W_6**
J	1	2	3	3	3	UNK
E	1	{1,2}	3	3	3	1

After normalisation, equation (45) becomes: ω_J=0.56 and ω_E = 0.44. These weights allow a manager to have an "average" classification of criteria that could affect the acceptance degree and to do a complementary work to correct the most important (in our case, the "worry to lose their job").

4. ACCEPTANCE DEGREE

We considered that the indicator for acceptance degree must illustrate the effects of all criteria tested by the manager. Generally a simple method of aggregation is applied for it which is based on the multi-attribute utility theory (MAUT) techniques. However, utility function is not necessary additive because the criteria set can be in interaction (in synergy or in redundancy). For it, we adapted the criteria aggregation by the 2-additive form of the Choquet integral (Rico, 2002) where global utility is:

$$u = \sum_{i=1}^{n} \omega_i \times u_i - \frac{1}{2} \sum_{s=1}^{n} \sum_{t=s+1}^{n} I_{st} \times |u_s - u_t| \quad (47)$$

with: ω_i is the weight of the criterion C_i ; u_i is the average value of utility defined by equation (45) and I_{st} is the interaction between the criteria C_s and C_t which must be must computed.

For it a recent work (Grabisch & Perny, 2003) has proposed the concept of k-additive measure and some methods for computing the weights of interactions between criteria. These methods deal with classification problems (i.e. candidates ranking etc.) and they are not adequate in our work.

Our method is based on the belief theory. Let *{E_i, i=1,…,p}* be a set of workers and {C_k, *k=1,..,n*} be a set of criteria whose index interactions we want to determine *{I_{ij}, i,j=1,…,n}*. We define a set of levels for importance of interactions that the workers use for giving their opinion. In our application, this set contains 5 levels as follow: *Ω={High Negative Interaction*

(-2), Less positive Interaction (-1), Not Interaction (0), Less positive Interaction (+1), High positive Interaction (+2)}.

Weights of interactions are computed as follow:

$$\begin{cases} I_{ij} = \sum_{k=1}^{5} BetP_{i,j}(k') \times V(k') \\ BetP_{i,j}(k') = Freq(k') + \sum_{l \neq k, |l| \geq 2}^{5} \frac{Freq(l)}{|l|} \end{cases} \quad (48)$$

where $k' \in \Omega$; *Freq(k')* is frequency of appearance of levels for importance of interaction; | *l* | : cardinality of the set *l*; *BetP(k')* is the "pignistic probability". *V(k')* reflects the importance of an interaction and it is given by the following equation:

$$V(k') = \frac{2}{(n-1)} \times k' \quad (49)$$

For three interactions studied related to the criteria ("Worry to lose a job" (J.), Security level (S.), "Time efficiency at work"(E.)), the frequency of apparition is done in table 2.15.

Table 2.15. **Frequency of apparition**

Levels/ Criteria	-2	-1	0	1	2	-2,-1	1,2	UNK
{J., S.}	0	0	0.5	0	0	0	0	0.5
{J., E}	0.5	0	0	0	0	0.5	0	0
{S, E}	0	0	0	0.5	0	0	0.5	0

Interaction indexes are respectively: {J., S.}=0; {J, E.}=- 0,875; {S., E.}= 0,625. Two pairs of criteria are strongly correlated but the effect of interaction "worry to lose his job" and "time efficiency at work" is the most important and it is perceived as harmful by the end users. By applying equation 47, a value of acceptance degree for a phase of implementation of the project can be computed. This operation has an interest only if a comparative approach is designed. Suppose that this indicator is evaluated for several phases (before and during the implementation of the automation chain); average value of utility associated to each criterion could change, as well as weights of interactions perceived by end users. A manager could have a realistic idea of global perception of impacts of the project (using acceptance degree) and can imagine corrective strategies to manage a successful transfer technology (using weights of criteria and of interactions).

5. CONCLUSIONS AND PERSPECTIVES

Power and hierarchical decision-making, individual versus collective practices, and the perceived consequences may require consideration when technology is transferred. We have proposed a methodology for the evaluation of acceptance degree for a technology transfer in automation field, under the framework of utility and belief theory. Its interest is the capacity to combine linguistic evaluations of end users in an effective way, taking into account indecision, ignorance and suspicion. The manager is able to estimate pertinent criteria, evolution of acceptance degree and to establish corrective strategies during the implementation of the project.

This approach will be tested in Romanian companies, especially in automobile field where people attitudes concerning automation processes have been strongly affected during last few years, due to the success of transfer technology.

2.4 Researches on the optimization tools designed with the information technology capabilities and used in management science

In the following paragraphs will be described two of the main application software developed with the occasion of publishing of two scientific articles (in the Annals of the Oradea University Fascicle of Management and Technological Engineering CD-ROM Edition, volum II (XII), 2003 and in the Annals of the Oradea University Fascicle of Management and

Technological Engineering, CD – Rom Edition, volume III (XIII)) and of a book called: “Methods, techniques and tools applied in management”, authors: **Cătălin Popescu**, Madalina Albu and Mihaela Otelea, UPG Publishing House, Ploiesti, 2012.

2.4.1 Software application of an assignment problem

We live in a world of scarce resources in which individuals and groups must make good allocations of limited resources. From the beginning of time, people have had to make best of these limitations. The present paper presents the general problem of an assignment problem and proposes a software solution to the problem. Software application called “Assignment Problem” is designed using Visual Delphi 5.0. Visual Delphi 5.0 is supplied by Borland, being dedicate to the programmers wish to develop Windows applications. The language used by Delphi system is named Object Pascal, which is a developed version of classical Pascal. Proposed application software is friendly, easy to use and offer rapidly the optimum solution. Example:

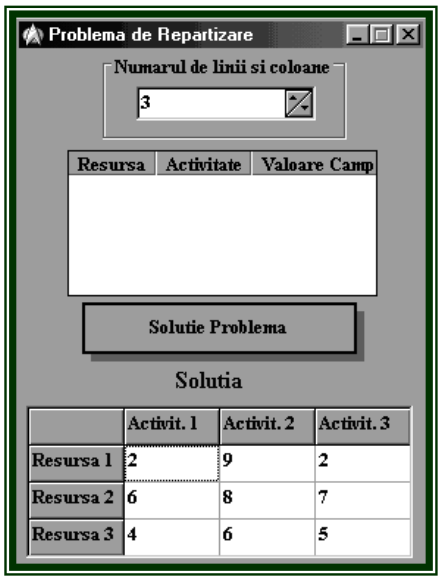


Figure 2.31. **Application**

At the beginning will be determined the number of resources and activities, and then it will be selected the program matrix size (fig.2.31). After this, is filling in with problem data the matrix with known size. After checking these values click on "problem solution" and the results will be displayed as shown in fig. 2.32.

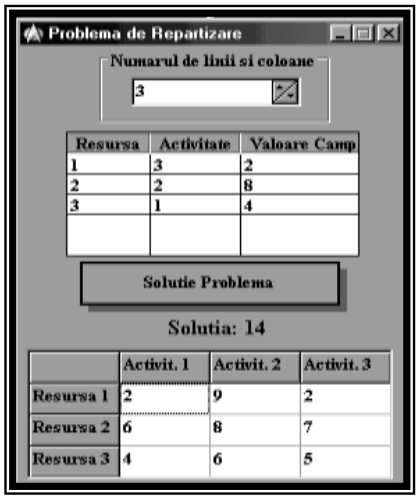


Figure 2.32 **Results**

The system is provided with a well documented Help menu, which includes besides standard commands other commands for the presentation of Object Pascal language, the way of developing applications, detailed description of objects and components.

According to data supplied by the company producing system speed is extremely high. To a computer with proper capacity (Pentium II) within a minute are processed more than one million source lines. Delphi software directly creates executable files that can be launched running even if it is not installed on that computer Delphi system. The need for expanded memory is also impressive: at least 32 megabytes. But in this case, due to the phenomenon of swapping the speed program is quite small. It is recommended to equip a computer with extended memory size 64 megabytes or more. Computer processor has to be Pentium II or Pentium III. On the other hand the type of the monitor should be at least EGA; it is recommended the use of a Microsoft mouse type or compatible.

2.4.2 Software application in decision making using utility theory

This application intends to solve some questions that arise within a seminar from *Quantitative methods and techniques used in Management and Business Administration* discipline regarding the subject: “Utility theory applied in the case of decision making for optimizing the choice of equipment”. Regarding the hardware, this application can run on a standard system, requiring a free space on hard disk of 600KB. The algorithm is based on using a consequences matrix which could help to calculate a cumulative utility for each existing variant or alternative. At the end of running process, the programme delivers the optimum solution represented by that alternative with maximum of cumulative utility. From the functional point of view the programme contains a series of interface elements such as: radio keys, confirmation keys, text boxes etc. all necessary to entry data problem.

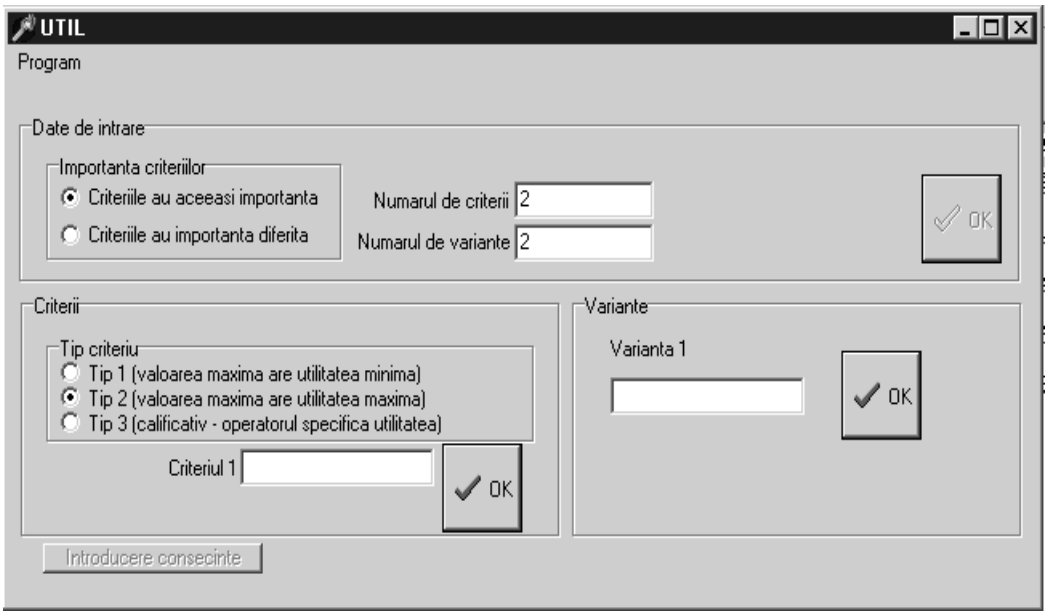


Figure 2.33. **Main screen of *“UTIL”* programme**

In figure 2.33 is described the main screen programme. In the first phase, the user establish if regarding the criteria it will be equal importance granted to these criteria or the election process is carried out by taken in account different importance for each criteria. To do this the user could use the radio keys group called: “Importanţa criteriilor”. After this step are inserted the criteria number and number of alternatives in the appropriate text boxes and then is press “OK” key. In this moment is activated the keys used for entering criteria and alternatives (fig.2.34).

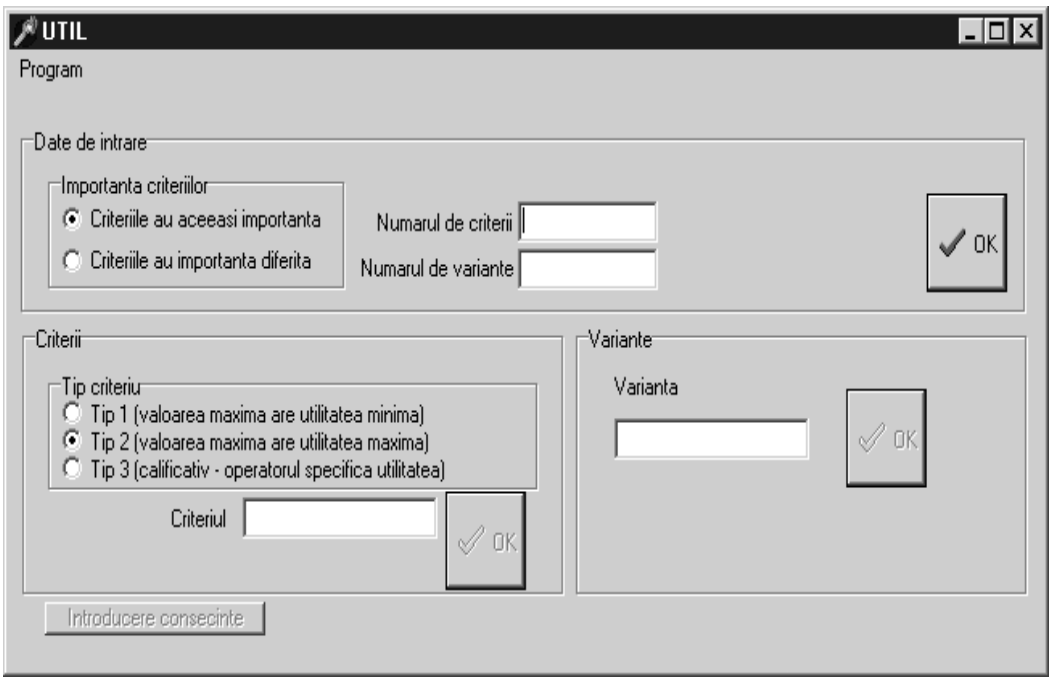


Figure 2.34. **Entering criteria and alternatives**

Every alternative entering is followed by pressing “OK” key. In the same way is carried out the criteria entering process. Radio keys group called “Tip criteriu” is used to establish the criteria nature. Type 1 represents those criteria for which to maximum values of the consequences are corresponding maximum values of utilities. The second type refers to that cases for which to maximum values of the consequences are corresponding minimum values of utilities and the third type is for those criteria with consequences that have attributes. The next step refers to entering the values/attributes for consequences by press the key "Introducere consecinţe" which become active after the data entering process (fig.2.35).

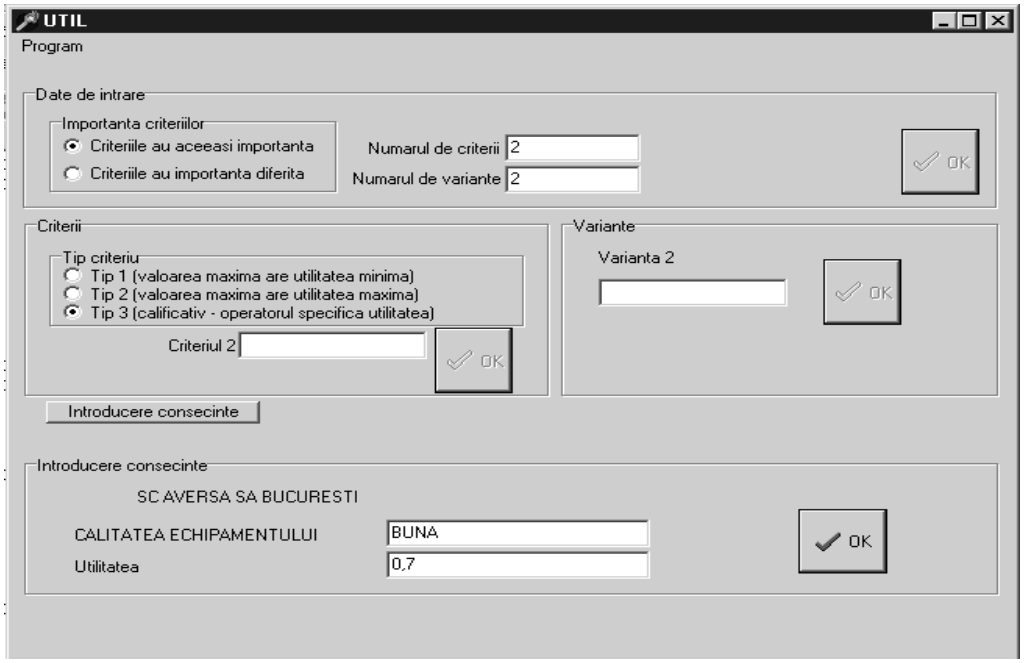


Figure 2.35. **Consequences entering screen**

The process of entering consequences requires special attention in order to keep the link between the criteria type, consequences values/attributes and corresponding utilities.

After this process is finished the fields with data already entered will be replaced by a key which deliver, after is pressed, the results for the current problem (fig.2.36).

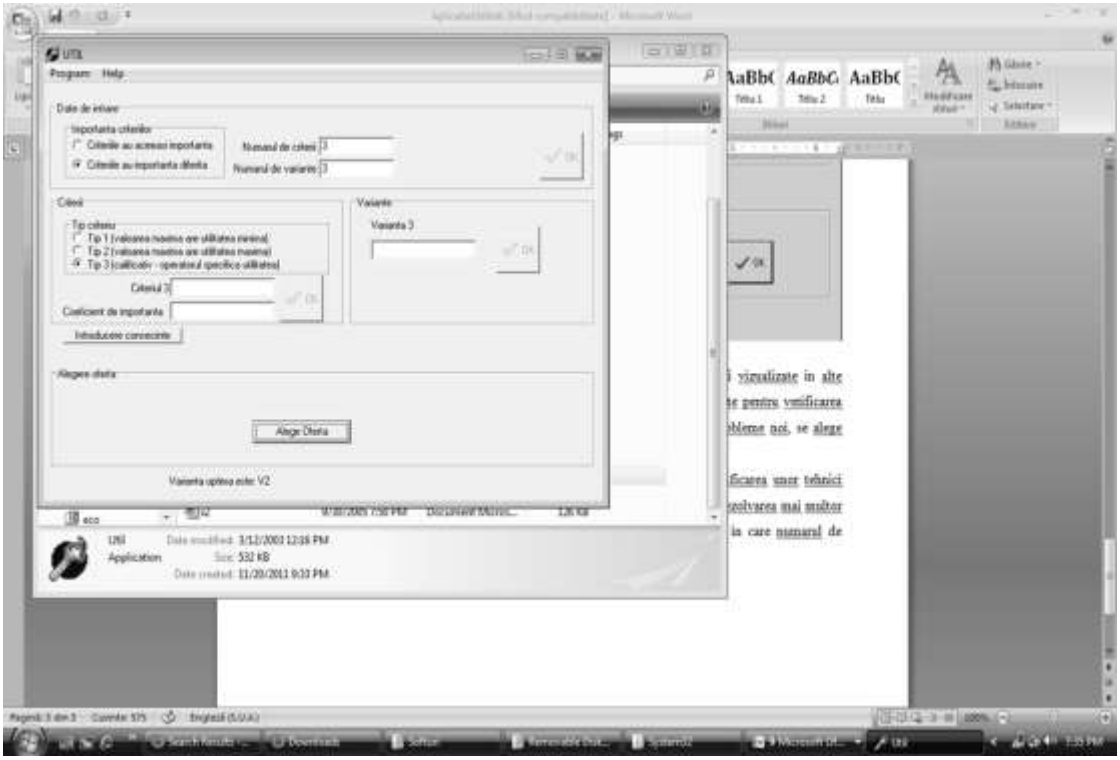


Figure 2.36. **Results for current problem**

Chapter 3. FUTURE DIRECTIONS FOR ACADEMIC, SCIENTIFIC AND PROFESSIONAL CAREER DEVELOPMENT

Discussions on the need for an higher training the upper focused on certain sectors bring to the forefront the question of find out solutions for properly and oriented training to graduates from higher education institutions in order to expand their skill level that correspond to economic developments and in relation to labor market requirements. These developments and requirements have to be coupled to the global European context, particularly in relation to certain outstanding events defining the last few years: the adoption in 2005 by Romania of the Bologna system in terms of higher education, Romania's integration in the EU since 1 January 2007, the gradual abolition of barriers related to access to the labor market to Romanians in the countries of the EU, a last example being that of Great Britain who raised these restrictions for citizens of Romania and Bulgaria. An efficient way of adapting to these trends refers to the possibility that the best graduates of undergraduate and master's study programme to continue training through their integration in doctoral educational cycles. Given that in recent years the number of students in the field of Engineering and Management was always at a very high level, with a peak value of more than 20,000 students in 2012, according to the National Statistics Institute, representing approximately 15% of total students who were integrated into the technical sector, we can say that there is a high interest from young people for such a field. From this point of view I can say that I am able to contribute, through the expertise gained in the last 15 years, with all the other colleagues involved in this area, to the career development of these young people.

Current and future personal preoccupations regarding scientific area can intersect constructively and effectively with the budding desires of these graduates, especially for those who would like to complete their training acquired in college. The realities are related to the willingness of smaller universities, by number of students and study domains, to create a sustainable perspective in terms of doctoral studies. From this point of view Petroleum-Gas University of Ploiesti, as well, needs a redefinition of main research directions in terms of doctoral studies as in the present there are still a small number of scientific PhD coordinators and also an insufficient number of areas in terms of doctoral studies domains.

Research directions

1. Research on technical and economic optimization in the energy sector

In the light of previous research could be highlighted some specific research topics and themes in order to continue the work done so far.

In this respect, first it has to be started from certain realities. These are related to: the oil and gas industry, general economic trends concomitant with labor market dynamics, the trends and requirements in the field of academic education, the important influences generated by the information and communication technologies, the new concepts and principles that define modern management.

Taking them one by one is the time to warn about a crucial problem of contemporary society. Increased need for energy, dynamic growing in consumption of liquid and solid fuel, on one hand, coupled with the dramatic exhaustion of mineral resources on the background of the environment deterioration, on the other hand, generated a state of concern among most of the countries.

During this period, every country is trying to maximize its chances of access to the energy sources that can offer them the opportunity to obtain bigger energy independence. Since in most cases there were not discovered new mineral resources and additionally, the use in excess of them generated an obvious change in the quality of air, water and soil quality, but also led to increasing greenhouse phenomenon, more states are concerned to minimize/optimize the cost of energy production, to obtain energy efficiency, to reduce energy intensity and to investigate the potential of alternative energy sources.

Romania's case in this regard has pluses and minuses. Romania is considered to be a rich country in poor resources, but expensive. Indigenous reserves of oil and natural gas are in an advanced process of depletion for the next 15-20 years. Production' dynamics does not

show very well since in 2004 the oil production was 5.5 million tonnes and production of natural gas reached 13.0 billion cubic meters while in 2011 oil production was 4.0 million tonnes and natural gas production decreased to 11.16 billion cubic meters. The production declines have to be compensated, in order to cover required production quantities for energy production, by increasing the imports of oil and gas and also, by carrying out investment projects in the field of alternative energy sources. Specifically, to cover the total demands for natural resources of oil and natural gas, now the imports exceed production levels achieved both for crude oil and also for natural gas.

The oil crisis, reflected by a major decline of the oil barrel price, in latest years, up to a historic lowest level of approx. 27USD / barrel oil in 20 January 2016, has had influence throughout the global economy. The realities say that the current model of civilization is based on the energy consumption mainly from exhaustible natural resources.

In addition there is a range of factors that could develop or boost an energy crisis:

1. there is an uneven distribution of primary energy resources which divides the world in rich countries in natural resources and countries lacking of such resources;
2. the pressure generated by large transnational corporations that operate in the oil and gas industry, through their financial power, may have important influences on various markets of resources, goods and services, with major effects on the world economy;
3. the development strategies in industrial and economic field of some developed countries to have access to various primary energy resources that are owned by less developed countries;
4. the environmental impact generated by important consumption of fossil type resource, since the energy sector besides the transport system is the main agent of pollution of any type that could create climate change.

At the same time, we have to be aware that the evolution of human society will increase the consumption of any kind, including in particular the energy consumption. This aspect should be complemented with other trends that will be manifested pronounced in the future: technical development and technological development involving automation and robotics processes of any type; increasing urbanization; displacement of preoccupations in investigating the use of alternative energy sources amid exhaustion dramatic of conventional energy resources; the need for research and financing projects in order to reduce energy intensity.

Based on these realities and adding that among the priority areas of research which the *Executive Unit for Financing Higher Education, Research, Development and Innovation (UEFISCDI)* it had financed or will finance them, is also energy domain, I declare that a vital direction which I will focus my preoccupations related on scientific research will be the energy sector.

2. Innovative instruments for increasing the firm' competitiveness and for forming skills on entrepreneurship

Another direction in the field of scientific research has the aim to analyse and propose tools and measures in the sphere of innovation, in order to assist in improving the economic competitiveness of the companies and for forming specialists that will promote an entrepreneurial spirit. Forming and assessment of entrepreneurial skills can help to develop entrepreneurial business environment, creating a greater number of small and medium enterprises, create jobs and thus improve the macroeconomic performance. This guidance in terms of scientific research is needed due to the fact that Romania Research and Innovation Strategy for 2014-2020 stated the following: "*Creativity, boosted in all stages and forms of education, activate entrepreneurship based on innovation. In a space of trust and integrity, entrepreneurial success generates inspirational models, animating a broader culture of innovation and, ultimately, a society where innovation has become a lifestyle*". Learning method called "Simulated enterprise" is an innovative and interactive tool with high demand among students. POSDRU project entitled "*From theory to practice through simulated enterprise*" was a first step in the forming of specialists able to acquire entrepreneurial skills.

An important measure which confirmed the sustainability of the project was the change in the curriculum to students undergraduate from the Management domain, Petroleum-Gas University of Ploiesti, by entering into the third year of a discipline entitled: Simulations and project management where over 4 hours of laboratory weekly the students have the opportunity to familiarize themselves with all notions and concepts defining entrepreneurship and management of small and medium enterprises. Additionally there are organized, on a voluntary basis, groups of students from all fields of study from the Faculty of Economics which are attend weekly meetings that are organized within simulated enterprises approach. To be in the proximity of the business environment can be achieved by integrating this innovative method in educational system with the help of companies that may find a "clone company" in these laboratories of simulated enterprise. Thus, in a virtual environment can operate companies that exist in the real economy. These real companies "borrow" elements to simulated enterprise such as: own identification mark, type of business, organizational structure, suppliers, customers, markets, while real business leaders can engage themselves directly in guiding students along with teachers involved in the operation of a virtual company. This learning solution develops skills and abilities for future graduates by which they can be integrated more easily and quickly in the work. Furthermore the collaboration between academia and business can increase the companies' interest in their involvement in improving the practical training of future employees.

The informational support related to dynamic innovation and to the SMEs evolution it is filled by the quality of being editor-in-chief of two magazines: Journal of Innovation and Business Best Practices (JIBBP), Stamford Publishing, USA and Economic Insights - Trends and Challenges, Romania.

3. Existing computer applications and design of specific computer solutions

The fact that the doctoral dissertation had the title: "Modelling and Simulation of manufacturing systems redesigning under optimal regime of production systems", the doctorate field being Automatics, represents an asset in what it means the design and use of IT solutions in various situations.

Therefore, a new line of research, useful also for the future candidates of doctoral studies refers, on one hand, to the integrating and using powerful software applications that are able to provide quick solutions to optimize the functioning of various technical and economic systems, and on the other hand, to the designing of customised computer solutions, of client type, capable of solving technical, economic and financial specific problems.

To meet the first declared challenge, an example is given of how is used Monte Carlo simulation method in the oil and gas industry. Such a problem can be adequately treated by appealing to well known computer software: Crystal Ball, produced by Decisionieering Company. In relation to this computer software and its capabilities can be estimated indicators of economic performance drilling and operation of a well strongly deviated. The application runs using Excel from Microsoft Office. Cells where are defined forecasts has to contain formulas while those that contain assumptions have to be filled with values.

The following paragraphs will provide a brief description of the methodology to apply Crystal Ball software as a tool for analyzing the economic performance of a new drilling operation. The evaluation method used is the Discounted Cash Flow containing the economic performance indicators as follows: the aggregate value of discounted cash flow (net present value), internal rate of return, payback time and profitability index. For simulation have to be entered some data: the depth of drilling, the investment (with associated type of distribution), the oil price (with associated type of distribution), the chance of success for the operation (with associated type of distribution), the discount factor, the total cost of maintenance of the field where is drilled the borehole, amortization method, baseline flow of crude oil extracted, the assessment time concern drill operation, known tax rates: the royalty, tax on production, depletion, government fees. The simulation results provide on three levels of probability values for: aggregate value of discounted cash flow (net present value), internal rate of return, payback time, the index of profitability, values of all taxes.

Example of a computer application that treats linear programming

This example, responds to the second theme, of designing of dedicated computer applications. The application is not yet finished, since testing and error correction operation was not completed. As functional procedure there are inserted in the dedicated fields characteristic values for the objective function and for system of constrains (as shown below), and then is validated the running of the model.

4. Construction of effective proposals of project and national and international grants in order to obtain funding by using the European funds mechanism

Acquired experience in implementing projects with external funding covers various topics but with impact on society:

- for easier transition from school to active work and to a successful career

a) POSDRU Project: "*From theory to practice through simulated enterprise*", 90/2.1/S/ 58123

The project has created opportunities for training students in a practical and efficient manner, using the capabilities created by an exceptional IT infrastructure and by using a virtual environment, of functioning the enterprises that simulate, through well defined mechanisms, activity of real companies;

b) POSDRU Project "*VIA-vocation, self development, path to professional success*", 90/2.1/S/63742

Because students' transition to working life has to be achieved rapidly, is necessary a unified development of the guidance and counselling services in the national education system. Thus, both pupils and students are receiving assistance for educational purposes concerning their professional future, as long as those persons that are in charge in delivering activities regarding professional counselling and guidance, works with an important set of data and information in terms of volume and are they using ICT tools which are adequate. The project envisaged the creation and use of a computerized system for assessing vocational psychological profiles and for generating databases for professions which prevail;

c) International Research Project Progress: "*FIRST STEP TO FIRST JOB - Youth Innovative Methods leading to a solid career*", VS/2012/0017

Analyses concern integration of young people into active work and the values of youth unemployment in Europe show the difficulties facing faculty graduates. Therefore, the project has discussed innovative measures and methods through which young people to find a job.

- for the creation and development of specific skills for certain domains

a) POSDRU Project: "*The formation of university staff and students in using modern computer tools in academic management field*", 86/1.2/S/62689

The project intended to improve the quality and relevance of educational offers in higher education, through innovative actions of ensuring the quality of educational process

and its adaptation to labor market requirements. Organized training courses are related with ERP systems and schooling management system.

b)POSDRU Project:"*Vocational training and promoting new technologies for employees from oil and gas field, in order to increase the quality of services, professional competitiveness and improving specific activities and processes*", 81/3.2/S/59102

The fundamental objective of the project was improvement and perfecting of professional skills of specialists in the field of oil and gas, by providing professional training programs. Concretely, the project has considered in improving the knowledge of employees and responsible from the oil and gas industry in ICT field, in improving practical skills and theoretical knowledge by participating in professional training programs in relation to best practice and European experiences, in familiarity with innovative tools for e-learning training.

The experience gained in these projects is a prerequisite for building new applications proposals with a higher quality level and with increased relevance, creating the possibility of obtaining funds required for carrying out the proposed activities of these projects.

In terms of underfunding of education, by failure to obtain the percentage referred by the law of 6%, and of substantial reductions in core funding to universities, lack of money can create an imbalance in the effective functioning of the education system in Romania. Therefore, a welcome solution relates to the identification of funding sources much more diverse. After a period of less national competitions concerning research funding, since the second half of 2016, UEFISCDI launched PNCDI III round of programs containing four major topics:

- P1 - Development of the National Research - Development system, with Human Resources sub-program;
- P2 – Increasing the competitiveness of the Romanian economy through CDI, with Competitiveness through CDI sub-program;
- P3 - European and international cooperation, with Horizon 2020 sub-program;
- P4 - Basic and frontier research.

On the other hand another important source of funding for higher education refers to European funding. Thus, according to the website of the Ministry of European Funds on 31 May 2016 Romania has obtained an effective absorption rate of 65.05% on all seven operational programs defining the financial year 2007-2013. The new multiannual financial program 2014-2020 provides new opportunities to the applicants from Romania through six operational programs:

- POCU – Operational Program HUMAN CAPITAL;
- POC – Operational Program COMPETITIVENESS;
- POIM – Operational Program BIG INFRASTRUCTURE;
- POR – Operational Program REGIONAL DEVELOPMENT;
- POCA – Operational Program ADMINISTRATIVE CAPACITY;
- POAD – Operational Program HELPING THE DISADVANTAGED PERSONS.

All these opportunities have to be used in relation to the idea of integrating sustainable development into future proposals for projects on the three defining components: environment (through environmental protection and proper use of natural resources), society (with a focus on improving living standards, improving the level of health population and raising awareness of the new role which the human has it in the information society) and the economy (in the idea of economic competitiveness, in general, and of productivity growth, in particular). The idea of sustainability of any project from the sustainable development perspective is a necessary element to be treated it so that the approaches that have been included in all the studies and research mentioned in this thesis provide elements that confirm, in my case, such a preoccupation.

Chapter 4. REFERENCES

-in order of subchapters and paragraphs-

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Links

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