

7th International Conference on
**ENGINEERING, PROJECT
AND PRODUCTION MANAGEMENT**

EPPM2016

Book of abstracts

Edited by Alicja E. Gudanowska



Bialystok, Poland, September 21-23, 2016



7th International Conference on Engineering, Project, and Production Management (EPPM2016) is financed in the framework of the contract no. 712/P-DUN/2016 by the Ministry of Science and Higher Education from the funds earmarked for the public understanding of science initiatives.

7th International Conference on Engineering, Project, and Production Management (EPPM2016) finansowana w ramach umowy 712/P-DUN/2016 ze środków Ministra Nauki i Szkolnictwa Wyższego przeznaczonych na działalność upowszechniającą naukę.



7th International Conference

**On Engineering, Project, and Production Management
(EPPM2016)**

BOOK OF ABSTRACTS

Edited by Alicja E. Gudanowska

Białystok, Poland, September 21–23, 2016

Reviewers

prof. dr hab. inż. Joanicjusz Nazarko

© copyright by: Białystok University of Technology

Białystok 2016

ISBN 978-83-65596-02-4

Edition	150 copies
Editors	Alicja E. Gudanowska
Cover design	Tomasz Trochimczuk
Technical editing and typesetting	Publishing House of Białystok University of Technology
Printing:	Publishing House of Białystok University of Technology

ORGANIZERS



Faculty of Management, Bialystok University of Technology, Poland



Association of Engineering, Project, and Production Management (EPPM), Taiwan



Polish Academy of Sciences' Committee on Production Engineering, Poland



International Society for Manufacturing, Service and Management Engineering (ISMSME), Poland



Agency for Restructuring and Modernisation of Agriculture, Poland

CONFERENCE CHAIRS

Joanicjusz Nazarko, Chair

Dean of Faculty of Management
Bialystok University of Technology, Poland

Kassim Gidado, Co-Chair

President of EPPM Association
University of Brighton, UK

Ryszard Knosala, Co-Chair

Chair of Production Engineering Committee of the Polish Academy of Sciences
Opole University of Technology, Poland

Turki I. Obaidat, Co-Chair

President Al-Zaytoonah University of Jordan

SCIENTIFIC CHAIRS

Katarzyna Halicka, Chair

Vice-Chair of Department of Business Informatics and Logistics
Bialystok University of Technology, Poland

Wang Hao, Co-Chair

Co-Director of International China and Central-Eastern Europe Institute of Logistics and Service Science
Zhejiang University Ningbo Institute of Technology (ZJUNIT), China

Kriengsak Panuwatwanich, Co-Chair

Vice-President of EPPM Association
Griffith University, Australia

Subhi Bazlamit, Co-Chair

Dean of College of Engineering and Technology
Al-Zaytoonah University of Jordan, Jordan

INTERNATIONAL SCIENTIFIC COMMITTEE

Ernest Abbott	National University of Singapore, Singapore
Hesham Ahmad	Al-Zaytoonah University of Jordan, Jordan
Shabbab Alotaibi	Shaqra University, Saudi Arabia
Nicholas Chileshe	University of South Australia, Australia
Thanwadee Chinda	Thammasat University, Thailand
David Chua	National University of Singapore, Singapore
Agata Czarnigowska	Lublin University of Technology, Poland
Jeung-Hwan Doh	Griffith University, Australia
Krzysztof Dziekoński	Bialystok University of Technology, Poland
Fidelis Emuze	Central University of Technology, Free State, South Africa
Józef Gawlik	Cracow University of Technology, Poland
Romuladas Ginevicius	Vilnius Gediminas Technical University, Lithuania
Adam Hamrol	Poznan University of Technology, Poland
Hsiang-Hsi Huang	National Pingtung University of Science and Technology, Taiwan
Ali Jaafari	Asia Pacific International College, Australia
Jerzy Jaroszewicz	Bialystok University of Technology, Poland
Krzysztof Jemieliński	Warsaw University of Technology, Poland
Arkadiusz Jurczuk	Bialystok University of Technology, Poland
Sittimont Kanjanabootra	University of Newcastle, Australia
Oleg Kaplinski	Poznan University of Technology, Poland
Ryszard Knosala	Opole University of Technology, Poland
Anna Kononiuk	Bialystok University of Technology, Poland
Katarzyna Kuźmicz	Bialystok University of Technology, Poland
Jan Kaźmierczak	Silesian University of Technology, Poland
Bazyli Krupicz	Bialystok University of Technology, Poland
Józef Kuczmazewski	Lublin University of Technology, Poland
Toma Lankauskienė	Vilnius Gediminas Technical University, Lithuania
Teresa Lis	Silesian University of Technology, Poland
Andrzej Magruk	Bialystok University of Technology, Poland
Wiesław Matwiejczuk	Bialystok University of Technology, Poland
Sherif Mohamed	Griffith University, Australia
Łukasz Nazarko	Bialystok University of Technology, Poland
Yiannis Nikolaidis	University of Macedonia, Greece
Krzysztof Nowacki	Silesian University of Technology, Poland
Aiyetan A Olatunji	Central University of Technology, Free State, South Africa
Cezary Orłowski	Gdańsk University of Technology, Poland
Noel Painting	University of Brighton, UK
Erwin Pesch	University of Siegen, Germany
Poorang Piroozfar	University of Brighton, UK

Waldemar Rakowski	Bialystok University of Technology, Poland
Rafał Rusinek	Lublin University of Technology, Poland
Krzysztof Santarek	Warsaw University of Technology, Poland
Jonas Saparauskas	Vilnius Gediminas Technical University, Lithuania
Dariusz Siemieniako	Bialystok University of Technology, Poland
Mirosław Skibniewski	University of Maryland, College Park, USA
Adam Skorek	University of Quebec, Canada
John Smallwood	Nelson Mandela Metropolitan University, South Africa
Jelena Stankevičienė	Vilnius Gediminas Technical University, Lithuania
Maciej Szymczak	Poznań University of Economics, Poland
Jolanta Tamosaitiene	Vilnius Gediminas Technical University, Lithuania
Stefan Trzcieliński	Poznan University of Technology, Poland
Wiesław Urban	Bialystok University of Technology, Poland
Leonas Uscinovicius	Vilnius Gediminas Technical University, Lithuania
Andrzej Wasiak	Bialystok University of Technology, Poland
Marek Wirkus	Gdańsk University of Technology, Poland
Magdalena Wyrwicka	Poznan University of Technology, Poland
Ker-Wei Yeoh	National University of Singapore, Singapore
Janusz Zawiła-Niedzwiecki	Warsaw University of Technology, Poland

TABLE OF CONTENTS

Foreword	12
Keynote Speaker – Kośmider Tomasz <i>Evolution of Research Structures to Improve Research Management Effectiveness</i>	13
Ahmad Hesham S., Bazlamit Issa M., Ayoush Maha D. <i>Investigation of document management systems in small construction companies in Jordan</i>	14
Alencastroa João, Fuertesa Alba, de Wilde Pieter <i>Delivering energy-efficient social housing: implications of the procurement process</i>	15
Al-Hazima Nabil, Abu Salem Zaydoun, Ahmad Hesham S. <i>Delay and cost overrun in infrastructure projects in Jordan</i>	16
Antosz Katarzyna, Stadnicka Dorota <i>Lean philosophy implementation in SMEs – study results</i>	17
Araszkiewicz Krystyna <i>Application of critical chain management in construction projects schedules in a multi-project environment: a case study</i> ..	18
Awtoniuk Michał, Chochowski Andrzej <i>Compost temperature prediction in a mushroom production process</i>	19
Ayessaki Winn-Yam, Smallwood John <i>Influencing workers' performance through health and safety interventions</i>	20
Baraniecka Anna, Jajko-Siwec Alicja, Szuster Mariusz, Szymczak Maciej, Wieteska Grażyna <i>Relativism in the approach to managing supply chain maturity</i>	21
Barska Anetta, Śnihur Janusz <i>Seniors as a challenge for innovative enterprises</i>	22
Bartkowiak Anna, Bartkowiak Piotr <i>Technical and technological progress in the context of sustainable development of agriculture in Poland</i>	23
Bartkowiak Piotr, Koszel Maciej <i>Forms of relationships among local government units in Polish metropolitan areas</i>	24
Bazlamit Subhi M., Ahmad Hesham S., Obaidat Turki I. <i>Pavement maintenance applications using Geographic Information Systems</i>	25
Biruk Sławomir, Jaśkowski Piotr, Czarnigowska Agata <i>Modelling contractor's bidding decisions</i>	26
Chinda Thanwadee <i>Examination of factors influencing the successful implementation of reverse logistics in the construction industry: pilot study</i> ...	27
Chodakowska Ewa, Nazarko Joanicjusz, Żur Krzysztof Kami: <i>Models evaluating courier and messenger companies in Poland</i>	28
Czech Artur, Lewczuk Jerzy <i>Statistical assessment of the development of the transportation system in chosen countries – an international approach</i> ...	29
Czerewacz-Filipowicz Katarzyna <i>The Russian Federation RTAs in the light of global value chains</i>	30

Daniluk Andrzej <i>Cooperation between business companies and institutions in the context of innovations implementation</i>	31
Deptuła Anna Małgorzata <i>Analysis of criteria used in the risk assessment of technical innovations</i>	32
Dębkowska Katarzyna <i>E-logistics as an element of the business model maturity in enterprises of the TFL sector</i>	33
Dragun Łukasz <i>Prospects and risks of the development of energy production using a combined heat and power system and taking into account the characteristics of the biomass economy</i>	34
Dupont Quentin F. M., Chua David K. H., Tashrif Ahmad, Abbott Ernest L. S. <i>Potential Applications of UAV along the Construction Value Chain</i>	35
Dumrak Jantanee, Baroudi Bassam, Hadjinicolaou Nick <i>Exploring the association between project management knowledge areas and sustainable outcomes</i>	36
Dziekoński Krzysztof <i>Project managers' competencies model for the construction industry in Poland</i>	37
Ejdys Joanna <i>New Silk Road – a weak or a strong signal?</i>	38
Ejsmont Krzysztof <i>Holistic assessment method of intelligent technologies used in production processes</i>	39
Gabryelczyk Renata, Jurczuk Arkadiusz <i>Does experience matter? Factors affecting the understandability of the business process modelling notation</i>	40
Gierej Sylwia <i>The framework of business model in the context of Industrial Internet of Things</i>	41
Ginevičius Romualdas, Gedvilaitė Dainora, Stasiukynas Andrius <i>Assessment of the interrelations between economic and ecological development in regions of Lithuania</i>	42
Ginevičius Romualdas, Ginevičius Tomas, Gedvilaitė Dainora <i>Ranking of office-lease options by multi-criteria methods</i>	43
Golden Bruce, Nossack Jenny, Pesch Erwin, Zhang Rui <i>Routing problems with time dependencies or how different are trash collection or newspaper delivery from street sweeping or winter gritting?</i>	44
Gudanowska Alicja Ewa <i>Modern research trends within technology management in the light of selected publications</i>	45
Gulc Aleksandra <i>Models and methods for measuring the quality of logistic service</i>	46
Gurcanli G. Emre, Turkoglu Harun, Bilir Senem <i>Heavy equipment scheduling for horizontal construction projects</i>	47
Hadjinicolaou Nick, Dumrak Jantanee <i>Investigating association of benefits and barriers in project portfolio management to project success</i>	48
Hajduk Sławomira <i>Bibliometric analysis of publications on city logistics in international scientific literature</i>	49

Halicka Katarzyna	
<i>Main concepts of technology analysis in the light of the literature on the subject</i>	50
Jarocka Marta, Glińska Ewa	
<i>The state and prospects for the development of railway transport infrastructure in Eastern Poland – secondary data analysis ..</i>	51
Jędrzejczak-Gas Janina	
<i>Net working capital management strategies in the construction enterprises listed on the NewConnect market</i>	52
Jin Xiaohua, Zhang Guomin, Liu Junxiao, Feng Yingbin, Zuo Jian	
<i>Major participants in the construction industry and their approaches to risks: a theoretical framework</i>	53
Kikolski Mateusz	
<i>Study of production scenarios with the use of simulation models.....</i>	54
Ko Chien-Ho	
<i>Lean building design model</i>	55
Korponai János, Bányainé Tóth Ágota, Illés Béla	
<i>Effect of the safety stock on the probability of occurrence of stock shortage</i>	56
Kozłowska Justyna	
<i>Services in the machinery manufacturing sector in Poland</i>	57
Krawczyk-Dembicka Elżbieta	
<i>Analysis of technology management using the example of the production enterprise from the SME sector</i>	58
Krawczyńska-Piechna Anna	
<i>Comprehensive approach to efficient planning of formwork utilization on the construction site.....</i>	59
Krystosiak Krzysztof	
<i>Prediction method for winding parameters in label converting process with data mining tools.....</i>	60
Lipiak Jan	
<i>Methodology for assessing the factors affecting the quality and efficiency of flexographic printing process</i>	61
Łaska Grażyna	
<i>Wind energy and multi-criteria analysis in making decisions on the location of wind farms.....</i>	62
Magruk Andrzej	
<i>Phenomenon of uncertainty in the process of holistic anticipation of non-deterministic reality</i>	63
Maksymiuk Przemysław, Krupicz Bazyli, Krupicz Paweł	
<i>Plasticity of flat bars in platform gratings</i>	64
Matwiejczuk Wiesław, Matwiejczuk Tomasz, Michna Anna	
<i>Organisational and legal barriers in shaping the final value of construction contracts</i>	65
Mrugalska Beata, Wyrwicka Magdalena Krystyna	
<i>Towards Lean Production in Industry 4.0</i>	66
Nazarko Joanicjusz, Kuźmicz Katarzyna Anna	
<i>Introduction to the STEEPVL analysis of the New Silk Road initiative</i>	67
Nazarko Łukasz	
<i>Future-Oriented Technology Assessment.....</i>	68
Niazi Ghulam Abbas, Painting Noel	
<i>Significant factors causing cost overruns in the construction industry in Afghanistan</i>	69

Olszewska Anna Małgorzata <i>Research issues undertaken within quality management – the overview of selected literature and a knowledge map</i>	70
Orłowski Cezary, Ziółkowski Artur, Paciorekiewicz Grzegorz <i>Quantitative assessment of the IT agile transformation</i>	71
Orynycz Olga <i>Influence of tillage technology on the energy efficiency of a rapeseed plantation</i>	72
Panfiluk Eugenia <i>Analysis of the effectiveness the European Regional Development Fund disbursement for the selected tourism services with the use of the counterfactual method</i>	73
Panuwatwanicha Kriengsak, Nguyenb Thanh Tung <i>Influence of Total Quality Management on the performance of Vietnamese construction firms</i>	74
Pawlak Andrzej <i>The Ecosystem for Niche Technology Innovation</i>	75
Peng Le, Chua David K. H. <i>Decision support for mobile crane lifting plan with Building Information Modelling (BIM)</i>	76
Piechoczek Eugeniusz, Kaźmierczak Jan, Jafernik Henryk <i>Modelling the use of alternative technical means for services by piloted flying platforms: presentation of a research project</i>	77
Pimchangthong Daranee, Boonjing Veera <i>Effects of risk management practice on the success of IT projects</i>	78
Poterska Beata <i>Decision support system in the area of generating innovative research projects of the future</i>	79
Rakowski Waldemar Jan <i>Wavelet approach to damage detection of mechanical systems and structures</i>	80
Ratnayake R.M. Chandima, Antosz Katarzyna <i>Development of a risk matrix and extending the risk-based maintenance analysis with fuzzy logic</i>	81
Redutskiy Yury <i>Modelling and design of Safety Instrumented Systems for upstream processes of petroleum sector</i>	82
Rewers Paulina, Hamrol Adam, Żywicki Krzysztof, Bożek Mariusz, Kulus Wojciech <i>Production levelling as an effective method for production flow control – experience of Polish enterprises</i>	83
Ryciuk Urszula <i>Identification of factors related to trust formation in construction supply chains</i>	84
Sacio-Szymańska Anna, Kononiuk Anna, Tommei Stefano <i>Mobilizing corporate foresight potential among V4 countries – assumptions, rationales, and the methodology</i>	85
Siderska Julia <i>Neural model for assessing the value of social capital</i>	86
Sofuoğlu Mehmet Alper, Gürgen Selim, Çakır Fatih Hayati, Orak Sezan <i>Springback behaviour of AA6082T6 tubes in the three-point bending operation</i>	87
Snyman Tamlyn, Smallwood John <i>Improving productivity in the business of construction</i>	88

Stadnicka Dorota, Ratnayake R.M. Chandima <i>Enhancing aircraft maintenance services: a VSM-based case study</i>	89
Stepaniuk Krzysztof <i>Quality of accommodation services. The memetic approach</i>	90
Szafrański Maciej <i>Problem of language used to describe competences in the management of acceleration in the creation of knowledge resources in businesses</i>	91
Szymańska Elżbieta <i>User-Driven Innovation – the concept and research results</i>	92
Tomaszuk Anna <i>Importance of technological factors in the creation of cooperation</i>	93
Tomczak-Horyń Kamila, Knosala Ryszard <i>Evaluation of employee creativity as a stimulator of company development</i>	94
Tuan Nien-Tsu <i>Interpretive structural modelling in action – a preliminary exploration of AIDS pandemic in South Africa</i>	95
Urban Wiesław <i>System of amoebas as a remedy for employee engagement deficits – a conceptual deliberation</i>	96
Ustinovichius Leonas, Komarovska Andželika, Komarovski Robert <i>Methods of determining the region's investment strategy</i>	97
Wasiak Andrzej Leonard <i>Effect of biofuel production on sustainability of agriculture</i>	98
Wasilewska Barbara <i>System for stimulating the technical problem solutions</i>	99
Wasiluk Anna <i>Pro-innovative prerequisites for establishing the cooperation between companies (in the perspective of creation and development of clusters)</i>	100
Wirkus Marek, Kukułka Alicja <i>Evaluation of batch production processes based on seven criterions</i>	101
Wirkus Marek, Kukułka Alicja <i>Issues of measuring the course of batch production processes</i>	102
Wyrwa Joanna, Barska Anett: <i>Packaging as a source of information about food products</i>	103
Wyrwicka Magdalena Krystyna, Mrugalska Beata <i>Mirages of lean manufacturing in practice</i>	104

Foreword

On behalf of the Organising Committee, I am honoured to welcome you to the 7th International Conference on Engineering, Project, and Production Management (EPPM2016).

The EPPM2016 conference is interdisciplinary in nature and will be an excellent opportunity again to share unique knowledge at the interface of social sciences and engineering. I hope, this meeting will be an important and attractive scientific event which will bring a great opportunity to meet colleagues, exchange knowledge and experience as well as participate in productive discussions.

The book of abstracts comprises 91 papers that have been carefully selected on the basis of a double-blind review process. The articles present both the theoretical and practical examples of solving the problems that often are of an interdisciplinary nature. The authors of this year's conference have conducted theoretical discussions, data analysis, case studies, and industrial practices. Important problems from the perspectives of project and process management, service science and engineering as well as logistics and supply chain management have been widely discussed in the research papers. Also issues of quality, technology management, foresight, operational management and agricultural engineering have not been overlooked by the authors.

The EPPM2016 conference is proudly hosted by the Faculty of Management, Bialystok University of Technology in cooperation with the Association of Engineering, Project, and Production Management, the Polish Academy of Sciences' Committee on Production Engineering, the International Society for Manufacturing, Service and Management Engineering and the Agency for Restructuring and Modernisation of Agriculture.

On behalf of the conference hosts, I would like to thank sincerely to the Conference and Scientific Chairs, the members of the International Scientific Committee, the members of the Organising Committee, the Keynote Speaker and all the Authors for their effort and support. Your involvement is an excellent example of cooperation in an interdisciplinary team, which makes this conference successful.

I hope you will enjoy your time at our conference!

Editor of the *Book of Abstracts* – EPPM2016



KEYNOTE SPEAKER:

Tomasz Kośmider, PhD, MBA (INSEAD)^a

^aTECHNOLOGY PARTNERS Foundation, Pawinskiego 5A, 02-106 Warszawa, Poland

Evolution of Research Structures to Improve Research Management Effectiveness

Abstract: Research increasingly involves the co-operation of numerous research centres. There is a very noticeable trend of the use of new organisational solutions for such co-operation. Recently, this has led to different initiatives to create Advanced Technology Centres, Centres of Excellence, Technology Platforms, etc. operating on a regional, national, European and world wide scale. The initiatives carried out to date within these frameworks are perceived as easy to create, ambitious in their objectives, and apparently offering a highly diminished level of risk.

In view of the size and complexity of these structures, it is obvious that not all members possess equal levels of R&D management experience and skills. This constitutes a significant threat to their efficient functioning and achievement of foreseen results. The performance of research is also burdened with a high degree of risk of not achieving the original aims. The new structures have thus brought with them a new type of uncertainty and risk in R&D management.

The presentation proposes an approach for building a strong R&D network structure and an operation model for maximising its effectiveness in performing innovation processes and minimizing the risks and threats.

Investigation of document management systems in small construction companies in Jordan

Hesham S. Ahmad^a, Issa M. Bazlamit^a, Maha D. Ayoush^a

^aAl-Zaytoonah University of Jordan, P.O. Box: 130 Amman 11733 Jordan, Web-site: www.zuj.edu.jo, email: h.ahmad@zuj.edu.jo

Abstract: For successful management of construction projects and organisations, it is crucial to adopt effective management systems that can handle various information and documents of project activities. A Document Management System (DMS) is a system used to store, control, coordinate, process and/or retrieve documents whether electronic or paper-based.

Most of the contractors in Jordan are small companies. Besides, many large contractors tend to assign small companies as subcontractors to carry out projects. This makes the study of small contracting companies very important for the construction industry. However, small contracting companies may lack proper systems for document management that may negatively affect the management of construction projects.

This research aims to investigate the existing electronic and paper-based DMSs in a sample of small contracting companies in Jordan. Interviews and a questionnaire survey with contractors, contractor representatives, and practitioners of DMSs in a number of small contracting companies were carried out to investigate and evaluate the components, processes, motivations and challenges of the existing and intended DMSs. Electronic formats of documents and files used in small contracting companies will be investigated as well.

The results of this research can help contracting companies to enhance their DMSs, and improve the efficiency and performance of the processes pertaining to the management of construction projects.

Keywords: construction project management; document management system; interviews; questionnaire survey; small contracting companies.

References

- [1] Aurelia P, Ana T. *A Document Management System Modeling*. Oradea: Ann. Univ. 2008;17(4):1484–1489.
- [2] Björk BC. Electronic document management in construction – research issues and results. *Itcon* 2002;8:105–117.
- [3] Hola B, Sawicki M. Tacit knowledge contained in construction enterprise documents. *Procedia Engineering* 2014;85:231–239.
- [4] Tserng HP, Lin YC. Developing an activity-based knowledge management system for contractors. *Autom. Constr.* 2004;13(6):781–802.
- [5] Carrillo P, Robinson H, Al-Ghassani A, Anumba C. Knowledge management in UK construction: strategies, resources and barriers. *Proj. Manag. J.* 2004;35(1):46–56.
- [6] Ahmad H, An M. Knowledge management implementation in construction projects: a KM model for Knowledge Creation, Collection and Updating (KCCU). *J. Proj. Organ. Manag.* 2008;1(2):133–166.
- [7] Egbu C. Managing knowledge and intellectual capital for improved organizational innovations in the construction industry: an examination of critical success factors. *Eng. Constr. Archit. Manag.* 2004;11(5):301–315.
- [8] Gupta B, Iyer L, Aronson J. Knowledge management: practices and challenges. *Ind. Manag. Data Syst.* 2000;100(1):17–21.
- [9] Bryman A, Bell E. *Business research methods*. 4th ed. New York: Oxford University Press Inc.; 2015.

Delivering energy-efficient social housing: implications of the procurement process

João Alencastro^a, Alba Fuentas^a, Pieter de Wilde^a

^aEnvironmental Building Group, Plymouth University, Drake Circus, Plymouth, PL4 8TB, United Kingdom, e-mail: joao.ulrichdealencastro@plymouth.ac.uk

Abstract: The construction industry is often considered to perform poorly in terms of the quality of the products delivered when compared to other industries. However, developing and implementing quality management systems in construction is particularly difficult because of a lack of standardization, the intensive use of manual labour and the many parties involved. This paper explores the challenges faced by social housing providers in the UK when implementing quality assurance procedures in their effort to provide their tenants with energy-efficient homes. In particular, it focuses on the quality assurance procedures defined in the early stages of a project, at the procurement phase, and their impact during the construction process and on the ultimate building energy efficiency. Based on data collected from the project team and project documentation, a comparative analysis of the procurement process of two social housing developments in the UK is presented. The results of the study show that despite the two case studies pertaining to the same housing association, they followed different quality management approaches to deliver energy efficient dwellings. The most significant discrepancies were found with regards to the definition of energy performance targets, detailed quality assurance procedures and milestones for testing performance. The contribution of this paper is to create awareness of the importance of defining Quality Assurance Programs with a focus on energy performance from the early stages of a project.

Keywords: building energy performance, construction industry, defects, procurement, quality management, social housing.

References

- [1] NEF, *Insights from Social Housing Projects – Building Performance Evaluation Meta-Analysis*. Executive Report Innovate UK. National Energy Foundation; 2016.
- [2] Hansford P. *Solid Wall Insulation – Unlocking Demand and Driving Up Standards*. Green Construction Board and Government. HM Government; 2015.
- [3] Johnston D, Miles-Shenton D, Farmer D. Quantifying the domestic building fabric 'performance gap'. *Building Services Engineering Research and Technology* 2015;36(5):614–627.
- [4] Zero Carbon Hub, *Closing the gap between design and as-built performance, End of term report*. London: Zero Carbon Hub; 2014.
- [5] BSI, BS 8534:2011 Construction procurement policies, strategies and procedures – Code of practice; 2011.
- [6] Oyegoke AS, Dickinson M, Khalfan MM, McDermott P, Rowlinson S. Construction project procurement routes: an in-depth critique. *International Journal of Managing Projects in Business* 2009;2:338–354.
- [7] Naoum S, Egbu C. Critical Review of Procurement Method Research in Construction Journals. *Procedia Economics and Finance* 2015;21:6–13.
- [8] ISO, BS ISO 10845–1:2010 Construction procurement, Part 1: Processes, methods and procedures, 2011.
- [9] OGC, *Procurement and contract strategies. Achieving Excellence in Construction Procurement Guide 06*, Available online: <http://webarchive.nationalarchives.gov.uk/20100503135839/http://www.ogc.gov.uk/documents/CP0066AEGuide6.pdf>, 2007.
- [10] Hoonakker P, Carayon P, Loushine T. Barriers and benefits of quality management in the construction industry: An empirical study. *Total Qual Manag Bus*. 2010;21:953–969.

Delay and cost overrun in infrastructure projects in Jordan

Nabil Al-Hazim^a, Zaydoun Abu Salem^a, Hesham S. Ahmad^a

^aDepartment of Civil and Infrastructure Engineering, Al-Zaytoonah University of Jordan, Amman, Jordan, P.O. Box: 130 Amman 11733 Jordan,
e-mail: h.ahmad@zu.edu.jo

Abstract: The aim of this study is to investigate the factors that may cause overrun of the planned cost, allocated resources and scheduled time of infrastructure engineering projects in Jordan. A delay in project processes and completion as well as cost overrun can cause critical problems to several parties to the project such as the contractor, the employer, and the subcontractors. A cost overrun can be defined as the difference between the actual cost at the project completion and the originally estimated cost provided in the project contract. A delay of project completion and cost overrun in addition to the quality of final products and customer satisfaction are considered as major parameters, which determine the success of the project.

To achieve the goal of this study, final reports of a sample of 40 public infrastructure projects implemented during the period from 2000 to 2008 were collected and analysed. The final reports were collected from the Ministry of Public Works and Housing (MPWH) of Jordan, which administers the public infrastructure projects in the capital Amman.

The results of this study can help engineers to avoid delay and cost overrun in future infrastructure projects by improving planning and scheduling processes and adopting contingency plans for probable problems.

The analysis showed that delay and cost overrun of infrastructure projects were caused by 20 factors according to the records in the collected final reports of projects. The results showed that Terrain and Weather conditions are the top factors causing completion delay and cost overrun in infrastructure projects in Jordan.

Keywords: project management; infrastructure projects; delay and cost overrun; planning and scheduling.

References

- [1] Mahamid I. Cost overrun causes in infrastructure projects, "consultants perspective". 2nd International conference on construction and project management. Singapore, IPEDR. 2011.
- [2] Mahamid I. Common risks affecting time overrun in road projects in Palestine: Contractors' perspective. *Australasian Journal of Construction Economics and Building* 2013;13(2):45–53.
- [3] Alhomidan A. Factors affecting cost overrun in infrastructure projects in Saudi Arabia. *International Journal of Civil & Environmental Engineering* 2010;13(3).
- [4] Chan DW, Kumaraswamy MM. A comparative study of causes of time overruns in Hong Kong construction projects. *International Journal of Project Management* 1997;15(1):55–63.
- [5] Singh R. *Cost and time overruns in infrastructure projects: extent, causes and remedies*, org. Available online: <http://www.econdse.org/faculty/ram/ram.htm>.
- [6] Alghbari W, Kadir M, Salim A, Ernawati. The significant factors causing delay of building construction projects in Malaysia. *Journal of Engineering, Construction and Architectural Management* 2007;14(2):192–206.
- [7] Sambasivan M, Soon Y. Causes and effects of delays in Malaysian construction industry. *International Journal of Project Management* 2007;25(5):517–526.
- [8] Rathi AS, Khandve PV. Study of Factors Influencing Cost Overruns. *International Journal of Science and Research (IJSR)* 2016;5(3):334–336.
- [9] Vidalis SM, Najafi FT. Cost and time overrun in highway construction. 4th transportation specialty conference of the Canadian society for civil engineering. Canada. 2002.
- [10] Amandin MM, Kule JW. Project Delays on Cost Overrun Risks: A Study of Gasabo District Construction Projects Kigali, Rwanda. *ABC Journal of Advanced Research* 2016;5(1):21–34.
- [11] Al-Momani A. Construction delay: A quantitative analysis. *International Journal of Project Management*. 2000;18(1):51–59.

Lean philosophy implementation in SMEs – study results

Katarzyna Antosz^a, Dorota Stadnicka^a

^aRzeszow University of Technology, Al. Powstancow Warszawy 12, 35–959 Rzeszow, Poland, e-mail: katarzyna.antosz@prz.edu.pl; dsktmiop@prz.edu.pl

Abstract: The Lean Manufacturing (LM) philosophy is applied in different kinds of companies and their branches. LM uses many methods. Several enterprises, in order to minimize costs, use poor quality materials or overload workers with work. They do not realize other possibilities for the improvement of enterprise effectiveness. They are also troubled by the unknown. This problem is particular to many cases related to the LM concept. This paper shows the results of the study carried out in SMEs from different branches in the Podkarpackie Voivodship (Poland). The way of the LM system application by the enterprises was studied. The results show that many SMEs are eager to implement the LM philosophy.

Keywords: Lean Manufacturing; SME enterprises; wastes elimination.

References

- [1] Horbal R, Kagan R, Koch T, Sobczyk T. Minione 10 lat ruchu Lean Management w Polsce, wnioski i perspektywy [Last 10 years of Lean in Poland. Conclusions and perspectives]. Conference materials Lean Management, Wroclaw 2010.
- [2] Doolen TL, Hacker ME. A Review of Lean Assessment in Organizations: An Exploratory Study of Lean Practices by Electronics Manufacturers. *J Manuf Sys* 2005;24:55–67.
- [3] Basl J, Sasiadek M. Analysis of the lean IT penetration in selected Czech and Polish companies. *WAS '14 Proceedings of the 16th International Conference on Information Integration and Web-based Applications & Services* 2014;537–541.
- [4] Manoj D, Kumar M, Gellynck X. Determinants and barriers to lean implementation in food-processing SMEs – a multiple case analysis. *Prod Plann & Con: The Manag Op* 2016;27:1–23.
- [5] Dora M, Kumar M, Van Goubergen D, Molnar A, Gellynck X. Operational performance and critical success factors of lean manufacturing In European food processing SMEs. *Trends in Food Sci & Tech* 2013;31:156–164.
- [6] Pérez MP, Sánchez AM. Lean production and supplier relations: a survey of practices in the Aragonese automotive industry. *Technovation* 2000;20:665–676.
- [7] Eswaramoorthi M, Kathiresan G. R., Prasad P. S. S., Mohanram P. V. A survey on lean practices in Indian machine tool industries. *Int J Adv Manuf Tech* 2011;52:1091–1101.
- [8] Stadnicka D, Antosz K. Lean in Large Enterprises: Study Results. *W Acad of Sci, Eng and Tech* 2013; 82:31–37.
- [9] Piasecka-Głuszak A. Skuteczność działań lean w polskich przedsiębiorstwach – wybrane aspekty rozwiązań przy zachowaniu ducha kaizen. Badania empiryczne [Effectiveness of lean actions in Polish companies – selected aspects of solutions in the spirit of kaizen. Empirical research]. *Int Bus and Glob Econ* 2014;33:595–608.
- [10] Bednarek M, Buczaccki A. Lean Manufacturing (LM) Practical Application in a Selected Polish Company. *EiOP* 2014;11:100–110.

Application of critical chain management in construction projects schedules in a multi-project environment: a case study

Krystyna Araszkievicz^a

^a Faculty of Civil Engineering and Architecture, West Pomeranian University of Technology Szczecin, Al. Piastow 50, 70–311 Szczecin, Poland,
e-mail: Krystyna.Araszkievicz@zut.edu.pl

Abstract: The issue of project portfolio management is related to detailed questions, such as resource management or pipeline management. Were the critical chain project management derived from the theory of constraints to be employed in a multi-project environment, it might provide a solution to the problems arising from resource overload and conflicts in the access to the critical resource. Indeed, the established mechanism for resolving conflicts in the access to the critical resource allows for the synchronization of the timetables of the projects, thus significantly reducing the risk of delays and the necessity to properly address them by means of costly corrective measures. The aim of this paper is to present the results of a comparative analysis of the application of the critical chain project management and traditional scheduling established according to the critical path method for the programme of the construction of several marinas in the area of north-western Poland. The scope of the analysis herein extends first and foremost to the possibility of shortening the implementation cycle of projects planned under the examined investment programme and reduction of conflicts in the access to resources. The obtained results are of importance as regards their possible application by building contractors or investors. Besides, they might be useful for further research connected with the effective management of a set of projects.

Keywords: critical chain; construction project; resource constrained project scheduling; multi – project environment.

References

- [1] *The Standard for Portfolio Management*. Project Management Institute Inc.; 2013.
- [2] Trocki M. *Nowoczesne zarządzanie projektami [Modern project management]*. Warszawa: PWE; 2012.
- [3] Marcińczyk B, Skołod B. Harmonogramowanie z ograniczeniami projektów współbieżnych [Resource – constrained multi project scheduling]. In: Knosala R. editor. *Innowacje w zarządzaniu i inżynierii produkcji [Innovations in management and production engineering]*. Opole: Oficyna Wyd. PTZP; 2012, p. 421–432.
- [4] Hashim NI, Chileshe N, Baroudi B. Management challenges within multiple project environments: lessons for developing countries. *Australasian J. of Construction Economics and Building Conference Series* 2012;1(2):21–31.
- [5] Sonta-Drączkowska E. *Zarządzanie wieloma projektami [Multi project management]*. Warszawa: PWE; 2012.
- [6] Thiry M. Managing Portfolios of Projects. In: Morris P, Pinto J, editors. *Gower Handbook of Project Management*, Aldershot: Gower Publishing; 2006.
- [7] Martinsuo M, Lehtonen P. Role of Single-project Management in Achieving Portfolio Management Efficiency. *Int. Journal of Project Management* 2007;25:56–65.
- [8] Kozarkiewicz A. *Zarządzanie portfelami projektów [Project portfolio management]*. Warszawa: PWN; 2012.
- [9] Ponsteen A, Kusters RJ. Classification of Human- and Automated Resource Allocation Approaches in Multi-Project Management. *Procedia – Social and Behavioral Sciences* 2015;194:165–173.
- [10] Engwall M, Jerbrandt A. The resource allocation syndrome: the prime challenge of multi – project management? *Int. Journal of Project Management* 2003;21:403–409.

Compost temperature prediction in a mushroom production process

Michał Awtoniuk^a, Andrzej Chochowski

^aFaculty of Production Engineering, Warsaw University of Life Sciences, Nowoursynowska 166, 02-787 Warsaw, Poland, email: michal_awtoniuk@sggw.pl

Abstract: Mushrooms production process requires controlling of the microclimate conditions. There are four major microclimate factors: air temperature, air relative humidity, compost temperature, and carbon dioxide concentration. These microclimate factors have to be controlled in a programmable way during cultivation. In addition, all factors are connected each other in the way that one influences the other. There is a need to use multidimensional control system to maintain the microclimate conditions. Synthesis of such a control system requires preparing a model that describes all the signals interactions during cultivation. In this paper we focus only on compost temperature prediction. This was the major aim of this paper.

We model the microclimate by means of parametric identification. We divide whole cultivation process into three different, characteristic, stages. After that we prepare one model for each stage. We evaluate model fitness to measured data by the fit indicator. To analyse dynamics of microclimate we transform the parametric models to transfer functions. The final step was to compare changes of model coefficients among three stages.

Our research shows there are strong variations in model coefficients between different stages. It indicates that the microclimate in mushroom production, understood as control object, is a nonstationary system.

Keywords: modeling, identification, ARX, microclimate, mushroom.

References

- [1] Gaohong Y, Jianmin L, Zhao Y. Region marking technique based on sequential scan and segmentation method of mushroom images. *Trans. CSAE*. 2006;22:139–142.
- [2] Gapiński M, Gnus R. Influence of the harvesting method of mushrooms (*Agaricus bisporus* (Lange) Sing.) grown on a phase four substrate on their yield. Part I. Size of yield. *Sci. Nat. Technol.* 2012;6.
- [3] Gapiński M, Gnus R. Influence of the harvesting method of mushrooms (*Agaricus bisporus* (Lange) Sing.) grown on a phase four substrate on their yield. Part II. Yield quality. *Sci. Nat. Technol.* 2012;6.
- [4] Gaze R. The large world of global mushrooms. *Mushroom J.* 2005;670:11–13.
- [5] Jarvis R. Sensor-based robotic automation of mushroom farming — Preliminary considerations. In: Sattar A, editor. *Advanced Topics in Artificial Intelligence*, Berlin Heidelberg : Springer; 1997, p. 446–455.
- [6] Koc G, Rak J, Gąsiorowska B, Radzka E, Jankowska J, Hydrożele w uprawie pieczarki dwuzarodnikowej [Hydrogels in cultivation of *Agaricus bisporus*]. *Infrastruct. Ecol. Rural Areas*. 2011;6:195–204.
- [7] Nosecka B. *Market Analysis*. Warszawa; 2015.
- [8] Panesar PS, Marwaha SS. *Biotechnology in Agriculture and Food Processing Opportunities and Challenges*. Boca Raton: CRC Press; 2014.
- [9] Reed JN, Tillett RD. Initial experiments in robotic mushroom harvesting. *Mechatron.* 1994;4:265–279.
- [10] Stążczek P, Plaska S. Identification of dynamic properties of reheating unit for PET preforms in stretch blow moulding machines. *Arch. Mech. Technol. Autom.* 2010; 30:169–174.
- [11] Stążczek P, Plaska S. Automated control of the preform reheating process in the manufacturing of poly(ethylene terephthalate) containers. Part II. Identification of the dynamical properties of controlled object. *Polimery*. 2013; 58:121–126.
- [12] Szarek S, Koc G. Uwarunkowania ekonomiczne produkcji pieczarek w Polsce [Economic Conditions of Mushroom Production in Poland]. *Zagadnienia Ekon. Rolnej*. 2011;3:178–187.
- [13] Szarek S, Koc G. Efektywność intensyfikacji produkcji pieczarek w warunkach produkcji towarowej w Polsce [Increasing Commercial Mushroom Production Efficiency in Poland]. *Ann. Pol. Assoc. Agric. Agribus. Econ.* 2012;14(1):519–523.
- [14] Vetter J. Chemical composition of fresh and conserved *Agaricus bisporus* mushroom. *Eur. Food Res. Technol.* 2003;217:10–12.
- [15] Wachowicz E. Application of fuzzy sets in microclimate control in agricultural buildings. *Agric. Eng.* 2011;6:265–270.
- [16] Wachowicz E, Grudziński P. Adaptive control for selected class of agricultural engineering processes. *Agric. Eng.* 2008;11:247–254.

Influencing workers' performance through health and safety interventions

Winn-Yam Ayessaki^a, John Smallwood^a

^aNelson Mandela Metropolitan University, Port Elizabeth, 6001, South Africa, e-mail: john.smallwood@nmmu.ac.za

Abstract: Optimum worker performance is required to achieve project delivery within project parameters. However, construction workers are regularly exposed to hazards, involved in accidents, their productivity is poor, suffer from ill health and work-related musculoskeletal disorders (WMSDs), and contractors lack resources to allocate towards H&S. However, the lack or the absence of health and safety (H&S) measures, which the aforementioned depend upon, has a negative impact on workers' performance. A study was conducted among registered construction project managers (CPMs) and general contractor (GC) members of an employers association to determine whether CPMs can and do influence workers' performance through H&S interventions. The salient findings include that CPMs do influence workers' performance through H&S and related interventions during the design, procurement, and construction processes, however, there is potential to enhance such influence. Therefore, it can be concluded that CPMs have a major role to play in terms of influencing worker performance through H&S interventions. Recommendations include that CPMs should raise client awareness with respect to worker H&S and welfare facilities; optimise client contributions to H&S; improve communication channels between project stakeholders, and promote H&S training on projects.

Keywords: construction; health and safety; performance; project managers; workers.

References

- [1] Agapiou A, Price ADF, McCaffer R. Planning future construction skill requirements: understanding labour resource issues. *Construction Management and Economics* 1995;13:149–161.
- [2] Kalsum U. Assessing the performance of construction workers in Peninsula Malaysia. *International Journal of Engineering and Technology* 2010;7(2):47–60.
- [3] Rowlinson SM, Walker A. *The Construction Industry in Hong Kong*. Hong Kong: Longman; 1995.
- [4] Ameh OJ, Shokumbi BB. Effectiveness of Non-Financial Motivational Scheme on Construction Workers' Output in Nigeria. *Ethiopian Journal of Environmental Studies and Management* 2013;6(3):263–272.
- [5] Mee-Edoioye M, Andawei MM. Motivation, an alternative to improve workers' performance in today's construction industry. *The Quantity Surveyor* 2002;40(3):2–6.
- [6] Allmon E, Haas CT, Borcherding JD, Goodrum PM. U.S. construction labour productivity trends, 1970–1998. *Journal of Construction Engineering and Management* 2000;126:97–104.
- [7] Pekuri A, Haapasalo H, Herrala M. Productivity and performance management – Managerial practices in the construction industry. *International Journal of Performance Measurement* 2011;1(1):39–58.
- [8] Tangen S. Demystifying productivity and performance. *International Journal of Productivity and Performance Management* 2005;54(1):34–46.
- [9] Khosravi Y, Asilian-Mahadi H, Hajizadeh E, Hassanzadeh-Rangi N, Bastami H, Behzadan AH. Factors influencing unsafe behaviors and accidents on construction sites: a review. *International Journal of Occupational Safety and Ergonomics*. 2014;20(1):111–125.
- [10] Smallwood JJ, Venter DJL. The influence of project managers (PMs) on construction health and safety (H&S) in South Africa. *The Australian Journal of Construction Economics and Building* 2002;2(1):57–69.

Relativism in the approach to managing supply chain maturity

Anna Baraniecka^a, Alicja Jajko-Siwiek^b, Mariusz Szuster^c, Maciej Szymczak^c, Grażyna Wieteska^d

^aFaculty of Economics, Management and Tourism, Wrocław University of Economics, Nowowiejska 3, 58–500 Jelenia Góra, Poland

^bFaculty of Economics, Poznań University of Economics, Al. Niepodległości 10, 61–875 Poznań, Poland

^cFaculty of International Business and Economics, Poznań University of Economics, Al. Niepodległości 10, 61–875 Poznań, Poland,
e-mail: maciej.szymczak@ue.poznan.pl

^dFaculty of Management, University of Łódź, Matejki 22/26, 90–237 Łódź, Poland

Abstract: Over the past 30 years, a number of models supporting assessment processes and development of supply chains have emerged. Such models make it possible to analyse the existing state of processes in the supply chain and represent a source of guidance for streamlining these processes.

From a methodological point of view, clear assignment of a certain level of maturity to a given supply chain can be a real challenge when only part of the criteria for classification is fulfilled. The main scientific purpose of the paper is to propose an advanced statistical non-classical method as an approach to interpreting data from research projects on the supply chain maturity. The method of classification trees has been used and presented in this paper as a tool to achieve reasonable and valuable findings. Classification trees have been used in the assessment of supply chain maturity according to the most popularized model, which is the Poirier model. The authors surveyed 426 business entities and their supply chains. Based on a number of variables, they have been categorized into different levels of maturity giving accurate results.

The procedure of non-classical statistical analysis of the supply chain maturity level in conjunction with a variety of variables is intended to standardize the inference on the maturity of supply chains, which can contribute to increasing the popularity of maturity models, and hence also the very concept of supply chain management. This forms the value and implications of the paper to supply chain management theory and practice.

Keywords: supply chain management; supply chain maturity; supply chain maturity assessment; classification trees in supply chain maturity assessment.

References

- [1] Simchi-Levi S, Kaminsky P, Simchi-Levi E. *Designing and Managing the Supply Chain Concepts. Strategies and Case Studies*. Boston: McGraw-Hill/Irwin; 2000.
- [2] Poirier ChC. *Advanced Supply Chain Management*. San Francisco: Berrett-Koehler Publisher; 1999.
- [3] Poirier ChC, Quinn FJ. How are we doing – A survey of supply chain progress. *Supply Chain Management Review* 2004;8:24–31.
- [4] Witkowski J. *Zarządzanie łańcuchem dostaw. Koncepcje, procedury, doświadczenia [Supply Chain Management: Concepts, Procedures, Experiences]*. Warszawa: PWE; 2003.
- [5] Valaderes de Oliveira MP, Ladeira MB, McCormack KP. The supply chain process management maturity model – SCPM3. In: Önkal D, Aktas E, editors. *Supply Chain Management – Pathways for Research and Practice*. Rijeka: InTech; 2011, p. 201–218.
- [6] Lockamy III A, McCormack KP. Development of a supply chain management process maturity model. *Supply Chain Management: An International Journal* 2004;4:272–278.
- [7] Baraniecka A, Rodawski B. Model of supply chain management proficiency (1). *Pharma Poland News* 2007;8.
- [8] Tohamy N, Davis M. *Introducing the Five-Stage Demand-Driven Maturity Model for Supply Chain Leaders*. Gartner, Inc.; 2013.
- [9] Akkermans H, Bogerd P, Vos B. Virtuous and vicious cycles on the road toward international supply chain management. *International Journal of Operations and Production Management* 1999;5/6:565–581.
- [10] Breiman L, Friedman JH, Olshen RA, Stone CJ. *Classification and Regression Trees*. New York: Chapman & Hall; 1984.

Seniors as a challenge for innovative enterprises

Anetta Barska^a, Janusz Śnihur^a

^aFaculty of Economics and Management, University of Zielona Góra, Podgorna 50, 65–246 Zielona Góra, Poland, e-mail: A.Barska@wez.uz.zgora.pl

Abstract: Purpose: The segment of the seniors is constantly growing. The segment has specific needs and expectations towards offers made to them. Nowadays, a challenge for business is to create appropriate instruments of influence directed towards this market segment. The needs of this segment must be identified to adjust offers making sure they contain innovative solutions. The aim of this study is to discuss challenges a business faces in the development of the segment of the seniors.

Methodology: The research emerged from the deeper studies into the national and foreign literature. Frequency analysis allowed to reinforce theoretical deliberations and assess available research in the field of innovations for the seniors. Identification of the attitudes and expectations of the seniors towards innovation required a survey. It was conducted in a group of 345 respondents over the age of 55, using the questionnaire developed by the authors. Lubuskie Voivodship was chosen for the research. The main goal of field research was to study attitudes and behaviours of the seniors towards innovations. Before the commencement of the research, a pilot research was carried out, which enabled the verification of the measurement tool and eliminated potential irregularities.

Results: The focus on the segment of the seniors will ensure producers and contractors with the development of products for the elderly as well as the use of new technologies. The research proved that contrary to stereotypical opinions, the researched seniors from Lubuskie Voivodship have a positive attitude towards innovations, especially the market of food products. Every fourth respondent claimed that he/she is knowledgeable about market novelties.

Practical implications: The research constitute a significant cognitive material, and the resulting knowledge can serve as a basis for the formulation of marketing strategies by entrepreneurs working in the silver sector.

Keywords: innovation; demographic transformations; senior; silver economy.

References

- [1] Ahtonen A. Healthy and active ageing: turning the 'silver' economy into gold. European Policy Centre, Policy Brief. 2012.
- [2] Barska A, Śnihur J. Innowacje w służbie srebrnej gospodarki [Innovations in the service of silver economy]. IX Kongres Ekonomistów Polskich, Warszawa; 2013.
- [3] Beard JR, Petitot C. Ageing and Urbanization: Can Cities be Designed to Foster Active Ageing? *Public Health Reviews* 2010;32:427–50.
- [4] Eitner C, Enste P, Naegle G, Leve V. The discovery and development of the silver market in Germany, In: Kohlbacher F, Herstatt C, edited. *The silver market phenomenon. Marketing and innovation in the aging society*. 2nd ed. Heidelberg: Springer; 2011, p. 309–320, 325–339.
- [5] Ejdys J. Prospective Quality Attributes Of Nursing Home Care Services. *The 9th International Scientific Conference Business and Management 2016: Conference Proceedings*; Vilnius; 2016. doi: 10.3846/bm.2016.59.
- [6] Golimowska S. Srebrna gospodarka i miejsce w niej sektora zdrowotnego. Koncepcja i regionalne przykłady zastosowania [Silver economy and how health sektor fits in it. The concept and regional examples of application]. *Zdrowie Publiczne i Zarządzanie* 2011;1:76–85. doi 10.4467/208426270Z.11.005.0342.
- [7] Kołodziejaska M. Obiecujący rynek [A promising market]. *Marketing w Praktyce* 2012;8:31–36.
- [8] Meiners NH, Seeberger B. Marketing to Senior Citizens: Challenges and Opportunities. *The Journal of Social, Political, and Economic Studies* 2010;35(3):293–328.
- [9] Mertin I. Wyzwania demograficzne Europy – Quo Vadis [Europe's demographic challenges – Quo Vadis]; Available online: https://www.princeton.edu/~achaney/tmve/wiki100k/docs/Demographics_of_Finland.html [03.06.2016].
- [10] Szukalski P. Srebrna gospodarka [Silver economy]. *Demografia i Gerontologia Społeczna. Biuletyn Informacyjny*, 2012;7.

Technical and technological progress in the context of sustainable development of agriculture in Poland

Anna Bartkowiak^a, Piotr Bartkowiak^b

^aInstitute of Technology and Life Sciences in Falenty, Branch in Poznan, Biskupinska 67, 60–463 Poznan, Poland

^bPoznan University of Economics, Al. Niepodległości 10, 61–875 Poznan, Poland, e-mail: p.bartkowiak@ue.poznan.pl

Abstract: The concept of sustainable development introduces a new system of agriculture adapted to contemporary conditions and requirements. It has become a new paradigm that competes with the industrial model. The objective of this paper is to analyse technical and technological progress in the Polish agriculture in the context of implementing the concept of sustainable development.

Analyses show that many farms are being modernized through investments, such as the introduction of energy-saving production technologies or the use of renewable energy sources. In an increasing number of farms, including commercial ones, in particular, biogas plants are built. For instance, 69 energy generation enterprises and 78 biogas plants were registered as of the end of 2015. In total, 429.40 GWh of electricity and 225 GWh of heat were generated from agricultural biogas.

Keywords: agriculture; sustainable development; technical and technological production.

References

- [1] Bartkowiak A, Bartkowiak P. The determinants of sustainable development of agriculture sector in Poland. *Transformations in Business & Economics* 2012;11(2A)/(26A):42–59.
- [2] Bartkowiak A. Analysis of indicators of sustainable development in animal production in the context of animal welfare according to the scheme P-S-R. *Problems of Agricultural Engineering* 2012;3(77):143–150.
- [3] Bartoszczuk P. Consumable – optimization aspect of the functioning biogas plants. In: Niedziółka D, editor. *Biogas, market competitiveness, efficiency analysis*. Warsaw: Cedewu Sp. z o.o.; 2015, p. 87–115.
- [4] Baum R. *Evaluation of sustainable development in agriculture (study methodical)*. Poznań: University of Life Sciences; 2011.
- [5] *Energy from renewable sources in 2014*, Warsaw: Central Statistical Office; 2015.
- [6] FAO. *Sustainable development and natural resources management*. Twenty-Fifth Conference. Paper C 89/2 – Sup. 2. Rome: Food and Agriculture Organization; 1989.
- [7] Maciulewski B, Pawlak J. Analysis of the equipment of farms Polish North-Eastern measures mechanization of livestock production. *Agricultural Engineering Problems* 2014;4(86):17–30.
- [8] Pawlak J. Contemporary challenges for agricultural engineering. *Agricultural Engineering Problems* 2010;4(70):5–12.
- [9] Romaniuk W. Directions of sustainable technology development and construction of animal husbandry. *Agricultural Engineering Problems* 2010;4(70):121–128.
- [10] *Strategy for sustainable rural development, agriculture and fisheries for the years 2012–2020*, strategic document, 2012.

Forms of relationships among local government units in Polish metropolitan areas

Piotr Bartkowiak^a, Maciej Koszel^a

^aPoznan University of Economics and Business, Al. Niepodległości 10, Poznan 61–875, Poland; e-mail: p.bartkowiak@ue.poznan.pl; mackoszel@gmail.com

Abstract: The primary purpose of the paper is to identify the main tendencies in forming relations between local government units within metropolitan areas of Poland. The authors focused on the study of the dominant logic of the procedure of researched units – competition or cooperation (coopetition as a simultaneous occurrence of these two).

For the purpose of the study, a qualitative method was used, i.e. a questionnaire that was addressed to representatives of local government units from metropolitan areas of Poland. The studies included metropolitan areas of Gdańsk, Katowice, Kraków, Łódź, Poznań, Szczecin, Warszawa and Wrocław.

The authors developed a typology of forms of relations within metropolitan areas based on the conducted studies as well as identified the main features of these relations.

Keywords: coopetition; relational resources; metropolitan areas; local government unit.

References

- [1] Barney J., Firm Resources and Sustained Competitive Advantage. *Journal of Management*, 1991;17(1):99–120.
- [2] Dyer JH, Singh H. The relational view: Cooperative strategies and sources of inter-organizational competitive advantage. *Academy of Management Review* 1998;23:660–679.
- [3] Castels M. *The Rise of the Network Society*. 2nd edition, Oxford: Blackwell Publishing; 2000, p.184–187.
- [4] Fehr E, Schmidt KM. A theory of fairness, competition and cooperation. *Quarterly Journal of Economics* 1999;114(3).
- [5] Brandenburger A, Nalebuff B. *Co-opetition. A revolutionary mindset that combines competition and cooperation*, New York: Currency Paperback; 1998.
- [6] Hampden-Turner Ch, Trompenaars A. *Riding the Waves of Culture: Understanding Cultural Diversity in Business*. 2nd ed. London & Santa Rosa: Nicolas Brealey Publishing Limited; 1997.
- [7] Czakon W, Mucha-Kuś K. Coopetition Research Landscape – a Systematic Literature Review 1997–2010. *Journal of Economics & Management* 2014;17:121–150.
- [8] Bengtsson M, Kock S. Co-opetition – Quo Vadis? Past accomplishments and future challenges, *Industrial Marketing Management* 2014;43(2):180–188.
- [9] Cygler J. Co-opetition in network relations between business, *Organization and Management* 2010; 1(139):59–71.

Pavement maintenance applications using Geographic Information Systems

Subhi M. Bazlamit^a, Hesham S. Ahmad^a, Turki I. Obaidat^a

^a Department of Civil and Infrastructure Engineering, Al-Zaytoonah University of Jordan, P.O. Box: 130 Amman 11733 Jordane, Web-site: www.zuj.edu.jo, e-mail: h.ahmad@zuj.edu.jo

Abstract: Large pavement networks require a systematic method to control the Maintenance and Rehabilitation (M&R) process and to define priorities as well as ensure the optimum allocation of resources. M&R strategies should take into consideration the engineering and economic factors in providing cost-effective rehabilitation decisions. A pavement-maintenance management system can be a useful tool for the evaluation and prioritization of M&R projects, and the determination of funding requirements and allocations. The aim of this research project is to develop a Pavement Maintenance Management System (PMMS) for the roads and parking network. This system will be developed, applied and tested for the roads network, pedestrian paths, parking lots and external yards at Al-Zaytoonah University of Jordan (ZUJ). In this research, an extensive review was carried out on previous PMMS projects used for roads in Jordan and other countries. Issues regarding the reviewed systems, such as advantages, disadvantages, and applicability, were discussed. Many systems employ a variety of computer software for their pavement management systems. Some use software for the management of pavement maintenance and incorporate other computer software for representing the roadway networks. A Geographical Information System (GIS) was used by other researchers and practitioners to represent the roadway network and its attributes.

This research focuses on the software called PAVER system that is used to create a comprehensive and integrated database and GIS-based map layers for the road pavement and engineering characteristics. A field survey was conducted to evaluate the Pavement Condition Index (PCI) for the selected pavement sections.

The research will contribute to the provision of a systematic method for the control of the Maintenance and Rehabilitation (M&R) process for paved networks. Although many researches in Jordan discuss reasons and procedures for M&R of road networks, there is still a lack of the systematic strategy and prediction procedure. This research will help to provide a model to be adopted in other organisations.

Keywords: maintenance and rehabilitation; pavement maintenance management system; pavement condition index; roads and parking network.

References

- [1] Shahin MY, Walther JA, *Pavement Maintenance Management for Roads and Streets Using the PAVER System*. 1st ed. US Army Corps of Engineering; 1990.
- [2] Shahin MY. *Pavement Management for Airports, Roads, and Parking Lots*. 2nd ed. LLC: Springer Science and Business Media; 2005.
- [3] Khedaywi TS. Factors that Affect the Damage of Flexible Pavements in Jordan. In: *Annual Symposium Meeting on Towards Better Roads*; 1984, p. 33–65.
- [4] Akpan O. Relationship Between Road Pavement Failure and Underlying Geology in a Tropical Environment, *Glob. J. Geol. Sci.* 2005;3(2):99–108.
- [5] Al-Khateeb G, Basheer I. A three-stage rutting model utilising rutting performance data from the Hamburg Wheel-Tracking Device (WTD), *Road Transp. Res.* 2009;18(3):32–45.
- [6] Al-Suleiman T, Al-Smadi Y. Pavement Condition Evaluation and Modelling of the Street Network in Amman City, *Mu'tah J. Res. Stud.* 1992;7(2):37–63.
- [7] Al-Soboh Y. *An Appraisal of Road Surface Management in Irbid City*, Master Thesis, Jordan University of Science and Technology; 1990.
- [8] Msallam M, Shareef O, Rawi A, Abudayyeh D, Assi I. Development of a Pavement Management System to be Used in Highway Pavement Evaluation in Jordan, *Civ. Environ. Res.* 2014;6(9):1–12.
- [9] Reza F, Boriboonsomsin K, Bazlamit SM. *Development of a Composite Pavement Performance Index*, (Final Rep. ST/SS/05–001). Ohio Dep. Transp. Columbus, OH; 2005.

Modelling contractor's bidding decisions

Sławomir Biruk^a, Piotr Jaśkowski^a, Agata Czarnigowska^a

^aFaculty of Civil Engineering and Architecture, Lublin University of Technology, Nadbystrzycka 40, 20–618 Lublin,
e-mail: s.biruk@pollub.pl, p.jaskowski@pollub.pl, a.czarnigowska@pollub.pl

Abstract: Experience and business intuition of a contractor are often insufficient to ensure that tender procedures will provide a good trade-off between the cost of bid preparation and the benefit of a high probability of winning a money-making contract. With the invitation to tender accepted, a contractor faces the problem of determining the bid price. It is expected to be high enough to provide a decent profit and, at the same time, low enough to beat the competition. To avoid cash-flow problems during the project delivery, the contractor must decide wisely on how to price particular work packages/items of the bills of quantities. Therefore, the contractor's decisions whether to bid, and later what price to offer and how to break it down, are complex and call for decision-support tools. The authors put forward a set of decision-support models: a multi-criteria analysis (simple additive weighting method) for assessing the desirability of a potential new contract, and two linear programming models: one for calculating the total price, and the other for distributing the bid amount among the items of the bill of quantities to maximize the contractor's cash flows. Application of the models is illustrated with a numerical example.

Keywords: construction management; decision support; decision to tender; linear programming, pricing.

References

- [1] Shash AA. Factors considered in tendering decisions by top UK contractors. *Constr Manage Econ* 2000;11: 111–118.
- [2] Wanous M, Boussabaine AH, Lewis J. To bid or not to bid: a parametric solution. *Constr Manage Econ* 2000; 18:457–466.
- [3] Chua DHK, Li D. Key factors in bid reasoning model. *J Constr Eng. Manage* 2000; 126 (5): 349–57.
- [4] Bageis S, Fortune C. Factors affecting the bid/no bid decision in the Saudi Arabian construction contractors. *Constr Manage Econ* 2009; 27:53–71.
- [5] Leśniak A, Plebankiewicz E. Modeling the Decision-Making Process Concerning Participation in Construction Bidding. *J Manage Eng* 2015; 31(2): 04014032, doi: 10.1061/ME.1943–5479.0000237.
- [6] Cheng Y-Y, Hsiang C-C, Tsai H-C, Do H-L. Bidding decision making for construction company using multi-criteria prospect model. *J Civ Eng Manage* 2011; 17(3):424–436.
- [7] Köksalan MM, Wallenius J, Zionts S. *Multiple Criteria Decision Making: From Early History to the 21st Century*. Singapore: World Scientific Publishing Co. Pte. Ltd.; 2011.
- [8] Mielec A, Jaśkowski P, Biruk S. Ustalenie wskaźnika narzutu zysku w strategii przetargowej przedsiębiorstwa budowlanego [Determining profit level: the contractor's bidding strategy]. *Przegląd Budowlany* 2009; 6:50–53.
- [9] Wang W-C, Dzeng R-J, Lu Y-H. Integration of simulation-based cost model and multi-criteria evaluation model for bid price decisions. *Comput-aided Civ Infrastruct Eng* 2007; 22:223–235.
- [10] Egemen M, Mohamed A. SCBMD: A knowledge – based system software for strategically correct bid/no bid and mark-up size decisions. *Automat Constr* 2008; 17:864–872.

Examination of factors influencing the successful implementation of reverse logistics in the construction industry: pilot study

Thanwadee Chinda^a

^aSchool of Management Technology, Sirindhorn International Institute of Technology, Thammasat University, Bangkadi, Muang, Pathumthani, 12000 Thailand, e-mail: thanwadee@siit.tu.ac.th

Abstract: Most of construction and demolition (C&D) waste, such as concrete, metal, plastic, and paper, can be reused, remanufactured, and recycled. This paper aims at examining key factors influencing the successful implementation of reverse logistics in the construction industry. A total of 17 associated factors is listed from construction-related literature. A pilot study was conducted with six construction companies located in Germany and Thailand. The results reveal three key factors, including the “compliance to law and regulation”, the open-minded to the use of recycled materials”, and the “management experience in reverse logistics implementation”, with the highest scores of 4.8 out of five. The “infrastructure to support the reverse logistics implementation” and the inclusion of reverse logistics in design stage” are, however, found having the least influence in reverse logistics implementation. Further study will be conducted with the exploratory factor analysis to group the 17 factors into key factors affecting successful reverse logistics implementation.

Keywords: construction and demolition waste; construction industry; reverse logistics.

References

- [1] Chileshe N, Rameezdeen R, Hosseini MR, Lehmann S. Barriers to implementing reverse logistics in South Australian construction organisations. *Supply Chain Management: An International Journal* 2015;20(2):179–204.
- [2] Schultmann F, Sunke N. Organisation of reverse logistics tasks in the construction industry. In: Braganca L, Pinheiro M, Jalali S, editors. *Proceedings of the Portugal SB07: Sustainable Construction, Materials and Practices*, Amsterdam: IOS Press, NLD; 2007, p. 577–584.
- [3] Chinda T, Supsinpaibool P, Kaewpitak P, Tangbunjardvanich S, Virivaroj T. Analytic hierarchy process of reverse logistics in the construction industry. In: *Proceedings of the 4th international conference on engineering, project, and production management*, Bangkok, Thailand; 2013.
- [4] Brauchle AA, Henne P, Maier SR, Chinda T. Decision making on reverse logistics in the German construction industry. In: *Proceedings of the international conference on technology, science, social sciences and humanities*, Bangkok, Thailand; 2015, p. 104–109.
- [5] Hosseini MR, Rameezdeen R, Chileshe N, Lehmann S. Reverse logistics in the construction industry: lessons from the manufacturing context. *International Journal of Construction Engineering and Management* 2014;3(3):75–90.
- [6] Sobotkaa A, Czaja J. Analysis of the factors stimulating and conditioning application of reverse logistics in construction. *Procedia Engineering* 2015;122:11–18.
- [7] Pumpinyo S, Nitivattananon V. Investigation of barriers and factors affecting the reverse logistics of waste management practice: a case study in Thailand. *Sustainability* 2014;6:7048–7062.
- [8] Kofoworola OF, Gheewala SH. Estimation of construction waste generation and management in Thailand. *Waste Management* 2009;29:732–738.
- [9] Sidique SF, Lupi F, Joshi SV. The effects of behaviour and attitudes on drop-off recycling activities. *Resources, Conservation and Recycling* 2010;54(3):163–170.
- [10] Nunes KRA, Mahler CF, Valle RA. Reverse logistics in the Brazilian construction industry. *Journal of Environmental Management* 2009;90(12):3717–3720.

Models evaluating courier and messenger companies in Poland

Ewa Chodakowska^a, Joanicjusz Nazarko^a, Krzysztof Kamil Żur^a

^aFaculty of Management, Białystok University of Technology, 45A Wiejska Str., Białystok, 15–351, Poland, e-mail: e.chodakowska@pb.edu.pl

Abstract: Data Envelopment Analysis (DEA) is a well-established, popular, and often used method for efficiency evaluation of units from all sectors, both commercial and non-profit organisations, of any scale of operations. Network DEA models are a relatively recent approach used to examine the efficiency of decision-making units (DMUs) having an internal structure of sub-processes. The article presents the concept of DEA network models in estimating the efficiency of courier and messenger companies with relations to their business clients. The considerations are supported by an example of data concerning leaders from the sector of couriers and messengers in Poland and one of the biggest and most popular online stores. The results are compared with the traditional DEA approach. In addition, to measure the reliability for DEA scores, the jack-knife procedure was performed. The author proves the usefulness of network DEA as a research and management tool.

Keywords: courier and messenger companies; network DEA; efficiency; evaluation.

References

- [1] Chen C, Yan H. Network DEA model for supply chain performance evaluation. *European Journal of Operational Research* 2011;213(1):147–155.
- [2] Chen Y, Liang L, Yang F. A DEA game model approach to supply chain efficiency. *Annals of Operations Research* 2006;145(1):5–13.
- [3] Cook WD, Zhu J, editors. *Data Envelopment Analysis: A Handbook of Modeling Internal Structure and Network*. New York: Springer; 2014.
- [4] Färe R, Grosskopf S. Network DEA. *Socio-Economic Planning Sciences* 2000;34:35–49.
- [5] Johnson A, Mcginnis L. Performance measurement in the warehousing industry. *IIE Transactions* 2011;43:220–230.
- [6] Kao C. Network data envelopment analysis: A review. *European Journal of Operational Research* 2014;239:1–16.
- [7] Kozłowska J. Technical efficiency of Polish companies operating in the couriers and messengers sector – the application of data envelopment analysis method. *Quantitative Methods in Economics* 2014;XV(2):339–348.
- [8] Lewis, HF, Sexton TR. Network DEA: efficiency analysis of organizations with complex internal structure. *Computers & Operations Research* 2004;31:1365–1410.
- [9] Liang L, Yang F, Cook WD, Zhu J. Data EA models for supply chain efficiency evaluation. *Annals of Operations Research* 2006;145(1):35–49.
- [10] Liang L, Li ZQ, Cook WD, Zhu J. Data envelopment analysis efficiency in two stage networks with feedback. *IIE Transactions* 2011;43(5):309–322.
- [11] Lu B, Wang XL. Comparative Studies on Efficiency Evaluation of Chinese and Korean Major Container Terminals. *Advances in information Sciences and Service Sciences (AISS)* 2012;4(23):434–442.
- [12] Mentzer JT, DeWitt W, Keebler JS, Soonhoong M, Nix NW, Smith CD, Zacharia ZG. Defining Supply Chain Management, *Journal of Business Logistics*, 2001;22(2):1–25.
- [13] Min H, Joo SJ. Benchmarking the operational efficiency of third party logistics providers using data envelopment analysis. *Supply Chain Management: An International Journal* 2006;11(3):259–265.
- [14] Mishra RK. Measuring supply chain efficiency: A DEA approach. *Journal of Operations and Supply Chain Management* 2012;5(1): 45–68.
- [15] Momeni E, Tavana M, Mirzagoltabar H, Mirhedayatian SM. A new fuzzy network slacks-based DEA model for evaluating performance of supply chains with reverse logistics. *Journal of Intelligent & Fuzzy Systems*, 2014;27:793–804.
- [16] QuariguasiFrotaNeto J, Bloemhof-Ruwaard JM, van Nunen JAEE, van Heck E. Designing and evaluating sustainable logistics networks. *Int. J. Production Economics* 2008;111:195–208.
- [17] Wong PW, Wong KY. Supply chain performance, measurement system using DEA modeling. *International Journal of Management and Data System* 2007;107(3):361–381.
- [18] Zhu J. *Quantitative models for performance evaluation and benchmarking: data envelopment analysis with spreadsheets and DEA Excel Solver*. Boston: Kluwer Academic Publishers; 2003.

Statistical assessment of the development of the transportation system in chosen countries – an international approach

Artur Czech³, Jerzy Lewczuk³

³Faculty of Management, Białystok University of Technology, 45A Wiejska Str., Białystok, 15–351, Poland, e-mail: a.czech@pb.edu.pl

Abstract: As a result of the accession of particular states to the European Union, transportation policies of Poland and other countries had to include strategical aims of the European transportation system. The aims are strictly connected with the so-called in-depth integration and regional policy, where the main purpose is to reduce the existing differences between different countries. Transport is considered to be a complex phenomenon with different relationships (interactions) in the area of infrastructure, road safety as well as technical aspects of transport. Moreover, a transportation system consists of different transport modes, such as road, railway, air and other transportation. This sophisticated system causes many difficulties to the assessment process and the introduction of the proper policy, which is based on limited financial resources. The main aim of the paper is to attempt the assessment of the process of the transport development in chosen countries with implementation methods, which allow taking into account interactions between different areas of the transportation system. Hence, the order taxonomic methods with the implementation of multidimensional Weber median were introduced. Additionally, implementation of this kind of median, except for the interactions included in the research, allows making the analysis immune to the skewness of diagnostic variables. The introduction of proper taxonomic methods in the assessment process of transportation system development can bring more opportunities in order to enhance the efficiency of the use of limited financial resources coming from the European Union as well as national budgets of particular countries.

Keywords: logistic; interactions; transport area; taxonomic measure.

References

- [1] Gratiela B. European Union's findings instruments in transport in the period 2014–2020. *Constanta Maritime University Annals* 2014;15(22):131–134.
- [2] Figura J. *Taksonomia w polityce logistycznej państwa [Taxonomy in the state policy]*. Katowice: Uniwersytet Ekonomiczny; 2013.
- [3] Grzyb U, Trzepacz P. Investment in transport infrastructure as a crucial factor of entrepreneurship development in the new UE member states – the Polish case. *European Integration Studies* 2012;6:94–100.
- [4] Marshal T. The European Union and major infrastructure policies: the reforms of the Trans-European networks programs and the implications for spatial planning. *European Planning Studies* 2014;22(7):1484–1506.
- [5] Cheba K. Taksonomiczna analiza rozwoju transportu drogowego w Polsce [Taxonomic analysis of road transport development in Poland], *Logistyka* 2001;2:97–106.
- [6] Tarka D. Infrastruktura transportowa w wybranych krajach Unii Europejskiej – analiza taksonomiczna [Transportation infrastructure in EU countries – taxonomic analysis]. *Economics and Management* 2012;4:88–100.
- [7] Hellwig Z. Zastosowanie metody taksonomicznej do typologicznego do typologicznego podziału krajów ze względu na poziom ich rozwoju oraz zasoby i strukturę wykwalifikowanych kadr [Application of the taxonomy method in typology classification of the countries due to the development level and resources and the structure of human resources]. *Przegląd Statystyczny* 1968;4:307–327.
- [8] Lira J, Wagner W, Wysocki F. Mediana w zagadnieniach porządkowania obiektów wielocechowych [Median in the ordering issues of multivariable objects], In: Paradyś WJ, editor. *Statystyka regionalna w służbie samorządu lokalnego i biznesu [Regional statistics for the local government purposes]*, Poznań: Internetowa Oficyna Wydawnicza Centrum Statystyki Regionalnej, Wydawnictwo Akademii Ekonomicznej; 2002, p. 87–99.
- [9] Czech A. Application of chosen normalization methods in the process of construction of synthetic measure in indirect consumption research. *Folia Oeconomica* 2014;3:231–239.
- [10] Młodak A, Józefowski T, Wawrowski Ł. Zastosowanie metod taksonomicznych w estymacji wskaźników ubóstwa [Using taxonomic methods in estimating poverty rates]. *Wiadomości Statystyczne* 2016;2:1–24.

The Russian Federation RTAs in the light of global value chains

Katarzyna Czerewacz-Filipowicz^a

^aFaculty of Management, Białystok University of Technology, 45A Wiejska Str., Białystok, 15–351, Poland, e-mail: k.czerewacz@pb.edu.pl

Abstract: In the literature, the regional integration policy of the Russian Federation has been studied in a variety of contexts. The focus is on the imperial and international aspirations of Russia. The result is that the starting point for the study into the Russian RTAs (Regional Trade Agreements) is often the analysis of top-down integration. This article proposes a completely different approach. Russia's participation in global value chains has been treated *de facto* as the degree of bottom-up integration of Russia into the world economy and individual countries.

The article attempts to answer the question of whether participation in global value chains can be treated as a new criterion of regional integration. The article analyses the participation of the Russian Federation in the global value chains with a special consideration of trade relations of this country. The article treats the participation of the Russian Federation in global value chains as an element of bottom-up integration so that it is possible to draw conclusions regarding the future effects of particular RTAs.

The research presented in the article allows the author to formulate a thesis that in the modern globalized world, the directions of the most favourable RTA should be determined not only by the volume and intensity of trade but also by the structure of the global value chains of a particular country. The conclusions from the studies are an extension of the theory of the international economic regional integration.

Keywords: RTA (Regional Trade Agreement); the Russian Federation; global value chains (GVC).

References

- [1] *Trade in goods with Russia*. European Union: European Commission, 2015. Available online: http://trade.ec.europa.eu/doclib/docs/2006/september/tradoc_113440.pdf, [15.05.2016].
- [2] Gereffi G, Sturgeon T. Global value chain-oriented industrial policy: the role of emerging economies. In: Elms DK, Low P, editors. *Global value chains in a changing world*, Switzerland: Fung Global Institute (FGI), Nanyang Technological University (NTU), and World Trade Organization (WTO) Secretariat; 2013, p. 329–360.
- [3] Global Value Chains (GVCs): Russian Federation. OECD; 2013. Available online: <http://www.oecd.org/sti/ind/GVCs%20-%20RUSSIAN%20FEDERATION.pdf>, [15.02.2016].
- [4] International Monetary Fund. Statistics Dept. *Direction of Trade Statistics, Yearbook 2014*. Washington, D.C.: International Monetary Fund; 2014.
- [5] OECD/WTO TRADE IN VALUE ADDED (TIVA) INDICATORS; 2013. Available online: http://www.oecd.org/sti/ind/TIVA_RUSSIA_MAY_2013.pdf, [15.02.2016].
- [6] Bożyk P. *Zagraniczna i międzynarodowa polityka ekonomiczna [Foreign and international economic policy]*. Warsaw: Polish Economic Publishing House; 2004.
- [7] Krugman PR. The Narrow and Broad Arguments for Free Trade. *The American Economic Review* 1993;83(2):362–366.
- [8] Banga R. *Measuring Value In Global Value Chains*. Regional Value Chains. Background paper no.RVC-8; UNCTAD; 2013.
- [9] *World Investment Report 2015 (WIR15)*; UNCTAD; 2015. Available online: http://unctad.org/en/PublicationsLibrary/wir2015_en.pdf, [15.01.2016].
- [10] World Trade Organization, Participation in Regional Trade Agreements, Russian Federation, Country Profile, 2015. Available online: <http://rtais.wto.org/UI/PublicSearchByMemberResult.aspx?MemberCode=643&lang=1&redirect=1> [15.05.2016].

Cooperation between business companies and institutions in the context of innovations implementation

Andrzej Daniluk^a

^aFaculty of Management, Białystok University of Technology, 45A Wiejska Str., Białystok, 15–351, Poland, e-mail: a.daniluk@pb.edu.pl

Abstract: Cooperation in the field of innovation activities means active participation in joint projects with other companies or non-profit institutions. Such cooperation can be long-term and have prospects. According to the author of this article, the research problem is the impact of the level of cooperation between companies and the institutions of the business environment on the innovations development. There are not many publications regarding the identification of the degree of readiness to cooperate by companies in the regional context. The aim of this article is to define the impact of this kind of cooperation in the context of innovations development.

The article uses the method of critical analysis of literature and statistical analysis of data obtained from a survey conducted in 381 Polish companies in Podlaskie. As a result of the literature analysis and discussions, the factors influencing cooperation were determined in the context of the implementation of innovations. The results show that in the group of studied companies, there is a small degree of interest in taking up cooperation with the institutions of the business environment. The higher the rating of the current level of contacts, the greater was also the tendency to cooperate in the future. From the perspective of the implementation of innovations, these are not optimistic observations. Some business institutions are involved in the cooperation with entrepreneurs to a very limited extent, which makes the help ineffective. In order to improve cooperation, a more proactive approach should be employed by research centres and business incubators to link the potential areas of cooperation.

Keywords: cooperation; business environment institutions; innovations.

References

- [1] Pietruszewska-Cetkowska I, Zygmunt S. *Model działania Instytucji Otoczenia Biznesu stymulujący proinnowacyjną współpracę przedsiębiorstw w województwie kujawsko-pomorskim [Model of Business Environment Institutions operations stimulating pro-innovative cooperation of companies in Kujawsko-Pomorskie Province]*. Toruń: Toruńska Agencja Rozwoju Regionalnego S.A.; 2014.
- [2] Gnyawali DR, Madhavan J, He R. Impact of co-opetition on firm competitive behaviour. An empirical examination. *Journal of Management* 2006;32(4):507–509.
- [3] Barska A, Bielski I, Choroś-Mrozowska D, Frejtag-Mika E, Piekutowska A, Podstawka M, Rollnik-Sadowska E, Wiazewicz J, Wyrwa J, Zalewski RI. *Regionalne aspekty gospodarki [Regional aspects of economy]*. Warszawa: PWE; 2014.
- [4] Bromski K, editor. *Współpraca nauki i biznesu. Doświadczenia i dobre praktyki wybranych projektów w ramach Programu Operacyjnego Innowacyjna Gospodarka na lata 2007–2013 [Cooperation of science and business. Experience and good practice of chosen projects in the frames of Operational Programme Innovative Economy 2007–2013]*. Warszawa: PARP; 2013.
- [5] Ejdays J, Ustinovičius L, Stankevičienė J. Innovative application of contemporary management methods in a knowledge-based economy – interdisciplinarity in science. *Journal of Business Economics and Management* 2014;16(1):261–274.
- [6] Leigh NG, Blakely EJ. *Planning Local Economic Development. Theory and Practice*. 5th ed. London: SAGE Publications; 2013.
- [7] Ford D, Håkansson H., Competition in business networks. *Industrial Marketing Management* 2013;42:1017–1024.
- [8] Wasiluk A. Prerequisites for undertaking and developing cooperation by industrial and construction companies, In: Stankevičienė J, Lankauskiene T, editors. *The 9th International Scientific Conference Business and Management 2016: Conference Proceedings*, Vilnius; 2016.
- [9] Wasiluk A. Zaufanie i współpraca pomiędzy przedsiębiorstwami w perspektywie budowy i rozwoju struktur klastrowych [Trust and cooperation between companies in the perspective of cluster structures formation and development]. *Economics and Management* 2013;4(5):49–66.
- [10] Wasiluk A, Daniluk A. *The possibilities of creating cross-border clusters*, Vilnius: Vilnius University Publishing House; 2013.

Analysis of criteria used in the risk assessment of technical innovations

Anna Małgorzata Deptuła^a

^a*Institute of Processes and Products Innovation, Department of Management and Production Engineering, Opole University of Technology, Ozimska 75, 45–370 Opole, Poland, e-mail: an.deptula@po.opole.pl*

Abstract: Risk assessment is an important step in the design and implementation of innovation. Therefore, the process of criteria selection and determination of relationships that may exist between them is a key element in a series of actions. This paper presents the dependence between criteria that can be used for risk assessment of technical innovation. In the theoretical part, the article presents an overview of the criteria that are used for assessing innovative projects. In particular, the paper focuses on the study of criteria for risk assessment. The practical part demonstrates the effect of defined criteria on the assessment of innovation risks. The dependence between criteria is significant for assessing the weight according to the method used to determine the weight of criteria (pair comparison). Therefore, this paper analyses the relationship between criteria and the use of the regression function. To achieve this goal, we used the method of pair comparison and assigned a relative weight to each criterion. Weights for all 14 criteria were determined by 42 independent experts. The results presented in the paper may have a significant value for companies implementing technical innovations. Moreover, the presented conclusions can be valuable in the field of production engineering.

Keywords: criteria of assessment; innovations; regression function; weights of criteria.

References

- [1] Linkov I, Shilling C, Slavin D, Shamir E. *Cognitive aspects of business innovation, in Real-Time and Deliberative Decision Making*. NATO Science for Peace and Security Series C: Environmental Security; 2008.
- [2] Cooper RG, Edgett SJ, Kleinschmidt EJ. New product portfolio management: practices and performance. *Journal of Product Innovation Management* 1999;16(4):333–351.
- [3] Danneels E, Kleinschmidt EJ. Product innovativeness from the firm's perspective: its dimensions and their relation with Project selection and performance. *Journal of Product Innovation Management* 2001; 18(6):357–373.
- [4] Ming-Lang T, An assessment of cause and effect decision-making model for firm environmental knowledge management capacities in uncertainty. *Environmental Monitoring and Assessment* 2010;161:549–564.
- [5] Jerrard RN, Barnes N, Reid A. Design, Risk and New Product Development in Five Small Creative Companies. *International Journal of Design* 2008;2(1):21–30.
- [6] Keizer JA, Vos J-P, Halman JIM. Risks in New Product Development: Devising a Reference Tool. *R&D Management* 2005;35(3):297–309.
- [7] Martinsuo M, Poskela J. Use of Evaluation Criteria and Innovation Performance in the Front End of Innovation. *Journal of Product Innovation Management* 2011;28(6):896–914.
- [8] Michnik J. *Wielokryterialne metody wspomagania decyzji w procesie innowacji [Multi-criteria decision support methods in the innovation process]*, Katowice: Wydawnictwo Uniwersytetu Ekonomicznego w Katowicach; 2013.
- [9] Rudnik K, Deptuła A.M. System with probabilistic fuzzy knowledge base and parametric inference operators in risk assessment of innovative Project. *Expert Systems with Applications* 2015;42(17–18):6365–6379.
- [10] Deptuła A.M, Knosala R. Risk assessment of the innovative projects implementation. *Management and Production Engineering Review* 2015;6(4):15–25.

E-logistics as an element of the business model maturity in enterprises of the TFL sector

Katarzyna Dębowska^a

^aFaculty of Management, Białystok University of Technology, 45A Wiejska Str., Białystok, 15–351, Poland, e-mail: k.debkowska@pb.edu.pl

Abstract: The aim of the paper is to compare the maturity of business models in two groups of companies in the TFL sector (transport–forwarding–logistics). The division into two groups was based on the use (or non-use) of e-logistics. The maturity of the model is assessed based on the financial ratios of the surveyed companies. To achieve the research objective, the ANOVA method was used. Statistical tests dedicated to this method made it possible to assess the presence of statistically significant differences in the assessment of the maturity of business models used in companies of the TFL sector, depending on the utilization or non-utilization of e-logistics in their business.

Keywords: business models; business model maturity; TFL sector, e-logistics; statistical methods, ANOVA.

References

- [1] Teece D. Business Models, Business Strategy and Innovation. *Long Range Planning* 2010;43:172–194.
- [2] Casadesus-Masanell R, Ricart JE. From strategy to business models and onto tactics. *Long Range Planning* 2010;43:195–215.
- [3] Mahadevan B. Business Models for Internet-based E-commerce: An Anatomy, California. *Management Review* 2000;42(4):55–69.
- [4] Baden-Fuller Ch, Morgan M. Business Models as Models. *Long Range Planning* 2010;43(2/3):156–171.
- [5] Jabłoński M, *Kształtowanie modeli biznesu w procesie kreacji wartości przedsiębiorstw [Shaping the business models in the process of creation of enterprise value]*. Warszawa: Difin; 2013.
- [6] Chesbrough H, Rosenbloom RS. The role of the business model in capturing value from innovation: evidence from Xerox Corporation's technology spin-off companies. *Industrial and Corporate Change* 2002;11(3):529–555.
- [7] Christensen C. *Innowacje. Następnym krokiem [Innovations. next step]*. Warszawa: Studio Emka; 2010.
- [8] Orłowski WW. *Komercjalizacja badań naukowych w Polsce. Bariery i możliwości ich przełamania [Commercialization of scientific research in Poland. Barriers and opportunities to overcome them]*. Raport PwC; 2013. Available online: <http://lifescience.pl/raporty/raport-komercjalizacja-badan-naukowych-w-polsce-bariery-imoziowosci-ich-przelamania> [24.04.2015].
- [9] McGrath RG. When your business model is in trouble, *Harvard Business Review* 2011;89(12):96–98.
- [10] Casadesus-Masanell R, Zhu F. Business model innovation and competitive imitation: the case of sponsor-based business models, *Strategic Management Journal* 2013;34:464–482.
- [11] Casprini E. Business Model Innovation: A Typology. In *Euromed. 2014 Conference Proceedings*, EMRBI; 2014, p. 502–515.
- [12] Dębowska K. The value of customer service as a fundamental dimension of the business model of companies in the TFL sector, focused on sales revenue. In: Stankevičienė J, Lankauskienė T, editors. *The 9th International Scientific Conference Business and Management 2016: Conference Proceedings*, Vilnius; 2016.
- [13] Zysińska M. Concept of business models in the industry TFL and their classification, *Autobusy, Technika, Eksploatacja, Systemy Transportowe* 2013;3:611–624.
- [14] Blanchard BS. *Logistics as an integrating system's function*. In: Taylor D, editor. *Logistics engineering handbook*, Boca Raton, London, New York: CRC Press; 2008.
- [15] Bamford C. The changing supply of logistics Services – a UK perspective. In: Waters D, editor. *Global logistics: new directions in supply chain management*. Philadelphia: Kogan Page London; 2010.
- [16] Wierczycki W, editor. *E-logistyka [E-logistics]*. Warszawa: PWE; 2013.
- [17] Crosby P. *Quality is free: The art of making quality certain*, New York: McGraw-Hill; 1979.
- [18] Aczel AD. *Statystyka w zarządzaniu [Statistics management]*. Warszawa: Wydawnictwo Naukowe PWN; 2000.

Prospects and risks of the development of energy production using a combined heat and power system and taking into account the characteristics of the biomass economy

Łukasz Dragun^a

^a Faculty of Management, Białystok University of Technology, 45A Wiejska Str., Białystok, 15–351, Poland, e-mail: l.dragun@pb.edu.pl

Abstract: The electric power industry is widely identified with a manufacturer that distributes electric and heat energy. The European Union directive enforced a partial development and modernization to a biomass system of the existing power stations, which use combined energy system for the electricity and heat production based on coal infrastructure. The main aim of this work is to present the current state of the electric power industry in Poland, taking into account characteristics of the biomass economy. The important part of this study is to forecast the energy consumption index using selected electrometric models, while the primary data source was the relevant literature of the subject entries. Currently, there is only a partial research that considers the use of biomass in the process of electricity and heat production, which is related to the cogeneration system. Developed by the Chancellery of the Prime Minister, Poland 2030 Development Challenges, is another relevant database. This work refers to the current issues, such as the input of biomass burning in the electricity and heat energy production, which is constantly present in the literature; however, there are areas in this field, which require a more comprehensive analysis. It should be expected that the number of positions in the literature will steadily grow due to the changes made to the current legal status. They are associated with adjustment of the Polish legislation following the requirements of the European Union regulations and closely linked to the limitation of carbon dioxide, sulfur oxide, and nitrogen oxide emissions into the atmosphere. Considering the aforementioned, the role of the author is to inquire the selected production companies about the problems occurring in practice and related to biomass burning contribution in the cogeneration process. This work is closely related to the scientific discipline of the production engineering.

Keywords: production process, electricity, cogeneration, biomass.

References

- [1] Raheem A, Hassan MY, Shakoor R. Bioenergy from anaerobic digestion in Pakistan: Potential, development and prospects. *Renewable and Sustainable Energy Reviews* 2016;59:264–275.
- [2] Igliński B, Piechota G, Iglińska A, Cichosz I, Buczkowski R. The study on the SWOT analysis of renewable energy sector on the example of the Pomorskie Voivodeship (Poland). *Clean Techn Environ Policy* 2016;18:45–61.
- [3] Szymańska, A, Lewandowska, Biogas Power Plants in Poland—Structure, Capacity, and Spatial Distribution. *Sustainability* 2015;7:16801–16819.
- [4] Shaikh F, Ji Q, Fan Y. Prospects of Pakistan—China Energy and Economic Corridor. *Renewable and Sustainable Energy Reviews* 2016;59:253–263.
- [5] Jones GA, Warner KJ. The 21st century population-energy-climate nexus, *Energy Policy* 2016;93:206–212.
- [6] Herbert GMJ, Krishnan AU. Quantifying environmental performance of biomass energy, *Renewable and Sustainable Energy Reviews* 2016;59:292–308.
- [7] Winkler J, Gaijo A, Pfluger B, Ragwitz M. Impact of renewables on electricity markets – Do support schemes matter? *Energy Policy* 2016;93:157–167.
- [8] Goerndt ME, Aguilar FX, Skog K. Drivers of biomass co-firing in U.S. coal-fired power plants. *Biomass and Bioenergy* 2013;58:158–167.
- [9] Hiloidhari M, Baruah DC. Rice straw residue biomass potential for decentralized electricity generation: A GIS based study in Lakhimpur district of Assam, India. *Energy for Sustainable Development* 2011;15:214–222.
- [10] Moriarty P, Honnery D. Can renewable energy power the future? *Energy Policy* 2016;93:3–7.

Potential Applications of UAV along the Construction Value Chain

Quentin F. M. Dupont^a, David K. H. Chua^a, Ahmad Tashrif^a, Ernest L. S. Abbott^a

^aDepartment of Civil and Environmental Engineering, National University of Singapore, Block E1A, #07-03 No.1 Engineering Drive 2, Singapore 117576, Singapore, e-mail: quentin.dupont@u.nus.edu

Abstract: Building Information Modelling (BIM) is foreseen as a key element in the improvements of future construction's productivity. Very few solutions currently allow the integration of as-built information into the model. This research explores the potential of Unmanned Aerial Vehicle (UAV) in linking BIM to the real world to improve the productivity.

This paper presents a technical review of the main challenges in addressing the need mentioned above. Also, it presents potential use cases. The study concludes that two main areas are to be analysed in greater depth (1) autonomous indoor flight for a UAV and (2) the smart integration of collected data into the existing BIM software.

Keywords: building information modelling (BIM); Unmanned Aerial Vehicle (UAV); construction productivity; construction site's automation; construction's value chain.

References

- [1] Canis B. Unmanned Aircraft Systems (UAS): Commercial Outlook for a New Industry. Report. Congressional Research Service; 2015.
- [2] Hazel B, Aoude G. In commercial drones, the race is on. Oliver Wyman; 2015.
- [3] Floreano D, Wood RJ. Science, technology and the future of small autonomous drones. *Nature* 2015;521:460–466.
- [4] Azhar S. Building Information Modeling (BIM): Trends, Benefits, Risks, and Challenges for the AEC Industry. *Leadership and Management in Engineering* 2011;11(3):241–252.
- [5] Goedert J, Meadati P. Integrating construction process documentation into building information modeling. *J. Constr. Eng. Manage.* 2008;134(7):509–516.
- [6] Golparvar-Fard M, Peña-Mora F, Savarese S. Integrated Sequential As-Built and As-Planned Representation with D4AR Tools in Support of Decision-Making Tasks in the AEC/FM Industry. *Journal of Construction Engineering and Management* 2011;137:1099–1116.
- [7] Ham Y, Han KK, Lin JJ, Golparvar-Fard M. Visual monitoring of civil infrastructure systems via camera-equipped Unmanned Aerial Vehicles (UAVs): a review of related works. *Visualization in Engineering* 2016;4(1).
- [8] Karsch K, Golparvar-Fard M, Forsyth D. ConstructAide: Analyzing and Visualizing Construction Sites through Photographs and Building Models. *ACM Transactions on Graphics (TOG) – Proceedings of ACM SIGGRAPH Asia 2014*; 33(6).
- [9] Knight W. New boss on construction sites is a drone. MIT Technology review; 2015.
- [10] Liu P, Chen AY, Huang Y-N, Han J-Y, Lai J-S, Kang S-C, Wu T-H, Wen M-C, Tsai M-H. A review of rotorcraft Unmanned Aerial Vehicle (UAV) developments and applications in civil engineering. *Smart Structures and Systems* 2014;13:1065–1094.

Exploring the association between project management knowledge areas and sustainable outcomes

Jantane Dumrak^a, Bassam Baroudi^b, Nick Hadjinicolaou^a

^aGlobal Project Management, Torrens University Australia, 82–98 Wakefield Street, Adelaide, South Australia 5000, Australia, e-mail: jdumrak@laureate.net.au

^bSchool of Natural and Built Environments, University of South Australia, North Terrace, Adelaide, South Australia 5000, Australia

Abstract: The popularity and familiarity of sustainable outcomes have been recognized in development studies through the expression of terminologies including “sustainability” or “benefit sustainability” or “sustained benefits” or “sustainable benefits”. Despite benefits generated by development projects, funding termination is likely to bring the projects to an end. This incidence leads to discontinuity in initiated development unless the projects can produce long-term benefits or outcomes which continuously contribute to developments after the funding expires. Major problems for reproductive health (RH) in low-income countries generally result from limited RH services and accessibility. To implement reproductive health development (RHD) projects under temporary funding, effective project management that hopefully leads to better long-term desired outcomes is required. This paper investigates a linkage between project management knowledge areas (PMKA) and sustainable outcomes from four RHD projects in Thailand. This empirical research employed a questionnaire survey to obtain data from 75 project practitioners from the four Thai RHD projects. Through quantitative data analysis using Chi-square and Cramer’s V association, different combinations of association between 10 project management knowledge areas (PMKA) and 11 targeted sustainable outcomes of the RHD projects are revealed. The research findings presented in this paper can be deployed in planning and evaluation of future development projects to effectively attain sustainable outcomes.

Keywords: PMKA; project management; reproductive health development; sustainable outcomes; sustained benefits.

References

- [1] PMI, *A guide to the project management body of knowledge*. 5th ed. Pennsylvania: Project Management Institute, Newtown Square; 2013.
- [2] Jenkins R, Kiima D, Njenga F, Okonji M, Kingora J, Kathuku D, Lock S. Integration of mental health into primary care in Kenya. *World Psychiatry* 2010;9:118–120.
- [3] Khumsaen N, Gary FA. Determinants of actual condom use among adolescents in Thailand. *Journal of the Association of Nurses in AIDS Care* 2009;20:218–229.
- [4] LaPelle N, Zapka J, Ockene J. Sustainability of public health programs: the example of tobacco treatment services in Massachusetts. *Am J. Public Health* 2006;96:1363–1369.
- [5] Sarriot EG, Winch PJ, Ryan LJ, Bowie J, Kouletio M, Swedberg E, LeBan K, Edison J, Welch R, Pacque MC. A methodological approach and framework for sustainability assessment in NGO-implemented primary health care programs. *International Journal of Health Planning and Management* 2004;19:23–41.
- [6] Scheirer MA, Hartling G, Hagerman D. Defining sustainability outcomes of health programs: illustrations from an on-line survey. *Evaluation and Program Planning* 2008;31:335–346.
- [7] Edwards NC, Roelofs SM. Sustainability: the elusive dimension of international health projects. *Can. J. Public Health* 2006;97:45–49.
- [8] Swidler A, Watkins SC. Teach a man to fish: the sustainability doctrine and its social consequences. *World Development* 2009;37:1182–1196.
- [9] Argaw D, Fanthahun M, Berhane Y. Sustainability and factors affecting the success of community-based reproductive health programs in rural Northwest Ethiopia. *African Journal of Reproductive Health* 2011;11:70–79.
- [10] Lechler TG, Dvir D. An alternative taxonomy of project management structures: linking project management structures and project success. *IEEE Transactions on Engineering Management* 2010;57:198–210.

Project managers' competencies model for the construction industry in Poland

Krzysztof Dziekoński^a

^aFaculty of Management, Białystok University of Technology, 45A Wiejska Str., Białystok, 15-351, Poland, e-mail: k.dziekonski@pb.edu.pl

Abstract: In many industries, the success of an organisation depends on the success of projects that are implemented in those organisations. This is critically important in the construction industry. A project leader has a distinct influence on the success of the project team. A project manager is required to perform a range of activities (from motivation, time, cost and scope management to administrative duties); therefore, the project manager needs a unique collection of capabilities and competencies. The issue of finding the project manager with the best set of generic or industry-related capabilities has been studied by many researchers.

The aim of this study is to create a model of construction project managers' competencies in Poland. The model includes factors related to the project manager's attributes.

The created model can serve as a reference in the development of an integrated approach to the management of construction projects in Poland. Using the proposed approach, the process of construction project management can be customized.

Keywords: model; project capabilities; project manager competencies.

References

- [1] Boyatzis RE. Competencies as a behavioural approach to emotional intelligence. *Journal of Management Development* 2009;28(9):749–770.
- [2] Dainty ARJ, Cheng MI, Moore DR. Competency-based model for predicting construction project managers' performance. *Journal of Management in Engineering* 2005;21(1):2–9.
- [3] Gaddis PO. The Project Manager. *Harvard Business Review* 1959;37(3):89–97.
- [4] Huemann M, Keegan AE, Turner JR. Human resource management in the project-oriented company: a review. *International Journal of Project Management* 2007;25(3):315–323.
- [5] Kerzner H. *Project Management*. 9th ed. John Wiley & Sons; 2005.
- [6] Konarski R. *Modele równań strukturalnych [Structural Equation Modelling]*. Warszawa: Wydawnictwo Naukowe PWN; 2009.
- [7] Lichtarski JM. Specyfika doboru pracowników do struktur zadaniowych w teorii i praktyce [Specifics of employees selection to task structures in theory and practice.]. *Zarządzanie Zasobami Ludzkimi* 2007;6:25–40.
- [8] Mulder M, Weigel T, Collins K. The concept of competence concept in the development of vocational education and training in selected EU member states. A critical analysis. *Journal of Vocational Education and Training* 2006;59(1): 65–85.
- [9] OGC, *Achieving Excellence in Construction Procurement Guide no 2. Project organization roles and responsibilities*. London: The UK Office of Government Commerce; 2007.
- [10] PMI. *Project manager competency development framework*. Newton Square, USA: Project Management Institute; 2007.

New Silk Road – a weak or a strong signal?

Joanna Ejdyś³

³Faculty of Management, Białystok University of Technology, 45A Wiejska Str., Białystok, 15–351, Poland, e-mail: j.ejdyś@pb.edu.pl

Abstract: The dynamics and complexity of the environment, in which enterprises operate requires both constant scanning of the environment as well as adapting long-term operational strategies to occurring changes. The analysis of the so-called weak signals is increasingly becoming the most important part of business environment scanning. Weak signals indicate the symptoms of possible changes in the future. They could be interpreted either as a sign or as a phenomenon in the early stage of development. According to Ansoff H.I., weak signals should be used by organizations to undertake proactive and much ahead of actions. The sooner an organization reacts to weak signals from the environment, the greater is the probability to seize new, more risky opportunities. A distinguishing feature of weak signals, in addition to anticipating the future, is the stimulation of innovative processes, often challenging existing mental models. Weak signals can be both a prerequisite for the development of new products, and entering new markets. In the initial period of the occurrence of the phenomenon referred to as a weak signal, the number of people noticing the phenomenon is small. The information is not being disseminated, the signs are weak, almost invisible and immeasurable. Along with the collection of information on the phenomenon, the probability of its occurrence increases. More visible and measurable nature of the phenomenon allows organizations to implement their plans and strategies. These types of signals are known as strong signals, in contrast to weak ones, and the basic criterion differentiating them is higher probability of occurrence of a certain phenomenon/event. The aim of the article is to present the concept of the New Silk Road, as a strong signal – a phenomenon that in the future may have a significant impact on the socio-economic development of Poland. For the formal inauguration of measures aiming at rebuilding the Silk Road, one may recognize a speech, held on September 7, 2013 at the University of Nazarbayev in Astana (Kazakhstan), by the President of the Republic of China, Xi Jinping who first pointed out the need for the joint development of a new Silk Road Economic Belt. The aim of the initiative is to improve relationships, communication between China and Western Europe. Poland, with its strategic location, could become a hub connecting Asia with Western Europe.

Keywords: New Silk Road, a weak signal, a strong signal

References

- [1] Ansoff H.I. Managing strategic surprise by response to weak signals. *California Management Review* 1975;18(2):21–33.
- [2] Magruk A. Stabe Sygnały i Dzikie Karty – Innowacyjne Metody Antycypacyjne [Weak Signals and Wild Cards – Innovative Methods of Anticipation]. *Ekonomia i zarządzanie* 2010;4:126–136.
- [3] Nazarko J, Kononiuk A. The critical analysis of scenario construction in the Polish foresight initiatives, *Technological and Economic Development of Economy* 2013;19(3):510–532.
- [4] Nazarko J. *Regionalny foresight gospodarczy. Metodologia i instrumentarium badawcze* [Regional economic foresight. Methodology and research instruments]. Warszawa: ZPWIM; 2013.
- [5] Nazarko J, Kędzior Z, editors. *Uwarunkowania nanotechnologii w województwie podlaskim. Wyniki analiz STEEPVL i SWOT [Determinants of the nanotechnology development in the Podlaskie region: results of the SWOT and STEEPVL analyzes]*. Białystok: Oficyna Wydawnicza Politechniki Białostockiej; 2010.
- [6] Nazarko J, Kuźmicz KA, Czerewacz-Filipowicz K. The New Silk Road – Analysis of the potential of new Eurasian transport corridors, In: Stankevičienė J, Lankauskienė T, editors. *The 9th International Scientific Conference Business and Management 2016: Conference Proceedings*, Vilnius; 2016.
- [7] Saritas O, Smith JE. The big picture – trends, drivers, wild cards, discontinuities and weak signals. *Futures* 2011;43:292–312.

Holistic assessment method of intelligent technologies used in production processes

Krzysztof Ejsmont^a

^aFaculty of Production Engineering, Warsaw University of Technology, Narbutta 86, 02–524 Warsaw, Poland, e-mail: krzysztof.ejsmont@wp.pl

Abstract: The following article shows a method of assessment of intelligent technologies used in the production area that can be employed for a wide range of applications. The assessment uses a holistic approach and assumes a paradigm based on the balance between the economy, society, and environment. The proposed method is based on the idea of the integrated method (created by Prof. Marciniak) and controlling. The article contains a modification and a combination of these two approaches and shows the holistic assessment method dedicated for intelligent technologies. As a result, the new solution includes elements that were not included in classical methods. The proposed assessment *has not yet been described in the literature*.

Keywords: intelligent technologies; holistic approach; integrated assessment method; controlling; technology evaluation.

References

- [1] Goyal S, Grover S, Advanced manufacturing technology effectiveness: A review of literature and some issues. *J. Frontiers of Mechanical Engineering* 2012;7(3):256–267.
- [2] Ejsmont K. Model oceny inteligentnych technologii [Assessment model of intelligent technology]. In: Knosala R, editor. *Innowacje w Zarządzaniu i Inżynierii Produkcji. Tom II*, Opole: Oficyna Wydawnicza Polskiego Towarzystwa Zarządzania Produkcją; 2016, p. 47–58.
- [3] Marciniak S, Ejsmont K. Ocena przedsięwzięć techniczno-organizacyjnych typu eScop [Assessment of Technical and Organizational Project eScop]. *Economics and Organization of Enterprise* 2015;12(791):17–32.
- [4] Slack N, Lewis M. *Operations Strategy*. 3rd ed. Harlow: Prentice Hall; 2011.
- [5] Marciniak S. Zespólna metoda oceny efektywności przedsięwzięć techniczno-organizacyjnych [The Combined Method of Efficiency Evaluation of Technical and Organizational Projects]. Warsaw: Warsaw University of Technology Publishing House; 1989.
- [6] Humphlett M. Smart manufacturing technologies build intelligent processes. *Control Engineering* 2014.
- [7] Marciniak S. Ocena efektywności nowatorskich przedsięwzięć techniczno-organizacyjnych – ujęcie holistyczne [Efficiency assessment of novel technical-organisational project – holistic approach]. *Scientific Papers of Silesian University of Technology* 2014;73:399–407.
- [8] Marciniak S. Technology Evaluation Using Modified Integrated Method of Technical Project Assessment, IFIP Advances in Information and Communication Technology. *Lecture Notes in Computer Science* 2015;460:493–501.
- [9] Marciniak S, Ejsmont K. Assessment of implementation eScop. In: Strzelczak S, lead editor. *D6.6 Guideline on eScop methodology*, EU Grant agreement no: 332946, eScop: Embedded systems Service-based Control for Open manufacturing and Process automation; 2016, p. 14–35.
- [10] Marciniak S, Ejsmont K. Ocena efektywności zintegrowanych systemów produkcyjnych w ujęciu holistycznym – podejście jakościowe [Assessment of the effectiveness of integrated manufacturing systems in holistic framework – quality approach]. *Journal of Organization Review* 2015;06:25–33.

Does experience matter? Factors affecting the understandability of the business process modelling notation

Renata Gabryelczyk^a, Arkadiusz Jurczuk^b

^aFaculty of Economic Sciences, University of Warsaw, 44/50 Długa Str., Warsaw, 00-241, Poland, e-mail: r.gabryelczyk@wne.uw.edu.pl

^bFaculty of Management, Białystok University of Technology, 45A Wiejska Str., Białystok, 15-351, Poland, e-mail: a.jurczuk@pb.edu.pl

Abstract: The use of an adequate and understandable modelling technique for business process modelling is a starting point in the implementation of process-based management. For this reason, this study proposes and tests an instrument for measuring the understandability of the selected business process modelling notation. Based on empirical research, we evaluated differences in the understandability of business process modelling notations between the groups of respondents, experienced and inexperienced in business processes modelling, and we identified the features of notations that determine the understandability of the modelling technique. Three notations were subjected to the diagnosis: EPC, BPMS, and BPMN. The analysis of differences in the understanding of a notation may be helpful when testing the process-related competence of people participating in process modelling and analysis projects.

Keywords: business process modelling; modelling notations; understandability; BPMS; BPMN; EPC.

References

- [1] Figl K, Mendling J, Strembeck M. The influence of notational deficiencies on process model comprehension. *Journal of the Association for Information Systems* 2013;14(6):312–338.
- [2] Fill HG, Karagiannis D. On the conceptualisation of modelling methods using the ADOxx meta modelling platform. *Enterprise Modelling and Information Systems Architectures-An International Journal* 2013;8(1):4–25.
- [3] Gabryelczyk R, Jurczuk A. The diagnosis of information potential of selected business process modelling notations. *Information Systems in Management* 2015;4.1:26–38.
- [4] Giaglis GM. A Taxonomy of Business Process Modeling and Information Systems Modeling Techniques. *The International Journal of Flexible Manufacturing Systems* 2001;13(2):209–228.
- [5] Jošt G, Huber J, Heričko M, Polančič G. An empirical investigation of intuitive understandability of process diagrams. *Computer Standards & Interfaces* 2016; 48:90–111.
- [6] Kock N, Verville J, Danesh-Pajou A, Deluca D. Communication flow orientation in business process modelling and its effect on redesign success: results from a field study. *Decision Support Systems* 2009;46:562–575.
- [7] Krčmar H, Schwarzer B. ProzeBorientierte Unternehmensmodellierung – Gründe, Anforderungen an Werkzeuge und Folgen für die Organisation [Process-oriented enterprise modeling – reasons demands on tools and implications for the organization]. In: Scheer A-W, editor. *Lehrstuhl für Wirtschaftsinformatik*, Wiesbaden: Gabler Verlag; 1994, p. 13–34.
- [8] Mendling J, Strembeck M. Influence factors of understanding business process models. In: Abramowicz W, Fensel D, editors. *Business information systems*, Berlin: Springer Berlin Heidelberg; 2008, p. 142–153.
- [9] Reijers HA, Mendling J. A study into the factors that influence the understandability of business process models. *IEEE Transactions on Systems, Man, and Cybernetics- Part A: Systems and Humans* 2011;41(3):449–462.
- [10] Schrepfer M, Wolf J, Mendling J, Reijers HA. The Impact of Secondary Notation on Process Model Understanding. In: Persson A, Stirna J, editors. *The Practice of Enterprise Modeling*, Stockholm: Springer Berlin Heidelberg; 2009, p. 161–175.

The framework of business model in the context of Industrial Internet of Things

Sylwia Gierej³

^aFaculty of Management, Bialystok University of Technology, 45A Wiejska Str., Bialystok, 15–351, Poland, e-mail: gierej.sylwia@gmail.com

Abstract: The purpose of this article is an attempt to develop the concept of a business model dedicated to companies implementing technologies of the Industrial Internet of Things. The proposed concept has been developed to support traditional companies in the transition to the digital market. The study was based on the available literature on the impact the Industrial Internet of Things has on the economy and business models.

Keywords: business model; Business Model Canvas; Lean Canvas; Industrial Internet of Things (IIoT); outcome economy.

References

- [1] Daugherty P, Banerjee P, Negm W. *Driving Unconventional Growth through the Industrial Internet of Things*. Accenture; 2015.
- [2] Ashton K, That's Internet of Things, *RFID Journal* 2009. Available online: www.rfidjournal.com/articles/view?4986 [10–06–2016].
- [3] Varghese A, Tandur D. Wireless requirements and challenges in Industry 4.0., *Proceedings of 1st IEEE International Conference: Contemporary Computing and Informatics* 2014; 634–638.
- [4] O'Halloran D., Kvochko E. *Industrial Internet of Things: Unleashing the Potential of Connected Products and Services*. World Economic Forum, Switzerland; 2015.
- [5] Osterwalder A. *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers*. New Jersey: John Wiley & Sons, Inc.; 2010.
- [6] Maurya A. *Running Lean: Iterate from Plan A to a Plan That Works*. Sebastopol (California): O'Reilly Media, Inc.; 2012.
- [7] Daugherty P., Biltz M., Bernstein A. *Accenture Technology Vision 2015*. Available online: www.accenture.com/us-en/it-technology-trends-2015 [11–06–2016].
- [8] Afuahg A, Tucci CL. *Internet Business Models and Strategies*. New York: McGraw-Hill Companies; 2001.
- [9] Pateli A, Giaglis G. A Framework for Understanding and Analysing eBusiness Models, *Proceedings of 16th Bled eCommerce Conference "eTransformation"* 2003; 329–348.
- [10] Bis J. An innovative business model – the way to increase competitive advantage, *Entrepreneurship and Management* 2013;13(2):53–63.

Assessment of the interrelations between economic and ecological development in regions of Lithuania

Romualdas Ginevičius^a, Dainora Gedvilaitė^b, Andrius Stasiukynas^b

^aFaculty of Management, Bialystok University of Technology, 45A Wiejska Str., Bialystok, 15–351, Poland

^bBusiness Management Faculty, Vilnius Gediminas Technical University, Saulėtekio ave. 11, LT–10223 Vilnius, Lithuania, e-mail: dainora.gedvilaitė@vgtu.lt

Abstract: In order to analyse the interaction of three components of sustainable development – economic, social and environmental – they must be defined in quantitative terms. In this respect, the ecological development plays a special role, since both economic and social development goals must conform to environmental protection restrictions. The ecological development, just as the other components of sustainable development, is a complex thing that manifests itself in many different ways. The indicators that express them have various dimensions, and their manner of change can vary, i.e. one indicator rises as the situation improves while another may fall. Multi-criteria methods are well suited for the qualitative analysis of such manifestations. The goal of this paper is to perform a comprehensive analysis of Lithuania's regional economic and ecological development using the MDE method (Multi-criteria Different Evaluation), taking into account factors that both positively and negatively affect the ecological situation, and to determine the effect that economic development has on ecological development. The following methods were used to achieve this goal: the analysis of scientific literature, multi-criteria evaluation methods and mathematical statistical methods.

Keywords: quantitative analysis; sustainable regional development; economic development; ecological development; MDE method; multi-criteria assessment.

References

- [1] Boggia A, Cortina C. Measuring sustainable development using a multi-criteria model: A case study. *Journal of Environmental Management* 2010;91:2301–2306.
- [2] Ferrarini A, Bodini A, Becchi M. Environmental quality and sustainability in the province of Reggio Emilia (Italy): using multi-criteria analysis to assess and compare municipal performance. *Journal of Environmental Management* 2001;63:117–131.
- [3] Kevin FRL. Evaluating environmental sustainability: an integration of multiple-criteria decision-making and Fuzzy logic. *Environmental Management* 2007;39:721–736.
- [4] Babu S, Datta SK. Revisiting the link between socio-economic development and environmental status indicators—focus on panel data. *Environment, Development and Sustainability* 2015;17(3):567–586.
- [5] Golusin M, Munitlak OI. Definition, characteristics and state of the indicators of sustainable development in countries of Southeastern Europe, Agriculture, *Ecosystems and Environment* 2009;130:67–74.
- [6] Kondyli J. Measurement and evaluation of sustainable development – a composite indicator for the islands of the North Aegean region, Greece. *Environmental Impact Assessment Review* 2010;30:347–356.
- [7] Zhou J, Xiao H, Shang J, Zhang X. Assessment of sustainable development system in Suihua City, China, Chinese. *Geographical Science* 2007;17(4):304–310.
- [8] Golusin M, Munitlak OI, Teodorovic N. The review of the achieved degree of sustainable development in South Eastern Europe – The use of linear regression method. *Renewable and Sustainable Energy Reviews* 2001;15:766–772.
- [9] Ginevičius R, Podvezko V. Complex assessment of sustainable development of state regions with emphasis on ecological and dwelling conditions. *Ekologija* 2007;53(Supplement):41–48.
- [10] Ginevičius R, Gedvilaitė D, Bruzėgė Š. Assessment of a country's regional economic development on the basis of Estimation of a Single Process (ESP) method. *Entrepreneurial business and economics review (EBER)* 2015;3(2):141–153.

Ranking of office-lease options by multi-criteria methods

Romualdas Ginevičius^a, Tomas Ginevičius^b, Dainora Gedvilaitė^b

^aFaculty of Management, Bialystok University of Technology, 45A Wiejska Str., Bialystok, 15–351, Poland

^bFaculty of Transport Engineering, Vilnius Gediminas Technical University, Saulėtekio ave. 11, LT–10223 Vilnius, Lithuania, e-mail: dainora.gedvilaitė@vgtu.lt

Abstract: Due to the growing scales of business and internationalisation, the issue of the office lease is becoming more and more relevant for companies. They are becoming an inherent part of business, on which the results of the commercial activity depend. Current methodologies for the assessment of the office-lease options are imperfect as they lack complexity; they are not associated with the objective of the lease, i.e. the improvement of business results; the methods of the quantitative assessment of lease options are far from perfect. The paper aims to formulate the hierarchical indicator system of commercial real estate facilities (offices) adjusted to the multi-criteria assessment and to calculate lease options based on this indicator system. To achieve this goal, the following methods have been used: scientific literature analysis and multi-criteria assessment methods.

Keywords: lease of commercial facilities (offices); forming the indicator system; multi-criteria assessment methods.

References

- [1] Nase I, Berry J, Adair A. Real estate value and quality design in commercial office properties. *Journal of European Real Estate Research* 2013;6(1):48–62.
- [2] Downs D, Güner Z. Commercial real estate, information production and market activity. *The Journal of Real Estate Finance and Economics* 2013;46(2):282–298.
- [3] Pagourtzi E, Assimakopoulos V, Hatzichristos T, French N. Real estate appraisal: a review of valuation methods. *Journal of Property Investment & Finance* 2003;21(4):383–401.
- [4] Ginevičius R, Podvezko V. Generation of a set evaluation criteria. *Business: Theory and Practice* 2005;6(4):199–207.
- [5] Mardani A, Jusoh A, Zavadskas EK, Khalifah Z, Nor KM. Application of multiple-criteria decision – making techniques and approaches to evaluating of service quality: a systematic review of the literature. *Journal of Business Economics and Management* 2015;16(5):1034–1068.
- [6] Saaty TL. *The analytic hierarchy process*. New York: McGraw Hill; 1980.
- [7] Ginevičius R. Some problems of quantitative evaluation of the state of social-economic system. *Business: Theory and Practice* 2009;10(2):69–83.
- [8] Ginevičius R. Hierarchical structuring of processes and phenomena. *Business: Theory and Practice* 2007;8(1):14–18.
- [9] Ginevičius R. Generating a structural system of criteria for describing a complicated phenomenon. *Business: Theory and Practice* 2007;8(2):68–72.
- [10] Ginevičius T. Options for quantitative assessment of types of commercial real estate leases. *Economics and Management* 2016;8(1):55–61.

Routing problems with time dependencies or how different are trash collection or newspaper delivery from street sweeping or winter gritting?

Bruce Golden^a, Jenny Nossack^b, Erwin Pesch^{b,c}, Rui Zhang^a

^aRobert H. Smith School of Business, University of Maryland, College Park, MD 20742, USA

^bCentre of Advanced Studies in Management, HHL Leipzig Graduate School of Management, 04109 Leipzig, Germany

^cDepartment of Management Information Science, University of Siegen, 57068 Siegen, Germany, e-mail: erwin.pesch@uni-siegen.de

Abstract: The focus of this paper is on the windy rural postman problem with the additional option to zigzag street segments during certain times of the day. If a street is narrow or traffic is light, it is possible (and often desirable) to service both sides of the street in a single pass by zigzagging. However, if a street is wide or traffic is heavy, we must service the street by two single traversals. For some streets, we further assume that they may only be zigzagged early in the morning when the traffic is low. Real-life applications arise, among others, in trash collection and newspaper delivery. This problem is solved by transforming it into a node routing problem and present a mathematical formulation.

Keywords: windy rural postman problem; arc routing with time-dependent zigzag options; time windows; city logistics; mathematical model; real-life applications.

References

- [1] Golden B. *Some interesting vehicle routing research topics: Suggestions from an oldtimer*. Technical report, presented at VeRoLog Conference, Southampton, U.K.; 2013.
- [2] Nossack J, Golden B, Pesch E, Zhang R. The windy rural postman problem with a time-dependent zigzag option, Working Paper, submitted to *European Journal of Operational Research*.
- [3] Mullaseril PA. *Capacitated rural postman problem with time windows and split delivery*. PhD thesis, University of Arizona, 1996.
- [4] Bodin LD, Kursh SJ. A computer-assisted system for the routing and scheduling of street sweepers. *Operations Research* 1978;26:525–537.
- [5] Eglese RW. Routeing winter gritting vehicles. *Discrete Applied Mathematics* 1994;48:231–244.
- [6] Tagmouti M, Gendreau M, Potvin JY. Arc routing problems with time-dependent service costs. *European Journal of Operational Research* 2007;181:30–39.
- [7] Irnich S. A note on postman problems with zigzag service. *INFOR* 2005;43:33–39.

Modern research trends within technology management in the light of selected publications

Alicja Ewa Gudanowska^a

^aFaculty of Management, Białystok University of Technology, 45A Wiejska Str., Białystok, 15–351, Poland, e-mail: a.gudanowska@pb.edu.pl

Abstract: The author of this article stresses the search for contemporary research trends within technology management. Thereby, this paper primarily focuses on investigating research areas and issues connected with technology management in contemporary scientific publications selected from the Web of Science database. The results of the undertaken overview of the selected literature lead to a visualisation of issues most frequently occurring in configuration with technology management, as well as the aspect of their coexistence in the analysed compilation of literature. Together with the description of the conducted analysis, it constitutes a fundamental result of this work.

Keywords: technology; technology management; research trends; visualisation of knowledge.

References

- [1] Halicka K. Innovative Classification of Methods of The Future-Oriented Technology Analysis. *Technological and Economic Development of Economy* 2016;22(4):574–597.
- [2] Cetindamar D, Phaal R, Probert D. Understanding technology management as a dynamic capability: A framework for technology management activities. *Technovation* 2009;29:237–246.
- [3] Beyhan B, Cetindamar D. No escape from the dominant theories: The analysis of intellectual pillars of technology management in developing countries. *Technological Forecasting and Social Change* 2011;78:103–115.
- [4] Chanaron JJ, Jolly D. Technological management: expanding the perspective of management of technology. *Management Decision* 1999;37(8):613–620.
- [5] Gregory MJ. Technology management: a process approach. *Proceedings of the Institution of Mechanical Engineers* 1995;209:347–356.
- [6] Phaal R, Farrukh CJP, Probert DR. Technology management process assessment: a case study. *International Journal of Operations & Production Management* 2001;21(8):1116–1132.
- [7] Phaal R, Farrukh CJP, Probert DR. Technology roadmapping – A planning framework for evolution and revolution. *Technological Forecasting and Social Change* 2004;71:5–26.
- [8] Nazarko Ł. Responsible research and innovation – new paradigm of technology management. In: Stankevičienė J, Lankauskienė T, editors. *The 9th International Scientific Conference Business and Management 2016: Conference Proceedings*, Vilnius; 2016.
- [9] Liao S. Technology management methodologies and applications. A literature review from 1995 to 2003. *Technovation* 2005;25:381–393.
- [10] Cetindamar D, Wasti SN, Ansal H, Beyhan B. Does technology management research diverge or converge in developing and developed countries? *Technovation* 2009;29:45–58.

Models and methods for measuring the quality of logistic service

Aleksandra Gulc^a

^aFaculty of Management, Białystok University of Technology, 45A Wiejska Str., Białystok, 15–351, Poland, e-mail: a.gulc@pb.edu.pl

Abstract: Under the conditions of strong competition and constant changes in the service market, the logistics operators have to adapt their offer to constantly changing client needs. Therefore, the quality of service should be the object of special interest, as it allows meeting client expectations. In order to measure the service quality, managers have a wide range of useful models and methods. The recognition of them allows matching the appropriate ones to particular requirements of the enterprise, then analyse the gathered data properly and finally make conclusions, which will affect future decisions. The main aim of the article is the identification and critical assessment of the most commonly used models and methods of measuring service quality. The last part of paper is dedicated to the overview of measurement issues taking into account the specific features of logistics service. The paper was based on the research methods of the systematic literature review and the critical analysis. Systematic reviews are characterized by a planned and structured approach to published academic research by using organised and replicable methods to identify, select, and critically assess literature searches. The article includes: (i) definitions of service quality, (ii) identification of the most popular models of service quality, (iii) overview of measuring methods of service quality, and (iv) the main research achievements on account of logistics service quality. The analysis of the literature has shown that the research conducted on the quality of logistics service is mainly based on models and methods constructed for service quality. However, some authors attempt to create their own original approach considering the quality of logistics service.

Keywords: service quality; service quality models and methods; logistics service quality.

References

- [1] Dziekoński K, Chwiećko J. Innowacyjność przedsiębiorstw z branży TSL [Innovativeness of enterprises within TSL branch]. *Economics and Management* 2012;2:176–193.
- [2] Stoma M. *Modele i metody pomiaru jakości usług [Models and methods for measuring quality of service]*. Lublin: Q&R Polska Sp. z o.o.; 2012.
- [3] Urban W. Definicje jakości – różnice oraz ich przyczyny [Definitions of quality – difference and their causes]. *Problemy jakości* 2007;39(3):4–9.
- [4] Garvin DA. *Managing Quality. The Strategic and Competitive Edge*, New York: The Free Press; 1988.
- [5] Seth N, Deshmukh SG, Vrat P. Service quality models: a review. *International Journal of Quality & Reliability Management* 2005; 22(9):913–949.
- [6] Gronroos C. A service quality model and its marketing implications. *European Journal of Marketing* 1984;18(4):36–44.
- [7] Cronin Jr. JJ, Taylor SA, SERVPERF versus SERVQUAL: Reconciling Performance-Based and Perceptions-Minus-Expectations Measurement of Service Quality. *Journal of Marketing* 1994;58(1):125–131.
- [8] Parasuraman A, Zeithaml VA, Berry LL, A conceptual model of service quality and its implications for future research. *Journal of Marketing* 1985;49:41–50.
- [9] Franceschini F, Rafele C. Quality evaluation in logistic services. *International Journal of Agile Management Systems* 2012;2(1):49–54.
- [10] Mentzer JT, Flint DJ, Kent JL. Developing a Logistics Service Quality Scale. *Journal of Business Logistics* 1999; 20(1):9–32.

Heavy equipment scheduling for horizontal construction projects

G. Emre Gurcanli^a, Harun Turkoglu^a, Senem Bilir^a

^a Civil Eng. Faculty, Istanbul Technical University, Ayazaga Kampusu, 34469, Istanbul, e-mail: gurcanlig@itu.edu.tr

Abstract: Construction project scheduling requires additional parameters and estimation if the projects are equipment intensive. Since preventive maintenance, multiple movement operations, and sitting idle vehicles affect not only the activity or the total project duration, but also the budget of the project, heavy equipment scheduling deserves a special focus. In this study, a survey was conducted within construction companies to collect information about how their productivity analysis and project scheduling were executed, and upon which parameters they were based. Additionally, in a selected residential building construction project, Monte Carlo simulation was applied for estimating the productivity on a construction site with selected parameters. The results reveal that Turkish construction companies have a poor focus on heavy equipment scheduling as well as productivity and their productivity data just relies on daily documents from a machinery department and basic extrapolation for future construction activities. This paper briefly reveals the characteristics of the Turkish construction industry towards equipment scheduling and productivity analyses and recommends simulation methods such as Monte Carlo for cost as well as productivity estimation to provide huge cost savings during construction projects

Keywords: equipment planning; Monte Carlo Simulation; productivity; construction projects.

References

- [1] Gransberg DD, Popescu CM, Ryan R. Construction Equipment Management for Engineers, Estimators and Owners. Boca Raton, Florida: CRC Press; 2006.
- [2] Oztas A, Okmen O. Judgmental risk analysis process development in construction projects. *Building and Environment* 2005;40(9):1244–1254.
- [3] Torres A, Echeverry D, Arciniegas F. Project Planning under uncertainty using Monte Carlo Simulations. In: *International Conference on Engineering and Technology Management, Pioneering New Technologies: Management Issues and Challenges in the Third Millennium. IEMC '98 Proceedings* 1998, p. 159–165.
- [4] McCabe B. Monte Carlo Simulation for Schedule Risks. *Simulation Conference. Proceedings of the 2003* 2003;Winter(2):1561–1565.
- [5] Peurifoy R, Schexnayder CJ, Shapira A, Schmitt R. Construction Planning, Equipment and Methods. 8th ed. New York: McGraw-Hill Education; 2006.
- [6] Nunnally SW. *Managing Construction Equipment*. Prentice Hall; 2004.
- [7] Douglas J. Equipment costs by current methods. *Journal of Construction Division ASCE* 1978;104(C02):191–225.
- [8] Sadeghi N, Robinson FA, Seresht NG. Queue performance measures in construction simulation models containing subjective uncertainty. *Automation in Construction* 2015;60:1–11.
- [9] Lai Y-T, Wang W-Ch, Wang HH. AHP-and simulation-based budget determination procedure for public building construction projects. *Automation in Construction* 2008;17(5):623–632.
- [10] Aminbakhsh S, Gunduz M, Sonmez R. Safety risk assessment using analytic hierarchy process (AHP) during planning and budgeting of construction projects. *Journal of safety research* 2013;46:99–105.
- [11] Vahdatikhaki F, Hammad A. Risk-based look-ahead workspace generation for earthwork equipment using near real-time simulation. *Automation in Construction* 2015;58:207–220.
- [12] Song L, Elding N. Adaptive real-time tracking and simulation of heavy construction operations for look-ahead scheduling. *Automation in Construction* 2012;27:32–39.
- [13] Aziz RF, Abdel-Hakam AA. Exploring delay causes of road construction projects in Egypt. *Alexandria Engineering Journal*; 2016;55(2):1515–1539.

Investigating association of benefits and barriers in project portfolio management to project success

Nick Hadjinicolaou^a, Jantane Dumrak^a

^aGlobal Project Management, Torrens University Australia, Wakefield Street, Adelaide, South Australia 5000, Australia, e-mail: nhadjinicolaou@laureate.net.au

Abstract: Projects are increasingly initiated by organisations across Australia in alignment with the corporate strategies. Concerned over constrained resources and rapid changes that exist in the project environment, project portfolio management (PPM) can support organisations in prioritizing and selecting the right projects to meet strategic objectives and improve project success rates. This paper investigates and analyses the application of PPM in Australia by conducting a questionnaire survey with senior project, program and portfolio managers across Australia. The paper provides the *status quo* of project portfolio management practices in the key Australian sectors. Quantitative analysis was conducted to rank the benefits and barriers of the practices. The results suggested improvement in decision making, maximizing resource usage, alignment with business strategy and organisational risk reduction are the most common benefits found when implementing PPM. On the other hand, internal politics and culture, lacking organisational management support, and disagreement on a common project prioritization approach are the main barriers impeding the application of PPM. The study concludes by visualizing relationships between benefit and barriers of PPM and project success. The presentation of the associations aims at contributing to the improvement of project portfolio management and project success amongst the key sectors.

Keywords: project management, project portfolio management, project success, portfolio management practices.

References

- [1] Turner JR. *The handbook of project-based management*. 3rd ed. New York: McGraw-Hill; 2009.
- [2] Archibald RD, Prado D. The importance of knowing your project, program and portfolio management maturity. *PM World Journal* 2014;3.
- [3] Meskendahl S. The influence of business strategy on project portfolio management and its success: a conceptual framework. *International Journal of Project management* 2010;28:807–817.
- [4] Crawford L, Hobbs JB, Turner JR. Aligning capability with strategy: categorizing projects to do the right projects and to do them right. *Project Management Journal* 2006;37:38–50.
- [5] PMI, *PMI's pulse of the profession in-depth report: the impact of PMOs on strategy implementation*. Newtown Square, Pennsylvania: Project Management Institute; 2013.
- [6] Markowitz H. Portfolio section. *The Journal of Finance* 1952;7:77–91.
- [7] Pallant J. *SPSS survival manual*. 5th ed. Crows Nest, New South Wales: Allen & Unwin; 2013.
- [8] Creswell JW, Plano VL. *Designing and conducting mixed methods research*. 2nd ed. Thousand Oaks, California: Sage; 2011.
- [9] Jackson SL. *Research methods and statistics: a critical thinking approach*. 3rd ed. Belmont, California: Wadsworth; 2009.
- [10] Constantino F, Gravio FD, Nonino F. Project selectin in project portfolio management: an artificial neural network model based on critical success factors. *International Project management Journal* 2015;33:1744–1754.

Bibliometric analysis of publications on city logistics in international scientific literature

Sławomira Hajduk^a

^aFaculty of Management, Bialystok University of Technology, 45A Wiejska Str., Bialystok, 15–351, Poland, e-mail: s.hajduk@pb.edu.pl

Abstract: This article aims to identify the trends and dynamics of changes in city logistics on the basis of bibliometric data of international literature published in the ISI Web of Science, Scopus, Elsevier, Emerald and EBSCO host databases in recent years. The study made use of basic techniques of the bibliometric method with the support of the VOS viewer software. On the basis of a huge number of literary work, the analysis allowed for the assessment in terms of chronological development, of research concerned with city logistics and the identification of main authors, publications, and journals being of crucial significance to this area of research.

Keywords: city logistics, ISO 37120, bibliometric analysis.

References

- [1] Ando N, Taniguchi E. Travel Time Reliability in Vehicle Routing and Scheduling with Time Windows. *Networks & Spatial Economics* 2006;6:293–311.
- [2] Crainic TG, Ricciardi N, Storch G. Advanced Freight Transportation System for Congested Urban Area. *Transportation Research Part C-Emerging* 2004;12:119–137.
- [3] Crainic TG, Gendreau M, Potvin JY. Intelligent Freight-Transportation Systems: Assessment and the Contribution of Operation Research. *Transportation Research Part C-Emerging Technologies* 2009;17:541–557.
- [4] Crainic TG, Ricciardi N, Storch G. Models for Evaluating and Planning City Logistics Systems. *Transportation Science* 2009;12:432–454.
- [5] Dabland L. Good Transport in Large European Cities: Difficult to Organize, Difficult to Modernize. *Transportation Research Part A-policy and Practice* 2007;41:280–285.
- [6] Hemmelmayr VC, Cordeau JF, Crainic TG. An Adaptive Large Neighborhood Search Heuristic for Two-Echelon Vehicle Routing Problems Arising in City Logistics. *Computers & Operations Research* 2012;39:3215–3228.
- [7] Munuzuri J, Larraneta J, Onieva L, Cortes P. Solution Applicable by Local Administrations for Urban Logistics Improvement. *Cities* 2005;22:15–28.
- [8] Perboli G, Tadei R, Vigo D. The Two-Echelon Capacitated Vehicle Routing Problem: Models and Math-Based Heuristics. *Transportation Science* 2011;45:364–380.
- [9] Taniguchi E, van der Heijden AMA. An Evaluation Methodology for City Logistics. *Transport Reviews* 2000;20:65–90.
- [10] Taniguchi E, Shimamoto H. Intelligent Transportation System Based Dynamic Vehicle Routing and Scheduling with Variable Travel times. *Transportation Research Part C-Emerging Technologies* 2004;12:235–250.

Main concepts of technology analysis in the light of the literature on the subject

Katarzyna Halicka^a

^aFaculty of Management, Białystok University of Technology, 45A Wiejska Str., Białystok, 15–351, Poland, e-mail: k.halicka@pb.edu.pl

Abstract: The main aim of this article is to identify and present the relevant concepts and methods of technology analysis. On the basis of the bibliometric analysis of scientific articles, research subareas related to the technology analysis were selected. Relationships between earlier executed research in this field were determined. Taking into account the obtained map of relationships, the possibility of the use of technology analysis was indicated. Also, methods used to analyse the current state of technology and concepts used for the prospective technology analysis were identified. Then, the concepts of predicting the technology development were discussed and compared. The conclusions from the conducted study can be used as the basis for determining the critical directions for the development of research areas related to the technology analysis.

Keywords: technology analysis; forecasting; foresight; technology assessment; Future-oriented Technology Analysis.

References

- [1] Carlson L. Using technology foresight to create business value. *Research Technology Management* 2004;47(5);5–60.
- [2] Gudanowska A E. *Technology mapping as a tool for technology analysis in foresight studies*. Technology Management Conference: ITMC 2014: IEEE International; Chicago 2014.
- [3] Nazarko J, Saparauskas J. Application of DEA method in efficiency evaluation of public higher education institutions. *Technological and Economic Development of Economy* 2014;20(1);25–44.
- [4] Porter AL, Cunningham SW, Banks J, Roper AT, Mason TW, Rossini FA. *Forecasting and Management of Technology*. New York: John Wiley & Sons; 2011.
- [5] Firat AK, Woon WL, Madnick S. *Technology Forecasting – A Review*. Composite Information Systems Laboratory Sloan School of Management. Cambridge: Massachusetts Institute of Technology; 2008.
- [6] Ejdys J, Ustinovicius L., Stankevicienė J. Innovative application of contemporary management methods in a knowledge-based economy – interdisciplinarity in science. *Journal of Business Economics and Management* 2015;16(1);261–274.
- [7] Nazarko J, Kononiuk A. The critical analysis of scenario construction in the Polish foresight initiatives. *Technological and Economic Development of Economy* 2013;19(3);510–532.
- [8] Magruk A. The Most Important Aspects of Uncertainty in the Internet of Things Field – Context of Smart Buildings. *Procedia Engineering* 2015;122;220–227.
- [9] Magruk A. Analiza niepewności w złożonych, dynamicznych systemach – przypadek Internetu Rzeczy [Analysis of uncertainty in complex, dynamic systems: Internet of Things case study]. *Przegląd Organizacji* 2016;1;53–59.
- [10] Ejdys J. Future oriented strategy for SMEs. *Procedia – Social and Behavioral Sciences* 2014;156;8–12.
- [11] Nazarko J, Głinska U, Kononiuk A, Nazarko L. Sectoral foresight in Poland: thematic and methodological analysis. *International Journal of Foresight and Innovation Policy* 2013;9(1);19–38.
- [12] Nazarko Ł. Responsible research and innovation – new paradigm of technology management. In: Stankevicienė J, Lankauskienė T, editors. *The 9th International Scientific Conference Business and Management 2016: Conference Proceedings*, Vilnius; 2016.
- [13] Nazarko Ł. Technology Assessment in Construction Sector as a Strategy towards Sustainability. *Procedia Engineering* 2015;122;290–295.
- [14] Mazurkiewicz A, Belina B, Poteralska B, Giesko T, Karsznia W. Universal methodology for the innovative technologies assessment. *Proceedings of the 10th European Conference on Innovation and Entrepreneurship* 2015;458–467.
- [15] Halicka K. Innovative Classification of Methods of The Future-Oriented Technology Analysis. *Technological and Economic Development of Economy* 2016;22(4);574–597.
- [16] Saritas O, Burmaoglu S. The evolution of the use of Foresight methods: a scientometric analysis of global FTA research output. *Scientometrics* 2015;105(1);497–508.
- [17] Halicka K, Lombardi PA, Styczyński Z. Future-oriented analysis of battery technologies. *Proceedings of the IEEE International Conference on Industrial Technology* 2015; 1019–1024.

The state and prospects for the development of railway transport infrastructure in Eastern Poland – secondary data analysis

Marta Jarocka^a, Ewa Glińska^a

^aFaculty of Management, Białystok University of Technology, 45A Wiejska Str., Białystok, 15–351, Poland, e-mail: e.glińska@pb.edu.pl

Abstract: According to the World Economic Forum, the transport infrastructure is one of the twelve pillars of every economy's competitiveness. Well-developed transport infrastructure affects a business location, integrates the national market and reduces the effect of distance between regions. Furthermore, the quality and extensiveness of infrastructure (both road and rail), determine the economic growth of the country and its particular regions. The aim of the article is to present the state of development of railway transport infrastructure in Eastern Poland (including five provinces located close to the eastern border of the country), as well as the analysis of basic indicators characterizing this aspect of the regional development of the analysed area in comparison to other Polish regions. The main directions of development of the railway transport infrastructure in Eastern Poland, which are described in both the national and EU strategic documents, will also be analysed. The research method that will be used to achieve the purpose of the article is the analysis of secondary data, including statistical data obtained from the Central Statistical Office in Poland as well as analysis of strategic documents, where the crucial directions of development of Eastern Poland are described. We also put forth our own concept of ranking voivodships based on available statistical data whose aim was to show the level, to which the various regions of Poland differ from each other when it comes to the development of rail infrastructure. The results of the analyses will have managerial implications. They will provide the source of considerable information for regional authorities of the eastern region of Poland in terms of differences in the level of development of the railway infrastructure of Eastern Poland and other regions of Poland.

Keywords: railway transport infrastructure; transport policy; Eastern Poland; regional development; transport accessibility.

References

- [1] Marcysiak A, Pieniak-Lendzion K, Lendzion M, Drygiel T. Rozwój infrastruktury transportu kolejowego w Polsce w ramach II Paneuropejskiego Korytarza Transportowego [Development of railway infrastructure in Poland under Pan-European Transport Corridor II]. *Zeszyty Naukowe Uniwersytetu Przyrodniczo-Humanistycznego w Siedlcach, Seria: Administracja i Zarządzanie* 2013;97:89–100.
- [2] Adamowicz E. Dostępność transportowa jako determinanta atrakcyjności inwestycyjnej polskich regionów [Transport accessibility as a determinant of investment attractiveness of Polish regions]. In: Jewtuchowicz A, Rzeńca A, editors. *Współczesne wyzwania miast i regionów [Contemporary challenges of cities and regions]*. Łódź: Wydawnictwo Uniwersytetu Łódzkiego; 2009, p. 263–277.
- [3] *Building Competitive Regions, Strategies and Governance*, Paris: OECD Publishing, Paris; 2005.
- [4] Kwarciański T. Dostępność transportowa jako przedmiot analizy teoretycznej [Transport availability as a subject of theoretical analysis]. *Zeszyty Naukowe Uniwersytetu Szczecińskiego. Problemy transportu i logistyki* 2011;14:53–64.
- [5] Spiekermann K, Neubauer J. *European Accessibility and Peripherality: Concepts, Models and Indicators*. Stockholm: Nordregio; 2002.
- [6] Tarkowski M, editor. *Atrakcyjność inwestycyjna województw i podregionów Polski 2015 [Investment attractiveness of Polish regions and subregions 2015]*, Gdańsk: Instytut Badań nad Gospodarką Rynkową, 2015.
- [7] Nazarko J, Kuźmicz KA, Czerewacz-Filipowicz K. Polska na Nowym Jedwabnym Szlaku. Wskoczyć do jedwabnego pociągu (Poland on the New Silk Road. Jump into the silk train), *Transport Manager* 2016;2:42–47.
- [8] Nazarko J, Kuźmicz KA, Czerewacz-Filipowicz K. The New Silk Road – analysis of the potential of new eurAsian transport corridors, In: Stankevičienė J, Lankauskienė T, editors. *The 9th International Scientific Conference Business and Management 2016: Conference Proceedings*, Vilnius; 2016.

Net working capital management strategies in the construction enterprises listed on the NewConnect market

Janina Jędrzejczak-Gas^a

^aUniversity of Zielona Gora, Faculty of Economics and Management, 50 Podgorna Str., Zielona Gora, 65–785, Poland, e-mail: j.jedrzejczak-gas@wez.uz.zgora.pl

Abstract: The purpose of this article is to identify the Net Working Capital (NWC) management strategies in enterprises operating in the construction sector quoted on the alternative exchange market NewConnect regarded as one of the most positively differentiating similar markets in Europe. It is in the article that the concept of the working capital was discussed, and the strategies for the net working capital management were presented.

The article shows the results of research, carried out on the example of companies of the construction quoted on the NewConnect market. The article shows the concept of identifying NWC management strategies.

The study shows that during the economic downturn, in the surveyed enterprises, moderate-aggressive and aggressive-aggressive strategies were dominant. This means that there was such a level of current assets in these companies that it provided them with an average or high risk of the current operation. In addition, these companies decided on a relatively high share of short-term liabilities, which means that it was important for them to acquire capital at a low cost. Although such activities reduce the level of liquidity, in the surveyed enterprises – despite factual albeit slight liquidity decrease – it still remained at an optimal level.

On the basis of the developed methodology, the types and the number of the management strategies applied by the examined companies were specified. The study covered 2009–2014, i.e. the period of the most severe economic crisis since the fourth decade of the twentieth century.

Keywords: net working capital; strategies of the net working capital management; construction sector.

References

- [1] Leahigh D.J. *Zarządzanie finansami [Financial Management]*. Warszawa: PWE; 1999.
- [2] Brigham EF, Houston JF. *Fundamentals of Financial Management*. 13th ed. Mason, Ohio: South-Western Cengage Learning; 2013.
- [3] Sierpińska M, Wędzki D. *Zarządzanie płynnością finansową w przedsiębiorstwie [Liquidity management in an enterprise]*. Warszawa: PWN; 1999.
- [4] Pluta W, editor. *Finanse małych i średnich przedsiębiorstw [Finance of small and medium-sized enterprises]*. Warszawa: PWE; 2004.
- [5] Gabrusewicz W. *Podstawy analizy finansowej [Basics of financial analysis]*. Warszawa: PWE; 2007.
- [6] Dobija M. *Rachunkowość zarządcza i controlling [Managerial Accounting and Controlling]*. Warszawa: PWN; 2001.
- [7] Wędzki D. *Analiza wskaźnikowa sprawozdania finansowego [Ratio analysis of financial statements]*. Kraków: Oficyna Ekonomiczna; 2006.
- [8] Sectoral indicators. Available online: https://rachunkowosc.com.pl/wskazniki-i-stawki/wskazniki_sektorowe.html; 2016 May.
- [9] Jędrzejczak-Gas J. Zarządzanie kapitałem obrotowym netto w przedsiębiorstwach sektora telekomunikacyjnego notowanych na rynku NewConnect [The net working capital management in the companies of the telecommunication industry quoted on the NewConnect market], *Zeszyty naukowe Uniwersytetu Szczecińskiego. Finanse, Rynki Finansowe, Ubezpieczenia* 2014;804(67): p. 49–59.
- [10] Website: <http://newconnect.pl>.

Major participants in the construction industry and their approaches to risks: a theoretical framework

Xiaohua Jin^a, Guomin Zhang^b, Junxiao Liu^c, Yingbin Feng^a, Jian Zuo^d

^aSchool of Computing, Engineering and Mathematics, Western Sydney University, Kingswood, New South Wales 2747 Australia,
e-mail: xiaohua.jin@westernsydney.edu.au

^bSchool of Civil, Environmental and Chemical Engineering, RMIT University, Melbourne, Victoria, Australia

^cDepartment of Civil Engineering, Curtin University, Perth, Western Australia 6845 Australia

^dSchool of Architecture & Built Environment, Faculty of the Professions, University of Adelaide, Adelaide, South Australia 5000 Australia

Abstract: The construction sector is an important engine for economic development in Australia. A variety of stakeholders is involved in any construction project. Major participants including design teams, clients, contractors and project managers are examples of stakeholders that have the ability to hinder or promote the progress of a construction undertaking. Each participant's approach towards the project is likely to be influenced by its characteristics such as power, interest, and influence as well as their actual role in the project, size, education, experience and time it has been established and its ability to cope with risk. This research is aimed at comparing the major participants of the client, design team, contractor and project manager involved in construction projects based on their characteristics and the risk management approaches they implement. The research will ascertain if there is a correlation between the major participants based on their characteristics and their approach to risk management. The concept of what constitutes an acceptable approach to risk for the participants will be considered in relation to their characteristics. Furthermore, client, design team, contractor and project manager approaches to risk management including the phenomenon of utilizing intuition and experience as a form of risk management will be addressed as a reality or a myth. In this paper, the literature review is reported, and a theoretical framework is introduced.

Keywords: risk management; stakeholders; construction industry; literature review.

References

- [1] Mahamid I. Common Risks Affecting Time Overrun in Road Construction Projects in Palestine: Contractors' Perspective. *Australasian Journal of Construction Economics and Building* 2013;13(2):45–53.
- [2] Ward S, Chapman C. Stakeholders and Uncertainty Management in Projects. *Construction Management and Economics* 2008;26(6):563–577.
- [3] Zavadskas EK, Turskis Z, Tamošaitiene J. Risk Assessment of Construction Projects. *Journal of Civil Engineering and Management* 2010;16(1):33–46.
- [4] Olander S. Stakeholder Impact Analysis in Construction Project Management. *Construction Management and Economics* 2007;25(3):277–287.
- [5] Akintoye AS, MacLeod MJ. Risk Analysis and Management in Construction. *International Journal of Project Management* 1997;15(1):31–38.
- [6] Chan DWM, Chan APC, Lam PTI, Yeung JFY, Chan JHL. Risk Ranking and Analysis in Target Cost Contracts: Empirical Evidence from the Construction Industry. *International Journal of Project Management* 2001;29(6):751–763.
- [7] Zou PXW, Zhang G, Wang J. Understanding the Key Risks in Construction Projects in China. *International Journal of Project Management* 2007;25(6):601–614.
- [8] Carr V, Tah JHM. A Fuzzy Approach to Construction Project Risk Assessment and Analysis: Construction Project Risk Management System. *Advances in Engineering Software* 2011;32(10–11):847–857.
- [9] Bourne L, Walker DHT. Visualizing Stakeholder Influence – Two Australian Examples. *Project Management Journal* 2006;37(1):5–21.
- [10] Jin X-H. A Model for Efficient Risk Allocation in Privately Financed Public Infrastructure Projects Using Neuro-Fuzzy Techniques. *ASCE Journal of Construction Engineering and Management* 2011;137(11):1003–1014.

Study of production scenarios with the use of simulation models

Mateusz Kikolski^a

^aFaculty of Management, Białystok University of Technology, 45A Wiejska Str., Białystok, 15–351, Poland, e-mail:m.kikolski@pb.edu.pl

Abstract: Simulation studies are gaining in popularity and are used in many scientific fields. Implementing computer solutions in production engineering allows reducing costs that an enterprise incurs due to erroneous decisions while planning and modernising production lines. This is also helpful in the reduction of the time required to develop plans for manufacturing new products. This problem is important in manufacturing companies that seek to reduce the volume of stocks while ensuring the continuity of the production process. The article presents possibilities of applying computer simulation models in studying chosen production scenarios. The basic methods of research used in the study were literature studies and computer simulation.

Keywords: computer simulation; modelling; production process; production scenarios; simulation model; Tecnomatix.

References

- [1] Gierulski W, Luściński S, Ryszard S. Symulacja komputerowa procesów logistycznych z wykorzystaniem programu Vensim [Computer simulation of the logistics processes using the program Vensim]. In: Knosala R, editor. *Innowacje w Zarządzaniu i Inżynierii Produkcji*, Opole: Oficyna Wydawnicza Polskiego Towarzystwa Zarządzania Produkcją; 2015, p. 843–854.
- [2] Gordon G. *Symulacja systemów [Systems Simulation]*. Warszawa: Wydawnictwa Naukowo-Techniczne; 1974.
- [3] Naylor TH. *Modelowanie cyfrowe systemów ekonomicznych [Digital modeling of economic systems]*. Warszawa: PWN; 1975.
- [4] Ciszak O. Komputerowo wspomagane modelowanie i symulacja procesów produkcyjnych [Computer aided modelling and simulation of production processes]. *Zeszyty naukowe Politechniki Poznańskiej. Budowa maszyn i zarządzanie produkcją* 2007;6:39–45.
- [5] Glinka M. Badania symulacyjne systemów obsługowych za pomocą programu WinQSB i jego modułu Queuing System Simulation [Simulative research on systems operated by winqsb program and its module Queuing System Simulation], *Logistyka* 2012;3:2637–2640.
- [6] Ignasiak E. *Badania operacyjne [Operational research]*. Warszawa: PWE; 1997.
- [7] Kłos S, Patalas-Maliszewska J. Symulacja przebiegu procesów produkcyjnych w systemach przepływowych w oparciu o oprogramowanie Tecnomatix Plant Simulation [Simulation of production processes in flow systems based on Tecnomatix Plant Simulationsoftware]. In: Knosala R, editor. *Innowacje w Zarządzaniu i Inżynierii Produkcji. Tom II*, Opole: Oficyna Wydawnicza Polskiego Towarzystwa Zarządzania Produkcją; 2016, p. 780–790.
- [8] Weiss Z. *Techniki komputerowe w przedsiębiorstwie [Computer technologies in the enterprise]*. Poznań: Wydawnictwo Politechniki Poznańskiej; 1998.
- [9] Website of Siemens Tecnomatix, http://www.plm.automation.siemens.com/pl_pl/products/tecomatix/production_management/index.shtml.
- [10] Karkula M. Weryfikacja i walidacja dynamicznych modeli symulacyjnych procesów logistycznych [Verification and validation of dynamic simulation models of logistics processes]. *Logistyka* 2012;2:717–726.

Lean building design model

Chien-Ho Ko^a

^aDepartment of Civil Engineering, National Pingtung University of Science and Technology, 1, Shuefu Road, Neipu, Pingtung 91201, Taiwan,
e-mail: ko@mail.npust.edu.tw

Abstract: Improper design in building projects leads to changes in orders, rework, budget overruns, schedule delays, and low constructability, making it a major cause of waste. The objective of this study is to develop a Lean Building Design Model (LBDM) using lean ideas to improve design quality. Waste in traditional design workflow is first identified by using the value stream mapping. Lean methods are then used to reduce the allocated waste. To improve the design quality, concurrent engineering is used to develop a learning environment that integrates design needs between project stakeholders. Feasibility of the proposed LBDM is validated using system dynamics. The analysis shows that the LBDM could improve the design quality, thus enhancing project performances.

Keywords: lean; design; concurrent engineering; building projects.

References

- [1] Gould F, Joyce N. *Construction Project Management*. 3rd ed. New York: Pearson Prentice Hall; 2009.
- [2] Abdelsalam SS, Sritharan S, Suleiman MT. Current design and construction practices of bridge pile foundations with emphasis on implementation of LRFD. *Journal of Bridge Engineering* 2010;15:749–758.
- [3] Josephson PE, Larsson B, Li H. Illustrative Benchmarking Rework and Rework Costs in Swedish Construction Industry. *Journal of Management in Engineering* 2002;18:76–83.
- [4] Günhan S, Arditi D, Doyle J. Avoiding change orders in public school construction. *Journal of Professional Issues in Engineering Education and Practice* 2007;133:67–73.
- [5] Ko CH, Chung NF. Lean design process. *Journal of Construction Engineering and Management* 2014;140(6).
- [6] Mendelsohn R. The Constructability Review Process: A Contractor's Perspective. *Journal of Management in Engineering* 1997;13:17–19.
- [7] Kawamura S. *Integrated design and operation of water treatment facilities*. New York: John Wiley & Sons. NY; 2000.
- [8] Soibelman L, Liu LY, Kirby JG, East EW, Caldas CH, Andlin KY. Design review checking system with corporate lessons learned. *Journal of Construction Engineering and Management* 2003;129:475–484.
- [9] Chang SD, Shi GS, Chou YS. *Courses for Change order and remedy methods in the construction phase*. Grant number 96642, China Engineering Consultants Inc.; 2007 (in Chinese).
- [10] Nysten KO. *Cost of Failure in a Major Civil Engineering Project*. Licentiate Thesis. Royal Institute of Technology; 1996.
- [11] Riley DR, Diller BE, Kerr D. Effects of delivery systems on change order size and frequency in mechanical construction. *Journal of Construction Engineering and Management* 2005;131:953–962.
- [12] Li H, Huang T, Kong CW, Guo HL, Baldwin A, Chan N, Wong J. Integrating design and construction through virtual prototyping. *Automation in Construction* 2008;17:915–922.
- [13] Ko CH, Kuo JD. Making formwork construction lean. *Journal of Civil Engineering and Management* 2015;21:444–458.
- [14] Ko CH, Li SC. Lean concurrent submittal review systems. *KSCCE Journal of Civil Engineering* 2015;19:478–484.
- [15] Liker JK. *The Toyota Way: 14 management principles from the world's greatest manufacturer*. NY: McGraw Hill; 2004.
- [16] Rother M, Shook J. *Learning to see: value-stream mapping to create value and eliminate muda*. MA: Lean Enterprise Institute; 1999.

Effect of the safety stock on the probability of occurrence of stock shortage

János Korponai^a, Ágota Bányainé Tóth^a, Béla Illés^a

^aUniversity of Miskolc, H-3515 Miskolc-Egyetemváros, Hungary, e-mail: janos.korponai@gmail.com

Abstract: To operate, all production companies require the acquisition of items from external resources, and their arrival by the specified deadline. The objective of the logistics management is to guarantee the stock level required for the adequate handling of production at the lowest possible level of costs and risks. During the definition of the optimal stock level of purchased parts, the expenses related to procurement and stock management are important aspects beside the stock level. By using the economic order quantity model, we can define the optimal order quantity, along which our stock management can be guaranteed by the most favourable cost level.

The theoretical approach of the model assumes a deterministic operational environment. In practice, however, there are several unpredictable factors influencing the operation of the production company. The aim of our analyses is to present the relations between the stock level and the risk of shortages. As a result of the research, the introduction of the safety stock is the solution to cover the effects of the uncertain factors in the supply chain. The avoidance of stock shortages would be possible only with the management of an infinite stock level due to the stochastic factors, but it is not feasible in practice. We need to quantify a service level, which determines the accepted probability of the shortage occurrence.

Keywords: safety stock; stock shortage; continuous review; periodic review; service level.

References

- [1] Koltai T. *Termésmenedzsment [Production Management]*, Budapest: Typotex Publisher; 2009.
- [2] Harris FW. How many parts to make at once, *Factory, The Magazine of Management* 1913;10(3):135–136, 152.
- [3] Wagner HM, Whitin TM. Dynamic version of the economic lot size model, *Manage Sci* 1958;5(1):89–96.
- [4] Kummer S, Grün O, Jammermegg W. *Basics of purchasing, production, logistics*, Munich: Pearson Studium; 2009.
- [5] Vörös J. *Termelés – és szolgáltatásmenedzsment [Production and service management]*, Budapest: Akadémia Publisher; 2010.
- [6] Chopra S, Meindl P. *Supply Chain Management: Strategy, Planning, and Operation*, New York: Pearson Prentice-Hall Publishers; 2007.
- [7] Vijayan T, Kumaran M. Fuzzy economic order time models with random demand, *Int J Approx Reason* 2009;50(3):529–540.
- [8] Huang B, Wu A. EOQ model with batch demand and planned backorders, *Appl Math Model* 2016;40(9–10):5482–5496.
- [9] Paknejad J, Nasri F, Affisco JF. Yield improvement and yield variability reduction in an EOQ model with planned shortages and random yield, *Comput Ind Eng* 2015;88:386–394.
- [10] Stockton DJ, Quinn L. Identifying economic order quantities using genetic algorithms, *Int J Oper Prod Man* 1993; 13: 92–103.

Services in the machinery manufacturing sector in Poland

Justyna Kozłowska^a

^aFaculty of Management, Białystok University of Technology, 45A Wiejska Str., Białystok, 15–351, Poland, e-mail: j.kozlowska@pb.edu.pl

Abstract: Nowadays, manufacturing companies increasingly face the problem of fierce market competition. This is partly caused by the continuous and accelerated technology development. Therefore, offering services as an addition to the product, or even shifting to service provision seem interesting and promising means for the manufacturer to become more competitive and distinctive. In the article, the basics of the servitization of the manufacturing industry concept are presented. The issue has been recently widely discussed in academic literature. However, the research on the level or scope of the services integration into the activity of a manufacturing company is usually limited to case studies. The main scientific purpose of the paper is to recognize the kind of services machinery manufacturers in Poland integrate with their products if any. Also, the assessment is made to ascertain whether the number of services offered by manufacture companies depends on the size of the organisation. Data on the machinery manufacturers operating in Poland were drawn from the Emerging Market Information Service (EMIS) database. The first step of the study was the identification of types of services that manufacturing companies offer on the basis of the content of company websites. Then statistic methods were employed to recognize if there were any significant relations between the size of the company and the number and types of services they offer. The analysis enabled to identify thirteen forms of services, which were provided by machinery producers in Poland, with the most popular being the warranty support and industrial services. The research also proved that the number of services that are included in the offer depends on the company size. The limitations of the study are discussed as well.

Keywords: machinery manufacturing; products and services integration; services; servitization of manufacturing.

References

- [1] Central Statistical Office report, *Rynek wewnętrzny w 2014 r [The internal market in 2014]*. Available online: <http://stat.gov.pl/obszary-tematyczne/ceny-handel/handel/rynek-wewnetrzny-w-2014-r-,7,20.html> [25.04.2016].
- [2] The Service Economy. OECD report. Paris: OECD Publishing; 2000.
- [3] Neely AD, Exploring the Financial Consequences of the Servitization of Manufacturing. *Operations Management Research* 2009;2(1):103–118.
- [4] Levitt T. Product-line approach to service. *Harvard Business Review*, 1972;50(5):20–31A.
- [5] Neely D. The Servitization of Manufacturing: An analysis of Global Trends. Conference paper, The 14th European Operations Management Association Conference, Ankara, Turkey. Available online: <http://sampsom.byu.edu/dsimini/proc/docs/2-8190.pdf> [09.06.2016].
- [6] Vandermerwe S, Rada J. Servitization of Business: Adding Value by Adding Services. *European Management Journal* 1988;6:314–324.
- [7] Goedkoop MJ, van Halen CJG, Riele te HRM, Rommens PJM. In: Product Service systems, Ecological and Economic Basics. Report for the Dutch ministries of Environment and Economic Affairs, Bahia: Universidade Federal da Bahia Escola Politécnica; 1999. Available online: <http://teclim.ufba.br/jjsf/indicadores/holan%20Product%20Service%20Systems%20main%20reort.pdf> [30.05.2016].
- [8] Kozłowska J. Product-Service Systems in a manufacturing company strategy – a review paper. *Economics and Management* 2015;7(2):48–56.
- [9] Tukker A. Eight types of product-service system: eight ways to sustainability? Experiences from SusProNet. *Business Strategy and the Environment* 2004;13(4):246–260.
- [10] Central Statistical Office report, *Outlays and results in industry in 2015*, Warsaw 2016. Available online: <http://stat.gov.pl/en/topics/industry-construction-fixed-assets/industry/> [10.06.2016].

Analysis of technology management using the example of the production enterprise from the SME sector

Elzbieta Krawczyk-Dembicka^a

^aFaculty of Management, Białystok University of Technology, 45A Wiejska Str., Białystok, 15–351, Poland, e-mail: e.dembicka@pb.edu.pl

Abstract: The method of managing technologies in manufacturing enterprises primarily depends on the size of the company and its organisational structure. Not without significance remains a way of understanding the definition of technology. The main purpose of this paper is the identification and analysis of the factors influencing the manner technologies are managed in small production enterprises within the metalworking industry. The research process is based on a case study of an enterprise. The received results will help to enhance knowledge related to the development of methods used for technology management in production enterprises.

Keywords: case study; metalworking industry; production enterprise; SME sector; technology management.

References

- [1] Dosi G. *Technical Change and Industrial Transformation*. London: The Macmillan Press Ltd.; 1984.
- [2] Ejdyś J, Ustinovicus L, Stankevičienė J. Innovative application of contemporary management methods in a knowledge-based economy – interdisciplinarity in science. *Journal of Business Economics and Management* 2015;16(1):261–274.
- [3] Gregory MJ. Technology management: a process approach. *Proceedings of the Institution of Mechanical Engineers* 1995;209:347–356.
- [4] Halicka K. Innovative Classification of Methods of The Future-Oriented Technology Analysis. *Technological and Economic Development of Economy* 2016;22(4):574–597.
- [5] Łunarski J. *Zarządzanie technologiami. Ocena i doskonalenie [Technology management. Evaluation and improvement]*. Rzeszów: Oficyna Wydawnicza Politechniki Rzeszowskiej; 2009.
- [6] Mazurkiewicz A, Belina B, Poteralska B, Giesko T, Karsznia W. Universal methodology for the innovative technologies assessment. In: Dameri RP, Beltrametti L, editors. *Proceedings of the 10th European Conference on Innovation and Entrepreneurship*; 2015, p. 458–467.
- [7] Pelsler TG, Prinsloo JJ. Technology management and the link with technology strategy and company performance. *Journal of Global Business and Technology* 2014;10(2).
- [8] Santarek K, editor. *Transfer technologii z uczelni do biznesu. Tworzenie mechanizmów transferu technologii [Technology transfer from universities to business. Creating mechanisms for technology transfer]*. Warszawa: Polska Agencja Rozwoju Przedsiębiorczości; 2008.
- [9] Song M, Zhao YL, Di Benedetto CA. Do perceived pioneering advantages lead to first-mover decisions? *Journal of Business Research* 2013;66(8):1143–1152.
- [10] *Task Force on Management of Technology, National Research Council (U.S.) Cross-Disciplinary Engineering Research Committee; National Research Council (U.S.) Manufacturing Studies Board: Management of Technology: the hidden competitive advantage*. Washington: National Academy Press Washington, D.C.; 1987.

Comprehensive approach to efficient planning of formwork utilization on the construction site

Anna Krawczyńska-Piechna^a

^aFaculty of Civil Engineering, Mechanics and Petrochemistry, Warsaw University of Technology, 17 Łukasiewicza Str., 09–400 Plock, Poland, e-mail: krawczynskaa@pw.plock.pl

Abstract: The paper presents a consistent approach to concrete works planning, which begins with formwork selection and ends with project scheduling, where formwork availability and utilization efficiency are analysed. To work out the first problem (the problem of formwork selection), selected MCDA methods are recommended. In order to apply them, the decisive criteria were recognized with a structured survey sent to contractors. Interactive computer simulations are, in turn, thought to be the most versatile tool to solve the second issue, i.e. the problem of concrete works scheduling. In the proposed method, in each step of the algorithm, the developed simulator informs the planner about formwork utilization efficiency and generates queries to the decision-maker, who is able then to accept or withdraw the decision, if the efficiency is unsatisfactory. The efficiency of formwork utilization is measured with a virtual cost of formwork under utilization, so when the formwork is available on the construction site but remains unused or when it should be struck but remains unremoved from the construction. Such measure was determined, after having analysed various criteria of schedule quality and optimality assessment. The described approach is illustrated with appropriate examples.

Keywords: formwork, monolithic concrete works, interactive planning, efficiency of formwork utilization.

References

- [1] Krawczyńska-Piechna A. Interaktywna metoda planowania robót betonowych z analizą wykorzystania deskowań systemowych. Rozprawa doktorska [An interactive method for concrete works planning with formwork utilization's efficiency analysis. PhD Thesis]. Warsaw University of Technology; 2016.
- [2] Krawczyńska-Piechna A. Application of TOPSIS method in formwork selection problem, *Applied Mechanics and Materials* 2015;797:101–107.
- [3] Kapliński O. *Metody i modele badań w inżynierii przedsięwzięć budowlanych [Research methods and models in project engineering]*. Warszawa: Komitet Inżynierii Lądowej i Wodnej PAN, 2007.
- [4] Marcinkowski R, Krawczyńska A. Wybór systemu i planowanie wykorzystania deskowań w wykonawstwie monolitycznych konstrukcji betonowych [Formwork selection and formwork utilization planning in monolithic concrete works performance]. *Przegląd Budowlany* 2009;3:53–59.
- [5] Biurk S, Jaśkowski P. Dobór elementów deskowania ścian z uwzględnieniem kryteriów ekonomicznych [Economic criteria for the selection of wall formwork]. *Budownictwo i Architektura* 2013;12(1):7–14.
- [6] Hanna AS, Willenbrock JH, Sanvido VE. Knowledge acquisition and development for formwork selection system. *J. Construction Engineering and Management* 1992;118(1):179–198.

Prediction method for winding parameters in label converting process with data mining tools

Krzysztof Krystosiak^a

^aFaculty of Production Engineering, Warsaw University of Technology, 85 Narbutta Str., Warsaw, 02–524, Poland, e-mail: k.krystosiak@wip.pw.edu.pl

Abstract: Winding quality of rolls on every stage of the process and beam quality are essential to achieving the optimal quality of shrink sleeve labels and roll-to-roll (R2R) winding process without any problems. In the case of the quality, it should be noted that significant factors that have an influence on the winding quality are initial tension parameters and the winding speed, which maintains the appropriate web tension in the process. The winding quality issues indicate one basic problem, which is incorrect tension parameters setup on converting machines. There are two problems related to incorrect tension parameters: the tension, which is either too high or too low. Both of them are causes for the occurrence of different defects.

This paper describes how developed models of data mining tools can be used for the prediction of initial tension parameters and winding speed for each new design of shrink sleeve labels. Every design of shrink sleeve label has a lot of factors. Some of them are more significant than others. The aim of this paper is to choose significant factors and build a model in the learning process using the collected data. Finally, when a model is computed, it can be used for prediction of key winding parameters of each new design of a shrink sleeve label. This saves time for experimental selection during the conversion of winding parameters such as tension and speed and minimizes the risk of occurrence of defects with incorrect winding parameters.

Keywords: data mining techniques; shrink sleeve labels; winding quality.

References

- [1] *Flexography: Principles and Practices*. 5th ed. Foundation of Flexographic Technical Association, Inc.; 1999.
- [2] Forum for Shrink Sleeve Technology Development in Poland; website: <http://www.forumsleeve.pl/>.
- [3] *Heat Shrink Sleeve Label Technical Manual & Test Methods*. Amsterdam: AWA Alexander Watson Associates; 2014.
- [4] Knosala R. *Applications of Artificial Intelligence in Production Engineering*. Warsaw: WNT; 2002.
- [5] Krystosiak K, Werpachowski W. Doskonalenie poziomu jakości opakowań z nadrukiem [The Improvements of the Quality Level of Packaging with Overprint]. *Economics and Organization of Enterprise* 2013;11:55–64.
- [6] Krystosiak K, Werpachowski W. *Zaawansowane metody eksploracji danych kluczem do doskonalenia procesu produkcji etykiet termokurczliwych [Advanced Data Mining Methods as a Key to Improvement of Shrink Sleeve Labels Production Process]*. Conference „Product & Packaging – Contemporary Challenges 2014”; Lodz University of Technology; 2014.
- [7] Roisum DR. How to measure roll quality. *Tappi Journal* 1988;71(10):91–103.
- [8] Tadeusiewicz R. *Neural networks*. Warsaw: Academic Publishing House; 1993.
- [9] Walker TJ. Stress & Strain. *Paper, Film & Foil Converter* 2009;6.
- [10] Walker TJ. What Is The Right Tension? *Paper, Film & Foil Converter* 2009;12.

Methodology for assessing the factors affecting the quality and efficiency of flexographic printing process

Jan Lipiak^a

^aFaculty of Production Engineering, Warsaw University of Technology, 85 Narbutta Str., Warsaw, 02–524, Poland, e-mail: janlipiak@etigraf.pl

Abstract: This paper is a theoretical-research case study. The main objective is to determine the methodology for assessing key factors which affect the quality and efficiency of a flexographic printing process. The aims of the research targets also involve: (1) identifying the basic methods of assessing the effectiveness, selection and prioritization of basic criteria, measurement and evaluation of indicators; stimulating improvement in the overall efficiency of the company; (2) developing modern design solutions in order to achieve the optimal level of production quality, according to current needs and market expectations; (3) offering modern organizational and technical solutions as well as an estimate of existing reserves with innovative implementations.

The subject of theoretical considerations is quality evaluation and basic information about efficiency method evaluation, like OEE, SMED and other. The article also presents an evaluation survey of the quality level of printing requirements for customers, conducted by the author. The results of the survey were summarized in a matrix called “quality house”, or QFD. In effect, the outcomes of research process led to practical implications. The essence of the proposed approach was to determine if the methods mentioned above can be useful for verifying both the quality level of printing products and the efficiency of production processes. The presented results reveal that those methods are suitable as advanced tools for measuring the quality and efficiency level of manufactured products and the production processes, which also improve customer satisfaction.

Keywords: efficiency; flexographic printing; labels; OEE; QFD; SMED.

References

- [1] Ejsmont K, Krystosiak K, Lipiak J. Zastosowanie wybranej techniki eksploracji danych w przemyśle poligraficznym [Application of Selected Data Mining Technique in Printing Industry]. In: Knosala R, editor. *Innowacje w Zarządzaniu i Inżynierii Produkcji. Tom II*, Opole: Oficyna Wydawnicza Polskiego Towarzystwa Zarządzania Produkcją; 2015, p. 75–86.
- [2] Ejsmont K., Lipiak J., Zastosowanie controllingu w przedsiębiorstwie poligraficznym – studium przypadku [Application of controlling in the printing company – study case]. In: Budzik R, editor. *Produkcja i Zarządzanie w Przemysle*, Częstochowa: Oficyna Wydawnicza Politechniki Częstochowskiej, 2016.
- [3] Lipiak J. Program TPM w przedsiębiorstwie poligraficznym. Studium przypadku [TPM program in the printing company. Study case]. *Opakowanie* 2015;2:62–66.
- [4] Lipiak J, Ejsmont K. Wdrażanie metody SMED w przedsiębiorstwie poligraficznym [Implementation of SMED method in printing company]. *Economics and Organization of Enterprise* 2015;4(783):104–116.
- [5] Lipiak J., Werpachowski W. Wykorzystywanie filozofii Kaizen w przedsiębiorstwach opakowaniowych [Using of Kaizen philosophy in the packaging companies]. *Economics and Organization of Enterprise* 2015; 8(787):43–53.
- [6] Lipiak J, Ejsmont K. Problematyka obliczania wskaźnika OEE dla maszyn fleksograficznych – studium przypadku [The problem of calculating the OEE for flexo presses – study case]. In: Knosala R, editor. *Innowacje w Zarządzaniu i Inżynierii Produkcji. Tom II*, Opole: Oficyna Wydawnicza Polskiego Towarzystwa Zarządzania Produkcją; 2016, p. 594–605.
- [7] Maciak J. 2010, Redukcja czasu przebrojenia maszyny przy użyciu techniki SMED [Reduction of machine changeover time using of SMED technique]. In: Knosala R, editor. *Komputerowo zintegrowane zarządzanie*, vol. II, Zakopane, p. 188–195.
- [8] Shingo S. *A revolution in manufacturing: the SMED system*. Portland – Oregon: Productivity Press;1985.
- [9] Wolak D, Lipiak J. Wykorzystanie metody QFD do oceny jakości produkcji w przedsiębiorstwie poligraficznym [Application of QFD method for production quality evaluation in the printing company]. *Economics and Organization of Enterprise* 2015;11(790).
- [10] Womack JP, Jones DT. Odchudzenie firm. Eliminacja marnotrawstwa – kluczem do sukcesu [Lean Enterprise. Waste Elimination – key to success], Warszawa: Centrum Informacji Menadżera; 2001.

Wind energy and multi-criteria analysis in making decisions on the location of wind farms

Grażyna Łaska^a

^aBiałystok University of Technology, 45A Wiejska Str., Białystok, 15–351, Poland, e-mail: g.laska@pb.edu.pl

Abstract: The paper presents a discussion on different methods of multi-criteria analysis and different rules of proceeding that have to be taken into account when making a decision regarding the location of a wind farm in the NE Poland. In the study, six multi-criteria analyses were discussed taking into account the main criteria, on which they are based: utility functions (MAUT, AHP, DEMATEL), relationships outranking (ELECTRE, PROMETHEE), and decision support (Borda ranking methods). Considering 9 criteria that should be met by the localisation of 14 wind turbines in Michałowo commune, the main three criteria (C3, C8, C9) were found to differentiate localisation of 6 wind turbines (T-3, T-5, T-6, T-11, T-13, T-14), according to two variants (I and II) of their localisation. The Borda method proved that from among the two variants considered, the second variant W II is considered a more suitable localisation of wind turbines than the first variant W I. The variant W II had a higher altitude of the terrain (C3) and less risk of impact on bird (C8) and bat species (C9) compared to the variant W I.

Keywords: Michałowo commune; 14 turbines; criteria; decision support; Borda ranking methods; optimum variant; objective result; sustained technologies.

References

- [1] Figueira J, Greco S, Ehrgott M. *Multiple criteria decision analysis: State of the art surveys. International Series in Operations Research & Management Science*. Boston: Springer Science+Bussines Media; 2005.
- [2] Saaty TL. The Analytic Hierarchy and Analytic Network Processes for the measurement of intangible criteria and for decision-making. In: Figueira J, Greco S, Ehrgott M, editors. *Multiple criteria decision analysis: State of the art surveys*. Boston; 2005, p. 345–405.
- [3] Vaidya OS, Kumar S. Analytic Hierarchy Process: an overview of applications. *European Journal of Operational Research* 2006;169(1):1–29.
- [4] Vidal LA, Marle F, Bocquet J-C. Using a Delphi process and the Analytic Hierarchy Process (AHP) to evaluate the complexity of projects. *Expert Systems with Applications* 2011;38(5):5388–5405.
- [5] Chiu YJ, Chen HC, Tzeng GH, Shyu JZ. Marketing strategy based on customer behavior for the LCD-TV. *International Journal of Management and Decision Making* 2006;7(2/3):143–165.
- [6] Tzeng GH, Chiang CH, Li CW. Evaluating intertwined effects in e-learning programs: A novel hybrid MCDM model based on factor analysis and DEMATEL. *Expert Systems with Applications* 2007;32(4):1028–1044.
- [7] Lin CL, Tzeng GH. A value-created system of science (technology) park by using DEMATEL. *Expert Systems with Applications* 2009;36:9683–9697.
- [8] Figueira JR, Greco S, Roy B, Slowinski R. ELECTRE methods: main feature and recent developments. *Applied Optimization* 2010;103:1–39.
- [9] Peng Y, Wang G, Wang H. User preferences based software defect detection algorithms selection using MCDM. *Information Sciences* 2012;191:3–13.
- [10] Behzadian M, Kazemzadeh RB, Albadvi A, Aghdasi M. PROMETHEE: A comprehensive literature review on methodologies and applications. *European Journal of Operational Research* 2010;200:198–215.

Phenomenon of uncertainty in the process of holistic anticipation of non-deterministic reality

Andrzej Magruk^a

^aFaculty of Management, Białystok University of Technology, 45A Wiejska Str., Białystok, 15–351, Poland, a.magruk@pb.edu.pl

Abstract: Uncertainty is one of the most important features of many areas of social and economic life, especially in the forward-looking context. On the one hand, the degree of uncertainty is associated with the objective essence of the randomness of the phenomenon, on the other hand, with the subjective perspective of a man, or a system as a human's product. The right decisions are not always equivalent to good results. Sometimes, the decision taken in accordance with general rules brings worse results than the one who breaks them. Such a situation is possible as a result of the uncertainty accompanying the predictions of the future. In order to significantly reduce the uncertainty in the current decision-making (by ordering the knowledge of the present tense), an entity can centre their actions around the future through the foresight actions. The research problem in this paper is focused on the identification of sources of uncertainty with the future research, in particular, the foresight research. This article attempts to answer the following research question: "What factors and methods of foresight methodology enable the identification, analysis and minimization of the effects of uncertainty in the process of holistic inquiry of the future?". The study uses the results of analysis methods and criticism of literature as main research methods. On this basis, the author conducted deductive reasoning.

Keywords: uncertainty; foresight; future; system; unexpected events.

References

- [1] Bojarski W. Zagadnienia nieokreśloności wielkich systemów i niepewności [Indeterminacy issues of great systems and uncertainties]. In: Bojarski W. *Metody modelowania i optymalizacji systemów energetycznych w warunkach niepewności*, Wrocław: PAN, Ossolineum; 1981.
- [2] Halicka K. Innovative Classification of Methods of The Future-Oriented Technology Analysis. *Technological and Economic Development of Economy* 2016;22(4):574–597.
- [3] Halicka K, Designing routes of development of renewable energy technologies. *Procedia – Social and Behavioral Sciences* 2014;156:58–62.
- [4] Nazarko J, Ejdys J, Kononiuk A, Gudanowska A, Magruk A, Nazarko Ł, *Badanie ewaluacyjne projektów foresight realizowanych w Polsce [Evaluation study of foresight projects implemented in Poland]*. Warszawa: Ministerstwo Nauki i Szkolnictwa Wyższego; 2012.
- [5] Janasz K, Ryzyko i niepewność w gospodarce – wybrane aspekty teoretyczne [Risk and uncertainty in the economy – selected theoretical aspects]. *Studia i Prace Wydziału Nauk Ekonomicznych i Zarządzania* 2009;14: 87–98.
- [6] Kononiuk A., Analiza STEEPVL na przykładzie projektu Foresight technologiczny. „NT FOR Podlaskie 2020” Regionalna strategia rozwoju nanotechnologii, *Economics and Management* 2010; 2(4): 105–115.
- [7] Magruk A. The process of selection of the main research methods in foresight from different perspectives. *Business, Management and Education* 2013;13(2):234–248.
- [8] Magruk A. Innovative classification of technology foresight methods. *Technological and Economic Development of Economy* 2011;17(4):700–716.
- [9] Samecki W. *Ryzyko i niepewność w działalności przedsiębiorstwa przemysłowego [Risks and uncertainties in the industrial company's activity]*. Warszawa: Państwowe Wydawnictwo Ekonomiczne; 1967.
- [10] Zawila-Niedźwiecki J. Niepewność w Zarządzaniu [Uncertainty in management]. *Zeszyty Naukowe. Prace Instytutu Ekonomiki i Organizacji Przedsiębiorstw* 2007;50(1): 253–259.

Plasticity of flat bars in platform gratings

Przemysław Maksymiuk^a, Bazyli Krupicz^a, Paweł Krupicz^b

^aBiałystok University of Technology, 45A Wiejska Str., Białystok, 15-351, Poland, e-mail: b.krupicz@pb.edu.pl

^bEQOS Energie Polska sp. z o.o.

Abstract: The aim of the paper is to study the difference in the R_e yield point and the ultimate R_m tensile strength in steel-sheet S235JR, samples taken from the outer and middle part of the top layer and the inner part of the circle. The mentioned material characteristics determine the bearing capacity and the stiffness of platform gratings of a certain construction. The samples were cut out at 0° , 45° , and 90° angles in relation to the steel-sheet rolling direction. The differences in the R_e and R_m values may be due to non-identical steel-sheet cooling times in different areas of the circle and the strain hardening of the pieces during flattening. The chemical composition and the structure of the flat bars were studied.

The acquired data answer the question whether there are significant differences in the R_e yield point of the samples from the outer and middle part of the sheets taken from the top layer (1) and the inner part of the circle (2). The flat bars of the platform gratings are cut out in the direction of the sheet rolling; hence, the quantitative analysis concerned this direction. It was found that the R_e yield point in case of the ($\alpha=0^\circ$) rolling direction is higher in sheet (2) than in sheet (1) by about 7.7% in the outer part and by about 1.6 % in the middle part. There are slight differences of 0.6% observed on the width of the sheet (2) between the middle and the outer part. In all cases, R_e yield point in the ($\alpha=0^\circ$) rolling direction is higher than in the $\alpha=45^\circ$ and 90° direction. R_m tensile strength on the width of sheets (1) and (2) is smaller in the middle section and does not exceed 2%. In the (0°) rolling direction, the R_e of the (inner) sheet (2) is higher by 1.8% compared with the (top) sheet (1). The different time of steel circle cooling and the plastic strain due to the grating production technology did not cause worse values compared with the ones quoted in the certificate.

Keywords: pressed platform gratings; steel-sheet coils; 235JR steel.

References

- [1] Sondej M. Kraty pomostowe w ujęciu norm i obliczeń numerycznych [Numerical analysis and design codes of steel gratings]. *Zeszyty Naukowe Politechniki Gdańskiej, Inżynieria Lądowa i Wodna I* 2012; 625:107–117.
- [2] Skowroński W, Włóka A, Chmiel R. Modelling of strength processes of S235JR steel at increased temperature. *Structure and Environment* 2014;6:32–37.
- [3] Chen J, Young B. Stress strain curves of stainless steel at elevated temperatures. *Engineering Structure* 2006;28:229–239.
- [4] Kossakowski PG. Simulation of ductile fracture of S235JR steel using computational cells with microstructurally-based length scales. *Journal of theoretical and applied mechanics* 2012;50:589–607.
- [5] Shokrieh MM, Heidari-Rarani M. Analysis of Fibreglass Reinforced Plastic Moulded Grating. *Iranian Polymer Journal* 2007;16:511–520.

Organisational and legal barriers in shaping the final value of construction contracts

Wiesław Matwiejczuk^a, Tomasz Matwiejczuk^b, Anna Michna^c

^a Faculty of Management, Białystok University of Technology, 45A Wiejska Str., Białystok, 15–351, Poland, e-mail: w.matwiejczuk@pb.edu.pl

^b University of Finance and Management in Białystok, 40 Ciepła Str., Białystok, 15–472, Poland

^c Faculty of Organization and Management, Silesian University of Technology, 26 Roosevelta Str., Zabrze, 41–800, Poland

Abstract: Choosing the method of organisation and the form of project management is one of the most important decisions affecting the efficiency and effectiveness of the entire investment process. Project management forms, based for instance, on FIDIC procedures, performing well in the European context, show many gaps and ambiguities hindering the efficient completion of contracts under the Polish system. The interpretation of rules governing the determination of the value of additional works, identified during contract implementation, is particularly difficult and creates many problems. These additional costs are not included in the contract price and can be significantly high, especially in road construction projects where terrain conditions are usually unpredictable. They raise the contract value, which often leads to exceeding the planned budget and deficit of financial resources secured to fund the project. The aim of the article is to identify barriers creating impediments to efficient project completion that result mainly from an erroneous interpretation of the rules for calculating the final value of performed construction works. Taking the selected case study of a road construction contract as an example, some factors were unearthed making it difficult to shape the relations between the investor and the contractor on an equal basis. The analysis and proposals will contribute to defining organisational conditions of the efficient and effective management of the investment process and will be useful for improving the legal provisions regulating obligations of investment process participants.

Keywords: investment process; investment project management; contract value; FIDIC procedures.

References

- [1] European Commission. *Project Cycle Management*. Brussels, Belgium: Europe Aid Co-operation Office, General Affairs, Evaluation; 2001.
- [2] Adams JR, Brandt SE. Behavioral Implications of the Project Life Cycle. In: Cleland DI, King WR, editors. *Project Management Handbook*, New York: Van Nostrand Reinhold Co.; 1983, p. 222–245.
- [3] Pinto JK, Slevin DP. Critical Success Factors Across The Project Life Cycle. *Project Management Journal* 1988;19(3):67–74.
- [4] Burton C, Michael N. *Zarządzanie projektem [Project Management]*. Wrocław: Wydawnictwo ASTRUM; 1999.
- [5] Behrens W, Hawranek PM. *Poradnik przygotowania przemysłowych studiów feasibility [Feasibility study preparation guide]*. Warszawa: United Nations Industrial Development Organization; 1993.
- [6] Grzybowski W. *Warianty wdrożeń PPP – różnice i zastosowanie [Public Private Partnership Deployment Variants – differences and implementations]*. Warszawa: Dolnośląska Grupa Doradcza; 2006.
- [7] Piłiszka J, editor. *Zastosowanie warunków kontraktowych FIDIC przy realizacji projektów w ramach Zintegrowanego Programu Operacyjnego Rozwoju Regionalnego. Podręcznik stosowania [Implementation of FIDIC contract conditions in projects realization for Integrated Operation Program of Podlaskie Regional Development Program]*, Warszawa: Ministerstwo Rozwoju Regionalnego; 2006.
- [8] *Warunki kontraktu na budowę dla robót budowlanych i inżynierskich projektowanych przez Zamawiającego. [Contract conditions for construction and engineering works]*. COSMOPOLI CONSULTANTS, english-polish edition, 2000. Translation of the first edition FIDIC 1999 (Fédération Internationale des Ingénieurs-Conseils).
- [9] Boczek Z. Procedury FIDIC w realizacji inwestycji [FIDIC procedures in investment realization]. *Buduj z głową. Kwartalnik kosztorysanta* 2003;2.
- [10] Dziadosz A, Tomczyk A, Kapliński O. Financial risk estimation in construction contracts. *Procedia Engineering* 2015;122:120–128.

Towards Lean Production in Industry 4.0

Beata Mrugalska^a, Magdalena Krystyna Wyrwicka^a

^aFaculty of Engineering Management, Poznan University of Technology, 11 Strzelecka Str., Poznan, 60–695, Poland, e-mail: beata.mrugalska@put.poznan.pl

Abstract: Lean Production principles were published in the early 1990s. Since then they have become widely recognized and accepted in the industrial setting. They concern the strict integration of humans in the manufacturing process, a continuous improvement and focus on value-adding activities by avoiding waste. However, in order to achieve it, the commitment is required from everyone in the organisation, i.e. people should feel respected, the production should be leveled and Just-in-Time, whereas the quality should be built into the whole manufacturing process. Recently, a new paradigm called Industry 4.0 or the fourth industrial revolution has emerged in the manufacturing sector. It refers to the process optimization, which is driven by cloud computing, Internet of Things, real-time sense-and-response technologies, cloud-based services, big data analytics, robotics, artificial intelligence, and 3D printing. It allows creating a smart network of machines, products, components, properties, individuals and ICT systems in the entire value chain to have an intelligent factory. So, now a question arises if and how these two approaches can coexist and support each other.

This paper gives an overview of the existing possibilities and examples for combining the information technology and Lean Production. Moreover, it shows how Industry 4.0 can add value to Lean Production in the future.

Keywords: industry 4.0; lean automation; lean production; production management.

References

- [1] Womack JP, Jones DT. *Lean thinking: banish waste and create wealth in your corporation*. New York: Simon and Schuster; 1996.
- [2] Wyrwicka MK, Mrugalska B. Barriers to eliminating waste in production system. In: Ejdys J, Chua D, Smallwood J, *Proceedings of the 6th international conference on engineering, project, and production management*, Australia: Griffith School of Engineering; 2015, p. 354–363.
- [3] Shah R, Ward P. Lean manufacturing: context, practice bundles, and performance. *Journal of Operations Management* 2003;21:129–149.
- [4] Hobbs DP. *Lean manufacturing implementation: a complete execution manual for any size manufacturer*. Boca Raton: Ross Publishing; 2004.
- [5] Bicheno J, Holweg M. *The lean toolbox*. Buckingham: PICSIE Books; 2009.
- [6] Wyrwicka MK. Kultura techniczna a rozwój przedsiębiorstwa [Technical culture and development of enterprise]. In: Szymańska K, editor. *Kultura organizacyjna we współczesnych organizacjach [Organizational culture in contemporary enterprises]*, Lodz: Publishing House of Lodz University of Technology; 2014, p. 66–75.
- [7] Schmitt M, Meixner G, Gorecky D, Seissler M, Loskyll M. Mobile interaction technologies in the factory of the future. *Analysis, Design, and Evaluation of Human-Machine Systems*. 2013;12(1):536–542.
- [8] Gorecky D, Schmitt M, Loskyll M. Human-machine-interaction in the industry 4.0 era. In: *12th IEEE International Conference on Industrial Informatics (INDIN)*, Porto Alegre, Brazil; 2014, p.289–294.
- [9] Posada J, Toro C, Barandiaran I, Oyarzun D, Stricker D, de Amicis R, Pinto EB, Eisert P, Döllner J, Vallarino I. Visual computing as a key enabling technology for Industrie 4.0 and industrial internet. *Computer Graphics and Application, IEEE* 2015;35(2):26–40.
- [10] Kolberg D, Zühlke D. Lean automation enabled by Industry 4.0 technologies. *IFAC-PapersOnLine* 2015;48(3):1870–1875.

Introduction to the STEEPVL analysis of the New Silk Road initiative

Joanicjusz Nazarko^a, Katarzyna Anna Kuźmicz^a

^aFaculty of Management, Białystok University of Technology, 45A Wiejska Str., Białystok, 15–351, Poland, e-mail: k.kuzmicz@pb.edu.pl

Abstract: The Chinese New Silk Road (NSR) initiative seems to be the greatest logistics endeavor of our times. It encompasses the rail and sea connection between Asia with Europe. Successfully implemented, the initiative will significantly change the transportation of goods on the route China–Europe, Europe–China. It will boost infrastructure investments and create many new political, economic and social relations. Therefore, the analysis of the possibilities of NSR development is of a great interest of those engaged in Euro–Asian markets and all the countries on the route.

The primary aim of the study is to determine the factors influencing the development of the rail part of the NSR. The methodology of the paper includes a desk research about the NSR potential and identification of STEEPVL analysis factors shaping the NSR. The STEEPVL analysis is a method of strategic management. The factors are grouped into seven dimensions: social, technological, economic, ecological, and political, and related to values and legal aspects. They constitute factors that can either enhance, accelerate or hamper the success of the NSR. The outcomes of the study comprise the introduction to the complete STEEPVL analysis.

Keywords: New Silk Road; STEEPVL analysis; supply chains; transport corridor.

References

- [1] Clover Ch, Hornby L. China's Great Game: Road to a new empire, *Financial Times*, October 12, 2015.
- [2] Zuokui L. *The role of Central and Eastern Europe in building of Silk Road economic belt*, China-CEEC Think-Thanks Network. Available online: <http://16plus1-thinktank.com/1/20160111/1096.html> [11.01.2016].
- [3] Lo Ch. China's Silk Road strategy, *The International Economy* 2015;Fall:54–55,71.
- [4] Nazarko J, Kuźmicz KA, Czerewacz-Filipowicz K. *The New Silk Road – Analysis of the potential of new Eurasian transport corridors*, In: Stankevičienė J, Lankauskienė T, editors. *The 9th International Scientific Conference Business and Management 2016: Conference Proceedings*, Vilnius; 2016.
- [5] Sahbaz U. The Modern Silk Road: One Way or Another?, *On wider Europe, Black Sea Trust for Regional Cooperation* 2014;January.
- [6] World Bank Logistic Performance Index, <https://lpi.worldbank.org/> [15.05.2016].
- [7] Rodemann H, Templar S. The enablers and inhibitors of intermodal rail freight between Asia and Europe. *Journal of Rail Transport Planning & Management* 2014;4:70–86.
- [8] Loveridge D. The STEEPV acronym and process – a clarification, *Ideas in Progress* 2002. Paper Number 29, The University of Manchester, PREST Policy Research in Engineering, Science and Technology.
- [9] Erickson T, Ritchey T. *Scenario Development and Force Requirements using Morphological Analysis*, Swedish Defence Research Agency (FOI). Available online: <http://ftp.rta.nato.int> [03.05.2014].
- [10] Nazarko J, Kędzior Z, editors. *Uwarunkowania nanotechnologii w województwie podlaskim. Wyniki analiz STEEPVL i SWOT [Determinants of the nanotechnology development in the Podlaskie region: results of the SWOT and STEEPVL analyses]*. Białystok: Oficyna Wydawnicza Politechniki Białostockiej; 2010.
- [11] Kononiuk A. Analiza STEEPVL na przykładzie projektu Foresight technologiczny. „NT FOR Podlaskie 2020” Regionalna strategia rozwoju nanotechnologii [The application of STEEPVL analysis in the project Technology foresight. 'NT FOR Podlaskie 2020'. Regional strategy of nanotechnology development], *Economy and Management* 2010;4:105–115.
- [12] Nazarko J. *Regionalny foresight gospodarczy. Metodologia i instrumentarium badawcze [Regional economic foresight. Methodology and research instruments]*. Warszawa: ZPWim; 2013.
- [13] Mendonca S, Cuhna MP, Kaivo-Oja J, Ruff F. Wild cards, weak signals and organizational improvisation. *Futures* 2004;36:201–218.
- [14] Wikipedia, http://en.wikipedia.org/wiki/PEST_analysis [15.05.2016].
- [15] Nazarko J, Kononiuk A. The critical analysis of scenario construction in the Polish foresight initiatives, *Technological and Economic Development of Economy* 2013;19(3):510–532.
- [16] Yiping H. The Silk Road Initiative: China's New Economic Diplomacy?, *China International Studies* 2015;March/April:45–54.

Future-Oriented Technology Assessment

Łukasz Nazarko^a

^aFaculty of Management, Białystok University of Technology, 45A Wiejska Str., Białystok, 15-351, Poland, e-mail: l.nazarko@pb.edu.pl

Abstract: The purpose of this paper is to develop a concept of Future-Oriented Technology Assessment (FOTA) as a particular form of Technology Assessment (TA) which is focused on the examination of the impact of emerging technologies that is considerably delayed in time, indirect and thus difficult to anticipate. In the article the author attempts to create a coherent conceptual system comprising Future-Oriented Technology Assessment (FTA), Future-Oriented Technology Analysis and Responsible Research and Innovation (RRI). The deliberations are based on the literature review, bibliometrics and the logical construction method. The paper is expected to provide grounding for further research on the objectives, methods, stakeholders, results and best practices of Future-Oriented Technology Assessment. In the context of the rising importance of the Responsible Research and Innovation idea, Future-Oriented Technology Assessment is discussed as a potentially effective tool to pursue policy goals within RRI agenda.

Keywords: technology assessment, Future-Oriented Technology Analysis, Responsible Research and Innovation, foresight, innovation policy

References

- [1] Belina B, Mazurkiewicz A, Giesko T, Karsznia W. Tracking and predicting solution development in R&D projects using a complex assessment method. *Economics and Management* 2015; 7(3):7–14.
- [2] Ejdys J. *Regionalny foresight gospodarczy. Scenariusze rozwoju lokalnego. [Regional business information foresight. Local development scenarios]*. Warszawa: Związek Pracodawców Warszawy i Mazowsza; 2013.
- [3] Ejdys J. Overcoming problems associated with uncertainty of the environment by using foresight approach. *Economics and Management* 2013; 18(2):331–339.
- [4] Ejdys J, Ustinovičius L, Stankevičienė J. Innovative application of contemporary management methods in a knowledge-based economy–interdisciplinarity in science. *Journal of Business Economics and Management* 2015; 16(1):261–274.
- [5] Halicka K. Innovative classification of methods of the Future-oriented Technology Analysis. *Technological and Economic Development of Economy* 2016; 22(4):574–597.
- [6] Gudanowska AE. Tworzenie mapy wiedzy opartej na tematyce projektów badawczo-rozwojowych na przykładzie województwa podlaskiego [Creating knowledge maps based on the themes of R&D projects on the example of the Podlaskie region]. *Economics and Management* 2015; 7(1):257–270.
- [7] Halicka K. Forward-Looking Planning of Technology Development. *Business, Management and Education* 2015; 13(2):308–320.
- [8] Halicka K. Designing routes of development of renewable energy technologies. *Procedia-Social and Behavioral Sciences* 2014; 156:58–62.
- [9] Halicka K. Prospektywna analiza technologii [Future-Oriented Technology Analysis]. In: Knosala R., ed., *Innowacje w zarządzaniu i inżynierii produkcji* 2015; 2:87–98.
- [10] Halicka K, Lombardi PA, Styczyński Z. Future-oriented analysis of battery technologies. *2015 IEEE International Conference on Industrial Technology (ICIT)*:1019–1024.
- [11] Kononiuk A, Gudanowska A, Nazarko J, Glińska E, Glińska U, Ejdys J. *Kierunki rozwoju nanotechnologii w województwie podlaskim. Mapy. Marszuty. Trendy. [Directions of nanotechnology development in Podlaskie Voivodship. Maps. Roadmaps. Trends]*. Białystok: Oficyna Wydawnicza Politechniki Białostockiej; 2013.
- [12] Nazarko J. Kształtowanie polityki innowacyjnej regionu np. foresightu technologicznego <NT FOR Podlaskie 2020>. [Shaping of the innovation policy of a region on the example of <NT FOR Podlaskie 2020> technology foresight]. *Optimum. Studia Ekonomiczne* 2011; 2(50):241–251.
- [13] Nazarko J. *Regionalny foresight gospodarczy. Metodologia i instrumenty badawcze [Regional business information foresight. Methodology and research instruments]*. Warszawa: Związek Pracodawców Warszawy i Mazowsza; 2013.
- [14] Nazarko Ł. Istota foresightu i jego percepcja w Polsce. [The essence and perception of foresight in Poland]. *Optimum. Studia Ekonomiczne* 2011; 4(52):224–234.

Significant factors causing cost overruns in the construction industry in Afghanistan

Ghulam Abbas Niazi^a, Noel Painting^b

^aTransportation Engineering Faculty, Kabul Polytechnic University, Kabul, Afghanistan, e-mail: abbas.niazi@kpu.edu.af

^bSchool of Environment and Technology, University of Brighton, Brighton, United Kingdom

Abstract: It is generally acknowledged that one criterion for judging the success of a construction project is whether it is completed within budget. Due to various factors, this is often more of a challenge in developing countries where budget problems are just one factor in often poor project performance. In Afghanistan, construction cost overruns are the most substantial problem (facing all parties to a project; suppliers, subcontractors, main contractors and clients). As a result, national development is hindered, and negative signals are sent to foreign investors. This research aims to identify the significant factors that lead to construction cost overruns in Afghanistan. After conducting an in-depth literature review and based on previous research, sixty-nine causes of the construction cost overruns were identified. Interviews were then conducted with ten construction professionals the results of which formed the basis of a questionnaire forwarded to seventy-five selected construction professionals based in Afghanistan including clients, contractors, and consultants. The finding of the research is that the key critical causes that potentially result in construction cost overruns in Afghanistan are: corruption, delay in progress payment by owner, difficulties in financing project by contractors, security, change the order by the owner during construction and market inflation.

Keywords: Afghanistan; cost overrun; construction projects.

References

- [1] Azhar N, Farouqi RU, Ahmed SM. Cost Overrun Factors in the Construction Industry of Pakistan, The 1st International Conference on Construction in Developing Countries: Advancing & Integrating Construction Education, Research and Practice, Karachi; 2008.
- [2] Flyvbjerg B, Skamris Holm MK, Buhl SL. What Causes Cost Overrun in Transport Infrastructure Projects? *Transport Reviews* 2004;24(1):3–18.
- [3] Olawale YA, Sun M, Cost and time control of construction project: Inhibiting factors and mitigating measures in practice. *Constr. Manage. Econ.* 2010;28:509–520.
- [4] Liu L, Zhu, K. A Stage-By-Stage Factor Control Framework For Cost Estimation Of Construction Projects. Clients Driving Innovation. International Conference; Brisbane, Qld: CRC for Construction Innovation, QUT; 2004.
- [5] Cantarelli CC, Flyvbjerg B, Wee van B, Molin EJE. *Lock-in and its influence on the project performance of large-scale transportation infrastructure projects. Investigating the way in which lock-in can emerge and affect cost overruns.* Washington, D.C.: Transportation Research Board; 2009.
- [6] Kaming PF, Olomolaiye PO, Holt GD, Harris FC. Factors influencing construction time and cost overruns on high-rise projects in Indonesia. *Construction Management and Economics* 1997;15(1):83–94.
- [7] Bubshait AA, Al-Juwait YA. Factors contributing to construction costs in Saudi Arabia, *J. of Cost Engineering* 2002;44(5):30–34.
- [8] Enshassi A, Sherif M, Saleh A. Factors affecting the performance of construction projects in the Gaza strip. *Journal of civil engineering and management* 2009;15(3):269–280.
- [9] Omoregie A, Radford D. Infrastructure delays and cost escalation: Causes and effects in Nigeria. Proceedings of the 6th International Conference on Postgraduate Research, the Netherland; 2006.
- [10] Le-Hoai L, Lee YD, Lee JY. Delay and Cost Overrun in Vietnam Large Construction Projects: A comparison with other selected Countries. *KSCE Journal of Civil Engineering* 2008;12(6):367–377.

Research issues undertaken within quality management – the overview of selected literature and a knowledge map

Anna Małgorzata Olszewska^a

^aFaculty of Management, Białystok University of Technology, 45A Wiejska Str., Białystok, 15–351, Poland, e-mail: a.olszewska@pb.edu.pl

Abstract: The issue of quality management, despite its long history, still remains a dynamically developing research discipline and a scientific consideration. Subsequently, this is a very extensive field which encompasses many issues. Thus, this work mainly focuses on identifying research threads undertaken within quality management in selected periodicals. The article describes the undertaken overview and indicates research threads entailed within the analysed subject matter. Moreover, the resultant list of threads was presented in the form of a knowledge map reflecting their coexistence in specific articles. The methods used while preparing this article constitute an overview of the literature and a network analysis.

Keywords: quality, quality management; research issues; knowledge map.

References

- [1] Elshennawy AK. Quality in the New Age and the Body of Knowledge for Quality Engineers. *Total Quality Management* 2004;15(5–6):603–614.
- [2] Szczepańska K. Doskonalenie zarządzania jakością: podstawy, ocena, perspektywa [Improvement of quality management: basis, evaluation, prospect]. Warszawa: Oficyna Wydawnicza Politechniki Warszawskiej; 2013.
- [3] Liepiņa R, Lapiņa I, Mazais J. Contemporary issues of quality management: relationship between conformity assessment and quality management, *Contemporary Issues in Business, Management and Education* 2013. *Procedia – Social and Behavioral Sciences* 2013;110:627–637.
- [4] Johnson K, Philip B. Crosby's mark on quality. *Quality Progress Oct* 2001;34(10):25–30.
- [5] Standard ISO 9000. *Quality management systems – Fundamentals and vocabulary*; 2005.
- [6] Website: <http://www.vosviewer.com/>.
- [7] Gudanowska AE. Tworzenie mapy wiedzy opartej na tematyce projektów badawczo-rozwojowych na przykładzie województwa podlaskiego [Creating knowledge maps based on the themes of R&D projects on the example of the Podlaskie region]. *Economics and Management* 2015;1:257–270.

Quantitative assessment of the IT agile transformation

Cezary Orłowski^a, Artur Ziółkowski^a, Grzegorz Paciorkiewicz^b

^aWyższa Szkoła Bankowa, Grunwaldzka 238A, 80–266 Gdansk, e-mail: corlowski@wsb.gda.pl, aziolkowski@wsb.gda.pl

^bIntel Technology Poland, Słowackiego 137, 80–298 Gdansk

Abstract: The aim of this paper is to present the quantitative perspective of the agile transformation processes in IT organisations. The phenomenon of agile transformation is a complex challenge for an IT organisation since it has not been analysed in detail so far. There is no research on the readiness of IT organisations for the realisation of agile transformation processes, and such processes prove to be of uncontrolled character. Therefore, to minimise the risk of failure referring to the realisation of transformation processes, it is necessary to monitor them. It is also necessary to identify and analyse such processes to ensure their continuous character.

Keywords: IT organization; agile transformation; agile project management; scrum; maturity capsule.

References

- [1] Friedman TL. *The World Is Flat: A Brief History of the Twenty-first Century*. New York: Farrar, Straus and Giroux; 2005.
- [2] Kniberg H. *The Unofficial Scrum Checklist. Version 2.2*. Crisp; 2010.
- [3] Kowalczyk Z, Orłowski C. *Advanced Modeling of Management Processes in Information Technology*. Heidelberg: Springer; 2014.
- [4] Marchewka JT. *Information Technology Project Management: Providing Measurable Organizational Value*. 3rd ed. USA: John Wiley & Sons; 2009.
- [5] Schwaber K. *Agile Project Management with Scrum*. Redmond, Washington: Microsoft Press; 2004.
- [6] Wysocki RK. *Effective Project Management Traditional, Agile, Extreme*. 6th ed. Indianapolis, Indiana: John Wiley & Sons; 2012.
- [7] *Agile Software Development*. Available online: en.wikipedia.org/wiki/Agile_software_development [02.12.2013].
- [8] James M. *Introduction to Scrum*. Available online: scrumtrainingseries.com/Intro_to_Scrum/Intro_to_Scrum [02.11.2013].
- [9] Schwaber K, Sutherland J. *Changes between 2011 and 2013 Scrum Guide*. Available online: www.scrum.org/About/All-Articles/articleType/ArticleView/articleId/724/Scrum-Update-2013 [12.12.2013].
- [10] Scrum Alliance. *Why Scrum*. Available online: www.scrumalliance.org/why-scrum [02.11.2013].

Influence of tillage technology on the energy efficiency of a rapeseed plantation

Olga Orynych^a

^aFaculty of Management, Białystok University of Technology, 45A Wiejska Str., Białystok, 15–351, Poland, e-mail: o.orynych@pb.edu.pl

Abstract: Various biomass crops are used worldwide for biofuel production. A number of industrial and agricultural technologies are used in this field. In many of operations performed during the biomass production, an input of energy is a necessary condition facilitating the progress of the process. Taking into account the energy economy, it can be expected that a well-designed technological process should consume less energy than may be obtained in the form of biofuel.

The paper aims to evaluate the energy efficiency of a plantation as a function of amounts of energy required by the agricultural production processes. Several topological structures of plantations, numerous production technologies, and transportation conditions are discussed.

Computer modelling was chosen as a method of investigations. Computations were based on derived mathematical formulas, and the elaborated algorithm was implemented as a macro in an EXCEL spreadsheet. Results were obtained for rapeseed plantations at various conditions concerning the structure of a plantation and applied agricultural operations. In addition, the effects of inter- and intra- plantation transportations were studied.

Based on the results, the EROEI type of indicators is strongly dependent on the choice of production technology, as well as on several aspects of workflow organisation.

Keywords: energy efficiency; EROEI; biofuels; agricultural subsystem.

References

- [1] Rasilavicius L, Bazaras Z. Ecological assessment and economic feasibility to utilize first generation biofuels in cogeneration output cycle – The case of Lithuania. *Energy* 2010;35:3666–3673.
- [2] Chum HM, Overend RP. Biomass and Renewable Fuels. *Fuel Processing Technology* 2001;71:187–195.
- [3] Fontaras G, Skoulou V, Zanakis G, Zabaniotou A, Samaras Z. Integrated environmental assessment of energy crops for biofuel and energy production in Greece. *Renewable Energy* 2012;43:201–209.
- [4] Painuly JP, Rao H, Parikh J. A rural energy-agriculture interaction model applied to Karnataka state. *Energy* 1995;20:219–233.
- [5] Abnisa F, Wan Daud WMA, Husin WNW, Sahu JN. Utilization possibilities of palm shell as a source of biomass energy in Malaysia by producing bio-oil in pyrolysis process. *Biomass and Bioenergy* 2011;35:1863–1872.
- [6] Pickard WF. Energy Return on Energy Invested (EROI): A quintessential but possibly Inadequate Metric for Sustainability in a Solar-Powered World?. *Proceedings of the IEEE* 2014;102:1118–1122.
- [7] Wasiak A, Orynych O. Formulation of a model for energetic efficiency of agricultural subsystem of biofuel production. *IEEE International Energy Conference: ENERGYCON 2014*, Dubrovnik, Croatia, 2014, 1333–1337.
- [8] Wasiak A, Orynych O. The Effects of Energy Contributions into Subsidiary Processes on Energetic Efficiency of Biomass Plantation Supplying Biofuel Production System. *Agriculture and Agricultural Science Procedia* 2015;7:292–300.
- [9] Wasiak A. The effect of biofuel production on sustainability of agriculture. 7th International Conference of Engineering, Project and Production Management; Białystok 2016; submitted to *Procedia Engineering* 2016.
- [10] Perrier T. Private communication – agricultural enterprise. *Barycz* 2014.

Analysis of the effectiveness the European Regional Development Fund disbursement for the selected tourism services with the use of the counterfactual method

Eugenia Panfiluk^a

^aFaculty of Management, Białystok University of Technology, 45A Wiejska Str., Białystok, 15–351, Poland, e-mail: e.panfiluk@pb.edu.pl

Abstract: The aim of the article is to analyse the effectiveness of decision-making in the disbursement of funds from the ERDF for the selected tourism services. The analysis of literature indicates that the existing research concerning management systems focused mostly on the identification and measurement of the impact of the positive effects of regional policies, including the ERDF. The study focused on evaluating the results of the implemented instruments and their impact on the socio – economic development of regions. This approach enables the identification of positive changes resulting from public intervention in the region. These studies, however, contain an important gap. The identified results cannot be cross-referenced with a comparable quantity. Therefore, it is not possible to determine whether the obtained results are the highest possible, or merely reached the minimum level. Therefore, it is not possible to draw conclusions about the efficiency of the management of individual instruments and their maximum use. Because of this problem, it is necessary to undertake studies allowing for the assessment of the level of use of financial instruments by the management system. In the theoretical part of the article, the model of assessment of the ERDF management system effectiveness was developed. This model is built on the basis of the *Propensity Score Matching* (PSM) method, used to assess the effectiveness of community programs. In the empirical part of the article, the verification of the model on the example of NUTS 2 Podlasie, the tourism sector was carried out. The obtained results allow concluding that the developed deadweight assessment model can be used in practice for the evaluation of the efficiency of the ERDF management system.

Keywords: European funds, deadweight evaluation model, public subsidies, management system.

References

- [1] Bernini C, Pellegrini G. How are growth and productivity in private firms affected by public subsidy? Evidence from a regional policy. *Regional Science and Urban Economics* 2011;41:253–265.
- [2] Bronzini R, Di Blasio G. Evaluating the impact of investment incentives: the case of Italy's Law 488/1992. *Journal of Urban Economics* 2006;60(2):327–349.
- [3] Dębikowska K, Szymańska E. Potencjał turystyczny województwa podlaskiego na tle kraju i regionów zagranicznych [The tourism potential of the Podlaskie Voivodeship in comparison with other Voivodeships and foreign regions]. In: Panfiluk E, Szymańska E, editors. *Wpływ projektów z zakresu turystyki i kultury na rozwój społeczno – gospodarczy regionu. Tom II*, Białystok: Urząd Marszałkowski Województwa Podlaskiego; 2015.
- [4] Denkowska S. Wybrane metody oceny jakości dopasowania w Propensity Score Matching [Selected methods of assessing the quality of matching in Propensity Score Matching]. *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu* 2015;384:61–62.
- [5] Gabe TM, Kraybill D. The effects of state economic development incentives on employment growth of establishments. *Journal of Regional Science* 2002;42(4):703–730.
- [6] Keyuraphan S, Thanarak P, Ketjoy N, Rakwichian W. Subsidy schemes of renewable energy policy for electricity generation in Thailand. *Procedia Engineering* 2012:440–448.
- [7] Panfiluk E. Wyniki ekonomiczne działalności inwestycyjnej sektora publicznego w turystyce [Economic Results of Investment Activities of the Public Sector in Tourism]. *Zeszyty Naukowe Uniwersytetu Ekonomicznego w Poznaniu* 2012;229:501–515.
- [8] Panfiluk E. Identyfikacja wskaźników i mierników oceny systemu zarządzania Europejskim Funduszem Rozwoju Regionalnego w sektorze turystycznym [Identification of the indicators and benchmarks of the assessment of the effects of management of the European Regional Development Fund in the tourism sector]. *Economics and Management* 2015;7:393–406.

Influence of Total Quality Management on the performance of Vietnamese construction firms

Kriengsak Panuwatwanicha^a, Thanh Tung Nguyen^b

^aGriffith School of Engineering, Griffith University, Gold Coast Campus, Queensland 4222, Australia, e-mail: k.panuwatwanich@griffith.edu.au

^bThe Office of Bac Giang Provincial People's Committee, Vietnam

Abstract: The key objective of this study is to examine the relationship between organisational culture (OC) and Total Quality Management (TQM), and the influence of TQM implementation on organisational performance improvement within the context of the Vietnamese construction industry. To achieve this, a survey was conducted in a number of Vietnamese construction firms, using validated survey instruments developed in previous studies. Findings based on the survey sample of 104 respondents employed in construction firms in Vietnam showed that Vietnamese construction firms are dominated by clan and hierarchy cultures rather than adhocracy and market cultures according to Competing Value Framework (CVF) of OC classification. Furthermore, organisations dominated by both market and hierarchy cultures indicate one only unfavourable culture for the use of TQM, whereas organisations dominated by either clan and hierarchy or clan and adhocracy, or not dominated by any specific cultures, could provide a successful environment for the TQM implementation. This study also confirmed the significant and positive relationship between TQM implementation and organisational performance improvement. Based on these findings, the author concluded that with the identified cultural characteristics in place, Vietnamese construction firms can employ TQM as management philosophy to improve their performance.

Keywords: organisational culture; Total Quality Management; organisational performance; Vietnamese construction firms.

References

- [1] Elghamrawy T, Shibayama T. Total Quality Management Implementation in the Egyptian construction. *Journal of Management in Engineering* 2008;24(3):156–161.
- [2] Nguyen LD, Ogunlana SO, Lan DTX. A study on project success factors in large construction projects in Vietnam. *Engineering Construction and Architectural Management* 2004;11(6):404–413.
- [3] Pham TK, Panuwatwanich K. *Management styles and employee satisfaction: the role of cultural diversities, The 14th East Asia-Pacific Conference on Structural Engineering and Construction (EASEC14)*. Ho Chi Minh City, Vietnam: Construction Publishing House; 2016, p. 1425–1432.
- [4] Cameron KS, Quinn RE, Francisco CA. *The Competing Values Framework*. San Francisco: Jossey-Bass; 2011.
- [5] Quinn RE. *Beyond rational management: Mastering the paradoxes and competing demands of high performance*. San Francisco: Jossey-Bass; 1988.
- [6] Luu TV, Kim SY, Cao HL, Park YM. Performance measurement of construction firms in developing countries. *Construction Management and Economics* 2008;26(4):373–386.
- [7] Long ND, Ogunlana S, Quang T, Lam KC. Large construction projects in developing countries: a case study from Vietnam. *International Journal of Project Management* 2004;22(7):553–561.
- [8] Arditi D, Gunaydin HM. Total quality management in the construction process. *International Journal of Project Management* 1997;15(4):235–243.
- [9] Panuwatwanich K, Stewart RA. Evaluating innovation diffusion readiness among architectural and engineering design firms: Empirical evidence from Australia. *Automation in construction* 2012;27:50–59.
- [10] Panuwatwanich K, Stewart RA, Mohamed S. The role of climate for innovation in enhancing business performance: the case of design firms, Engineering. *Construction and Architectural Management* 2008;15(5):407–422.

The Ecosystem for Niche Technology Innovation

Andrzej Pawlak^a

^aFaculty of Management, Bialystok University of Technology, 45A Wiejska Str., Bialystok, 15-351, Poland, e-mail: prezes@instytutik.com

Abstract: This paper describes the Ecosystem for Niche Technology Innovation (ENTI), developed by Prof. Andrzej M. Pawlak. The ENTI has been optimized for innovation of global technologies at regions with limited resources and lack of world-class technologies. Therefore, the ENTI has been devised for the less advanced economically regions where existing core competency and critical mass of technology are insufficient to support global technologies. This comprehensive, three-stage ecosystem has been devised for discovering and creating effective technology niches, or simply, finding successful product solutions within technology niches as well as bringing niche products to the global market. The first stage introduces the niche innovation method with its tools and procedures. The second stage enhances the pace of niche technology development. The final stage of the ENTI supports the commercialization of a niche technologies by means of a self-funding mechanism within the ENTI which enables a continuous cycle of niche technology development. Therefore, the ENTI has a potential to create unique cluster structures emulating new niches based on both competency and technology synergies

Keywords: innovation; core competency; critical mass of technology; niche; synergy; SME.

References

- [1] Pawlak AM. Fostering Creativity in the New Millennium. *Research-Technology Management* 2000; 43(6): 32–35.
- [2] Pawlak AM. Hidden Values of Technology. In: *Proceedings of ICEM'04*; Lodz: Technical University of Lodz; 2004, p. 134–141.
- [3] Pawlak AM. Intellectual Property Mapping of Mechatronics. In: *Proceedings of SME'2007, International Symposium on Electrical Machines*; Poznan: Poznan University of Technology; 2007.
- [4] Pawlak AM. Permanent Magnets Technology Map, In: *Proceedings of China Magnetics, Int. Conference on Mag. Mat.*; Beijing, China; 2007.
- [5] Pawlak AM. Promoting Breakthrough Innovation, Industrial Research Institute, NY, USA, 2009, p. 210–215.
- [6] Pawlak AM. Mapping of Mechatronics Technology Development, In: *Proceedings of PLM Road Map™*; Plymouth, USA; 2008.
- [7] Chesbrough HW. Open Innovation and Strategy. *California Management Review* 2007; 50(1):51–76.
- [8] Lowndes N. Inside Procter & Gamble's New Model for Innovation. *Harvard Business Review* 2006; 50(1): 58–66.
- [9] Pawlak AM. *Foresight. Perspektywa Technologiczna Kraków-Malopolska 2020. Mapy wiedzy dla Regionu Malopolski w Polsce*. Report. Cracow, Poland; 2009.
- [10] Pawlak AM. *Magnetic Latching Relay*. U.S. Patent 5,703,550; 1997.

Decision support for mobile crane lifting plan with Building Information Modelling (BIM)

Le Peng^a, David K. H. Chua^a

^aDepartment of Civil and Environmental Engineering, National University of Singapore, Block E1A, #07-03 No.1 Engineering Drive 2, Singapore 117576, Singapore, e-mail: peng_le@u.nus.edu

Abstract: Mobile cranes are one of the most commonly used equipment in construction, and an inappropriate choice of a mobile crane may cause a serious accident. The current practice relies on the engineers' experience in planning mobile crane operation, which is a tedious and potentially error-prone process. This paper makes use of recent developments in Building Information Modelling (BIM) to address the problem. It presents a comprehensive framework to model mobile crane safe lifting requirements from the 3D BIM model. Based on the requirements, it proposes a decision-support system for planning mobile crane operations. The result of this research facilitates engineers and construction managers in construction site planning and improve construction site safety.

Keywords: mobile crane lifting; code compliance; Building Information Modelling.

References

- [1] Tantisevi K, Akinci B. Automated generation of workspace requirements of mobile crane operations to support conflict detection; *Autom. Constr* 2007;16(3):262–276.
- [2] Zhang C, Hammad A. Improving lifting motion planning and re-planning of cranes with consideration for safety and efficiency. *Adv. Eng. Inform* 2012;26(2):396–410.
- [3] Lin Y, Wu D, Wang X, Wang X, Gao S. Lift path planning for a nonholonomic crawler crane. *Autom. Constr* 2014;44:12–24.
- [4] Lei Z, Taghaddos H, Hermann U, Al-Hussein M. A methodology for mobile crane lift path checking in heavy industrial projects. *Autom. Constr* 2013;31:41–53.
- [5] Malsane S, Matthews J, Lockley S, Love PE, Greenwood D. Development of an object model for automated compliance checking. *Autom. Constr* 2015;49:51–58.
- [6] Dimiyadi J, Clifton C, Spearpoint M, Amor R. Regulatory knowledge encoding guidelines for automated compliance audit of building engineering design. *Proceedings of the ICCBE/CIB W78* 2014;536–543.
- [7] Tashrif A, Chua D. Integrated Design Platform Incorporating Multi-Disciplinary Early Information to Reduce Potential Delays in the Design Phase of Public Housing Projects. *Proceedings of 6th International Conference of Engineering, Project and Production Management*; 2015.
- [8] Qui N, Abbott ELS, Chua DK, Goh YM. Formalizing Construction Safety Knowledge for Intelligent BIM-Based Review of Design for Safety. *Proceedings of CIB W099 International Conference on Achieving Sustainable Construction Health and Safety* 2014;565.
- [9] Yeoh KW, Chua DK. Representing Requirements of Construction from an IFC Model. *Comput. Civ. Build. Eng.* 2014:331–338.
- [10] Justin Yeoh KW, Wong JH, Peng L. Integrating Crane Information Models in BIM for Checking the Compliance of Lifting Plan Requirements; *Proceedings of 33rd International Symposium on Automation and Robotics in Construction* 2016; 974–982.

Modelling the use of alternative technical means for services by piloted flying platforms: presentation of a research project

Eugeniusz Piechoczek^a, Jan Kaźmierczak^b, Henryk Jafernik^a

^aSilesian University of Technology, 13, Krasinskiego Str., Katowice, 40–019, Poland, e-mail: eugenius@it.pl

^bSilesian University of Technology, 26–28 Roosevelta Str., Zabrze, 41–800, Poland, e-mail: jan.kazmierczak@polsl.pl

Abstract: The paper presents general assumptions and preliminary results of the studies on theoretical and practical aspects of providing selected services with alternative technical means. The study focused on the areas of aircraft application in building and utilising linear objects. The study purpose was based on an analysis of process-focused approach towards air services. The specificity of the assumptions in the selected areas was illustrated on the basis of examples of completed undertakings. Additionally, the article contains a list of examined factors influencing the adaptation of Unmanned Aircraft Systems as components of the model of conversion of services that could have an impact on decision-making in terms of applications of alternative air platforms.

Keywords: service provision effectiveness; process management; air services; air-services; Unmanned Aircraft Services (UAV/RPAS).

References

- [1] Kaźmierczak J, Piechoczek E. *Model idea of assist comparative estimation selected servise processes with utilization of optional technical means*. Zakopane: PTZP; 2016.
- [2] Piechoczek E, Kaźmierczak J. *Evaluation of application of alternative technical measure in providing selected air services*. Warszawa: Politechnika Warszawska; 2016.
- [3] Ścierański J. Mapowanie procesów [Mapping processes]. *Zeszyty Naukowe Politechniki Śląskiej Seria Organizacja i Zarządzanie* 2010;52.
- [4] Kaźmierczak J. *Estimation of public influence of innovation products and technologies*. *Technology Assessment*. Zakopane: PTZP; 2013.
- [5] Nelms D. *Unmanned Aircraft: The next Big Thing for Your Business*. Rotor FALL 2015.
- [6] Hąbek P, Wolniak R. Narzędzia jakości i ich rola w kształtowaniu innowacji w przemyśle [Quality tools and their role in industrial innovation formation]. In: Kaźmierczak J, Bartnicka J, editors. *Zarządzanie innowacjami w produkcji i usługach*, Opole: Oficyna Wydawnicza PTZP; 2014, p. 146–157.
- [7] Kaźmierczak J. Remarks concern to method and tools of estimation of public influence innovation products and technologies. *Technology Assessment*. In: Biały W, Midor K, editors. *Systemy Wspomagania w Inżynierii Produkcji. Innowacyjność, jakość, zarządzanie*, Gliwice: P.A.NOVA; 2013, p. 47–54.
- [8] Mazur J. *Management and marketing of service*. Warszawa: Wyd. Difin; 2001.
- [9] Shostack GL. Planning the service encounter. In: Czepiel JA, Solomon MR, Supernant CF, editors. *The service encounter*. Lexington, Mass: Lexington Books, D.C. Haeth and Company; 1985.
- [10] Skrzypek E. *Proces management in company*. Warszawa: Wolters Kluwer; 2010.
- [11] Kaźmierczak J. Management of design and exploitation processes of acoustic map of municipal area. In: Pyka J, editor. *Nowoczesność przemysłu i usług. Doskonalenie zarządzania jako źródło przewagi konkurencyjnej*, Katowice: TNOiK; 2006, p. 242–251.

Effects of risk management practice on the success of IT projects

Darane Pimchangthong^a, Veera Boonjing^b

^aRajamangala University of Technology Thanyaburi, Klong 6, Thanyaburi, Pathum Thani, 12110, Thailand, e-mail: Daranee_p@rmutt.ac.th

^bKing Mongkut's Institute of Technology Ladkrabang, Ladkrabang, Bangkok, 10520, Thailand

Abstract: Successful management of information technology (IT) projects is desirable to all organisations and stakeholders. Many researchers elaborated that risk management was a key part of project management for any project size. Risk management was so critical because it provided project managers with a forward-looking view of both threats and opportunities to improve the project success. The objectives of this research were to explore risk management practices influencing the success of IT projects. Risk management practices included risk identification, risk analysis, risk response planning, and risk monitoring and control. The IT project success was measured by process performance and product performance. Data were collected from 200 project managers, IT managers, and IT analysts in the IT firms through questionnaires and analysed using the Independent Sample t-test, One-way ANOVA, and Multiple Linear Regression at the statistical significance level of 0.05. The results demonstrated that the differences in organisational types affected the success of IT projects in all aspects, while the differences in organisational sizes affected the success of IT projects in terms of the aspect of product performance as well as total aspects. Risk identification and risk response planning influenced the process performance and the total aspects of the success of IT projects. Risk identification was the highest positive influence on product performance, followed closely by risk response, while risk analysis negatively influenced product performance.

Keywords: risk management; information technology; project success; project management.

References

- [1] Jenner S. Why do projects 'fail' and more to the point what can we do about it? The case for disciplined, 'fast and frugal' decision-making. *PM World Journal* 2015;5(3).
- [2] Didagra O. The Role and the Effects of Risk Management in IT Projects Success. *Informatica Economică* 2013;17(1).
- [3] Taylor H, Artman E, Woelfer JP. Information Technology Project Risk Management: Bridging the Gap between Research and Practice. *J Inform Technol.* 2012;27:17–34.
- [4] Alhawari S, Karadach L, Talet NA, Mansour E. Knowledge-based risk management framework for information technology project. *International Journal of Information Management* 2012;32(1):50–65.
- [5] Taylor H, Artman E, Woelfer JP. Information technology project risk management: bridging the gap between research and practice. *Journal of Information Technology* 2012;27:17–34.
- [6] Sudhakar GP. A model of critical success factors for software projects. *Enterprise Information Management* 2012;25(6):537–558.
- [7] Ward J, Daniel EM. The role of project management offices (PMOs) in IS project success and management satisfaction. *Journal of Enterprise Information Management* 2013;26(3):316–336.
- [8] Baccarini D. The logical Framework Method for Defining Project Success. *Project Management Journal* 1999;30(4):25–32.
- [9] Jun L, Qiuzhen W, Qingguo M. The effects of project uncertainty and risk management on IS development project performance: A vendor perspective. *International Journal of Project Management* 2011;29:923–933.
- [10] Wallace L, Keil M, Arun R. How software project risk affects project performance: an investigation of the dimensions of risk and an exploratory model. *Decision Sciences* 2004;35(2):289–321.

Decision support system in the area of generating innovative research projects of the future

Beata Poteralska^a

^aInstitute for Sustainable Technologies – National Research Institute, 6/10 K. Pułaskiego Str., Radom, 26–600, Poland, e-mail: beata.poteralska@itee.radom.pl

Abstract: The paper presents examples of attempts undertaken by scholars and practitioners to combine the foresight methodology with other tools aimed at supporting the decision-making processes. Against this background, the paper describes an author's proposal of a system combining the foresight methodology, technology assessment, and intellectual capital measurement. The system is aimed at generating research projects of the future, characterised by a high innovativeness level and a significant commercial potential, to be executed at R&D organisations and at enterprises, for which a necessary potential is available.

Keywords: decision making; foresight; innovation; intellectual capital measurement; technology assessment.

References

- [1] Giaoutzi M, Sapio B. In Search of Foresight Methodologies: Riddle or Necessity. In: Giaoutzi M, Sapio B, editors. *Recent Developments in Foresight Technology. Complex Networks and Dynamic Systems 1*, New York: Springer Science+Business Media; 2013.
- [2] van der Duin P. *Qualitative futures research for innovation*. Delft: Eburon Academic Publishers; 2006.
- [3] Krawczyk E, Slaughter R. New generations of futures methods. *Futures* 2010;42:75–82.
- [4] Kuhlmann S. Distributed Techno-Economic Intelligence for Policymaking. In: Fahrenkrog G, Polt W, Rojo J, Tübke A, Zinöcker K, editors. *RTD Evaluation Toolbox – Assessing the Socio-Economic Impact of RTD-Policies – Strata Project HPV 1 CT 1999 – 00005*, EUROPEAN COMMISSION, Joint Research Centre, Institute for Prospective Technological Studies (IPTS); 2002.
- [5] Kameoka A, Yokoo Y, Kuwahara T. A challenge of integrating technology foresight and assessment in industrial strategy development and policymaking. *Technological Forecasting & Social Change* 2004;71:579–598.
- [6] Rip A. Challenges for technology foresight / assessment and governance. Final Report of the STRATA consolidating workshop. European Commission. Directorate-General for Research. Unit RTD-K.2 – “Science and Technology foresight; links with the IPTS”. June 2002.
- [7] Georghiou L, Harper JC, Keenan M, Miles I, Popper R. *The Handbook of Technology Foresight: Concepts and Practice*. PRIME Series on Research and Innovation Policy. Edward Elgar Publishing Ltd.; 2008.
- [8] Leitner KH, Bornemann M, Schneider U. Development and Implementation of an Intellectual Capital Report for a Research Technology Organisation. In: Bontis N, editor. *World Congress on Intellectual Capital Readings*, Butterworth Heinemann; 2002, p. 266–285.
- [9] Tran T, Daim T. A taxonomic review of methods and tools applied in technology assessment. *Technological Forecasting & Social Change* 2008;75:1396–1405.
- [10] Mazurkiewicz A, Poteralska B. Application of the complex technology assessment system for product development. In: Galbraith B, editor. *Proceedings of the 9th European Conference on Innovation and Entrepreneurship*, UK: Academic Conferences and Publishing International Limited, Reading; 2014.

Wavelet approach to damage detection of mechanical systems and structures

Waldemar Jan Rakowski^a

^aFaculty of Management, Białystok University of Technology, 45A Wiejska Str., Białystok, 15–351, Poland, e-mail: w.rakowski@pb.edu.pl

Abstract: The damage detection methods of mechanical and civil structures have been drawing much interest from various fields. Many techniques to detect damage are based on the examination of the system response signals. Crack-like damages may contribute to the response signal edges (also called slopes) i.e. the localized sharp transitions of signal values. A powerful tool to characterize such local feature signals is the continuous wavelet transform (CWT). Despite its name, the CWT can be calculated on discrete data and requires an enormous computational cost. However, in many cases, the crack-like changes in the signal can be detected and localized using the discrete dyadic wavelet transform (DDWT) that has a fast transform algorithm. This paper presents an application of the DDWT to detect and localize the response signal features (slopes) due to cracks in mechanical and civil structures. The wavelets used to calculate the DDWT are cubic box splines. The numerical results for a response signal simulating cracks in structures are presented.

Keywords: damage detection; wavelet; discrete dyadic wavelet transform; cubic box spline wavelet.

References

- [1] Patel SS, Chourasia AP, Panigrahi Sk, Parashar J, Parvez N, Kumar M. Damage identification of rc structures using wavelet transformation. *Procedia Engineering* 2016;144:336–342.
- [2] Aguirre D, Gaviria CA, Montejo LA. Wavelet-based damage detection in reinforced concrete structures subjected to seismic excitations. *Journal of Earthquake Engineering* 2013;17(8):1103–1125.
- [3] Kim H, Melhem H. Damage detection of structures by wavelet analysis. *Engineering Structures* 2004;26:347–362.
- [4] Ovanesowa AV, Suarez LE. Applications of wavelet transforms to damage detection in frame structures. *Engineering Structures* 2004;26:39–49.
- [5] Mallat S. *A Wavelet Tour of Signal Processing: The Sparse Way*. 3rd ed. Academic Press; 2009.
- [6] Mallat S. Zero-crossings of a wavelet transform. *IEEE Transactions on Information Theory* 1991;37(4):1019–1033.
- [7] Mallat S, Hwang LW. Singularity detection and processing with wavelets. *IEEE Transactions on Information Theory* 1992;38(2):617–643.
- [8] Mallat S, Zhong S. Characterization of signals from multiscale edges. *IEEE Transactions on Pattern Analysis and Machine Intelligence* 1992;14(7):710–732.
- [9] Babaud J, Witkin AP, Baudin M. Uniqueness of the gaussian kernel for scale-space filtering. *IEEE Transactions on Pattern Analysis and Machine Intelligence* 1986;PAMI-8(1):26–33.
- [10] Rakowski W. Application of cubic box spline wavelets in the analysis of signal singularities. *Int. J. Appl. Math. Comput. Sci.* 2015;25(4):927–941.

Development of a risk matrix and extending the risk-based maintenance analysis with fuzzy logic

R.M. Chandima Ratnayake^a, Katarzyna Antosz^b

^a Department of Mechanical and Structural Engineering and Materials Science, University of Stavanger, P.O. Box 8600 Forus, N-4036, Stavanger, Norway, e-mail: chandima.ratnayake@uis.no

^b Department of Manufacturing Processes and Production Engineering, Rzeszow University of Technology, Al. Powstancow Warszawy 12, 35–959 Rzeszow, Poland

Abstract: Unexpected failures, the loss of production, and higher maintenance costs are major problems of manufacturing systems. Hence, certain investigating methods, such as Risk-based maintenance (RBM), help to deal with such issues. An important element of the RBM planning is to assess the consequences of action and prioritization of maintenance tasks based on the risk of potential failures. The main purpose of this classification is the right choice for maintenance strategy, maintenance intervals, and a certain level of spare parts in the storage. Although, the criticality assessment activities are widely performed with the support of a criticality matrix; due to inherent nature of a risk matrix, there is a high possibility of resulting in suboptimal classifications. This happens because there are no means to incorporate the actual circumstances at the boundary of the input ranges or the levels of linguistic data and risk categories. The risk matrix has been developed in collaboration with a manufacturing firm from Poland. This manuscript illustrates the use of fuzzy logic for the minimization of suboptimal classifications, and it suggests a fuzzy inference system (FIS) for overcoming the challenge mentioned above. Membership functions and the rule base are developed. Then, the rule view and the calculation result are demonstrated to illustrate the methodology. The machine classification based on fuzzy expert systems is performed with an illustrative calculation. The proposed approach will be gradually implemented in the selected case-study company. It is possible to integrate the suggested approach to currently existing computer-aided maintenance management system (CMMS) in a manufacturing firm (MF).

Keywords: classification; fuzzy logic; manufacturing systems; risk based maintenance; risk matrix.

References

- [1] Parida A, Kumar U. Maintenance productivity and performance measurement. In: Ben-Daya M, Duffuaa SO, Raouf A, Knezevic J, Ait-Kadi D, editors. *Handbook of maintenance management and engineering*, London: Springer-Verlag; 2009, p. 17–41.
- [2] Daya MB, DuffuaaSO, Raouf A, Knezevic J, Ait-Kadi D. *Handbook of maintenance management and engineering*, London: Springer-Verlag; 2009.
- [3] Daya MB, Duffuaa SO. Maintenance and Quality: The Missing Link, *J Qual in Maint Eng* 1995;1:20–26.
- [4] Wenchí S, Wang J, Wang X, Chong HY. An application of value stream mapping for turnaround maintenance in oil and gas industry: Case study and lessons learned. In: Raidén AB, Aboagye-Nimo E, editors. *Procs 31st Annual ARCOM Conference, 7-9 September 2015*, Lincoln, UK: Association of Researchers in Construction Management; 2015, p. 813–822.
- [5] Kurniati N, Yeh RH, Lin J. Quality Inspection and Maintenance: The Framework of Interaction. *Industrial Engineering and Service Science 2015, IESS 2015 Procead Manuf* 2015;4:244–251.
- [6] Ratnayake RMC, Stadnicka D, Antosz K. Deriving an Empirical Model for Machinery Prioritization: Mechanical Systems Maintenance, *Proceedings of the IEEE International Conference on Industrial Engineering and Engineering Management (IEEM)*, Bangkok; 2013, p. 1442–1447.
- [7] Ratnayake RMC. KBE Development for Criticality Classification of Mechanical Equipment: A Fuzzy Expert System. *Int J Dis and Risk Red* 2014;9:84–98.
- [8] Stadnicka D, Antosz K, Ratnayake RMC. Prioritization of Maintenance Tasks: Development of an Empirical Formula for Machine Classification. *Saf Sci* 2014;63:34–41.
- [9] Tay KM, Lim CP. On the use of fuzzy inference techniques in assessment models: part II: industrial applications'. *Fuz Opti and Dec Mak* 2008;3:283–302.
- [10] Ratnayake RMC. Knowledge based engineering approach for subsea pipeline systems' FFR assessment: A fuzzy expert system. *The TQM Journal* 2016;28:40–61.

Modelling and design of Safety Instrumented Systems for upstream processes of petroleum sector

Yury Redutskiy^a

^aMolde University College, P.O. Box 2110, NO-6402 Molde, Norway, e-mail: Yury.Redutskiy@HiMolde.no

Abstract: The adequacy of the decision-making regarding the specification of Safety Instrumented Systems (SIS) deployed for hazardous processes, contributes to avoiding incidents and corresponding losses. This paper proposes an approach to mathematically and economically substantiated design of SIS. Markov analysis is used for the stochastic process of SIS failures and technological incidents occurrence. The model is applied further for multi-objective optimization of SIS design. The research is relevant to engineering departments and contractors who specialize in planning and designing the technological solution.

Keywords: Emergency Shutdown System; Markov process; Multi-objective optimization; Risk management; Safety Instrumented System

References

- [1] Bukowski JV. Incorporating process demand into models for assessment of safety system performance. *RAMS'06. Annual Reliability and Maintainability Symposium 2006*;577–581.
- [2] CCPS (Centre for Chemical Process Safety). *Guidelines for Safe Process Operations and Maintenance*. New York: John Wiley & Sons; 2010.
- [3] Goble WM. *Control Systems Safety Evaluation and Reliability*. 3rd ed. Research Triangle Park: ISA; 2010.
- [4] Hauge S, Lundteigen MA, Hokstad P, Håbrekke S. *Reliability prediction method for safety instrumented systems*. Trondheim: SINTEF; 2010.
- [5] HSE Books. *Out of Control*. Second Edition. UK: Health & Safety Executive; 2003.
- [6] IEC 61511. *Functional safety – Safety instrumented system for the process industry sector*. Geneva, Switzerland: IEC; 2003.
- [7] Jin H, Lundteigen MA, Rausand M. Reliability performance of safety instrumented systems: A common approach for both low- and high-demand mode of operation. *Reliability Engineering & System Safety*. 2011; 96(3):365–373.
- [8] Deb K. *Multi-objective optimization using evolutionary algorithms*. Chichester, UK: John Wiley & Sons, 2001.
- [9] Kuo W. *Optimal reliability design: fundamentals and applications*. Cambridge, UK: Cambridge University Press; 2001.
- [10] Torres-Echeverria AC. *Modelling and Optimization of Safety Instrumented Systems Based on Dependability and Cost Measures*. PhD thesis. The University of Sheffield. 2009.

Production levelling as an effective method for production flow control – experience of Polish enterprises

Paulina Rewers^a, Adam Hamrol^a, Krzysztof Żywicki^a, Mariusz Bożek^b, Wojciech Kulus^b

^aPoznan University of Technology, 3 Piotrowo Str., Poznan 61–138, Poland; e-mail: krzysztof.zywicki@put.poznan.pl

^bAesculap Chifa Sp. z o.o, 14 Tysiadecia Str., Nowy Tomysl 64–300, Poland

Abstract: The article presents an extensive analysis of the literature on defining production levelling and the methodology for its implementation. Levelling production is widely known as a method of sequencing a variety of products in a mixed model production, primarily to balance the production, increase productivity and flexibility by eliminating waste and minimizing differences of the workplace. Without the implementation of the levelling production, a company it is unable to carefully control and predict the flow from production and the size of stocks of finished products and materials. In the introduction, the relation diagram shows the factors influencing production levels and those, which influence the production. The relation diagram is based on the authors' reflections and experience with Polish enterprises. The main aim of this article is to show how to change these factors after the implementation of production levelling. The article also presents an example of the implementation of levelling production at the department for the production of surgical instruments of a manufacturing enterprise. The current production scheme, including maps of material flow analysis, orders, and the flow from production are described. Finally, the article gives the successive steps in implementing the production levelling in the enterprise.

Keywords: production levelling; production flow; lean manufacturing.

References

- [1] Andel T. Accentuate heijunka, eliminate junk, supply chain flow. *Material Handling Engineering* 1999;54(8).
- [2] Bohnen F, Maschek T, Deuse J. Leveling of low volume and high mix production based on a Group Technology approach. *Journal of Manufacturing Science and Technology* 2015;4:247–251.
- [3] Chabowski P, Rewers P. Wpływ przebrojeń na elastyczność produkcji [The impact of changeovers on production flexibility]. *Logistyka* 2015;4: 8736–8743, CD3.
- [4] Elmaleh J, Eilon S. A new approach to production smoothing. *International Journal of Production Research* 1974;12(6):673–681.
- [5] Korytkowski P, Grimaud F, Dolgiu A. Exponential smoothing for multi-product lot-sizing with heijunka and varying demand. *Management and Production Engineering Review* 2014;5(2):20–26.
- [6] Matzka J, Di Mascolo M, Furmans K. Buffer sizing of a Heijunka Kanban system. *Journal of Intelligent Manufacturing* 2012;23(1):49–60.
- [7] Monden Y. *Toyota Production System*. Norcross, GA: Industrial Engineering and Management Press, Institute of Industrial Engineers; 1983.
- [8] Runkler TA. Controlling discrete manufacturing processes using Kanban and Heijunka approaches. *9th IEEE International Conference on Industrial Informatics* 2011;181–186.
- [9] Swanson R. A generalized approach to demand buffering and production levelling for JIT make-to-stock applications. *The Canadian Journal of Chemical Engineering* 2008;86(5):859–68.
- [10] Teece DJ, Pisano G, Shuen A. Dynamic capabilities and strategic management. *Strategic Management Journal* 1997;18:509–533.

Identification of factors related to trust formation in construction supply chains

Urszula Ryciuk^a

^aFaculty of Management, Bialystok University of Technology, 45A Wiejska Str., Bialystok, 15–351, Poland, e-mail: u.ryciuk@pb.edu.pl

Abstract: Trust is indicated as one of the main determinants of cooperation and a factor contributing to building successful and long-term supply chain relationships. However, the concept of trust is abstract and multidimensional, which means that it is difficult to measure, and the level of trust should be estimated taking into the consideration of many aspects at once. The main purpose of the paper was the identification of observable trust indicators in inter-organisational relations in construction supply chains, as well as factors closely related to trust and their observable indicators. The research was based on qualitative (focus group interview) and quantitative (230 computer assisted telephone interviews) studies conducted among construction companies. The study is the contribution to the area of research concerning trust in supply chains. The main result is the elaboration of scales that enable the measurement of inter-organisational trust and factors associated with trust.

Keywords: inter-organisational trust; construction supply chain; exploratory factor analysis (EFA); focus group interview (FGI); computer-assisted telephone interview (CATI).

References

- [1] Black C, Akintoye A, Fitzgerald E. An analysis of success factors and benefits of partnering in construction. *Int. J. Proj. Manag.* 2000;18:423–432.
- [2] Bresnen M, Marshall N. Partnering in construction: a critical review of issues, problems and dilemmas. *Construction Manag. and Econ.* 2000;18:229–237.
- [3] Chan APC, Chan DWM, Chiang YH, Tang BS, Chan EHW, Ho KSK. Exploring critical success factors for partnering in construction projects. *J. Constr. Eng. M.* 2004;130:188–198.
- [4] Chen WT, Chen TT. Critical success factors for construction partnering in Taiwan. *Int. J. Proj. Manag.* 2007;25:475–484.
- [5] Cheung SO, Wong WK, Yiu TW, Pang HY. Developing a trust inventory for construction contracting. *Int. J. Proj. Manag.* 2011;29:184–196.
- [6] Meng X. Assessment framework for construction supply chain relationships: Development and evaluation. *Int. J. Proj. Manag.* 2010;20: 695–707.
- [7] Pheng LS. The extension of construction partnering for relationship marketing. *Marketing Intelligence & Planning* 1999;17(3):155–160.
- [8] Tang W, Duffield CF, Young DM. Partnering mechanism in construction: An empirical study on the Chinese construction industry. *J. Constr. Eng. M.* 2006;132:217–229.
- [9] Wong PSP, Cheung SO. Structural Equation Model of trust and partnering success. *J. Manage. Eng.* 2005:70–80.
- [10] Wood G, McDermott P, Swan W. The ethical benefits of trust-based partnering: The example of the construction industry. *Bus. Ethic. European Rev.* 2002;11:4–13.
- [11] Kwon IWG, Suh T. Factors affecting the level of trust and commitment in supply chain relationships. *J. Supply Chain Manag.* 2004;40:4–14.
- [12] Sharif JT, Min S, Zacharia ZG. The nature of interfirm partnering in supply chain management. *J. Retailing* 2000;76:549–568.
- [13] Kadefors A. *Trust and distrust in temporary client-contractor relations*, 17th IMP-conference, Oslo, Norway; 2001.
- [14] Min S, Roath AS, Daugherty PJ, Genchev SE, Chen H, Arndt AD, Richey G. Supply chain collaboration: What is happening? *Int. J. Logistics Manag.* 2005;16:237–256.
- [15] Caoa M, Zhang Q. Supply chain collaboration: Impact on collaborative advantage and firm performance. *J. Oper. Manag.* 2011;29:163–180.
- [16] Hartmann A, Caerteling J. Subcontractor procurement in construction: the interplay of price and trust. *Supply Chain Manag.* 2010;15:354–362.
- [17] Maturana S, Alarcon L, Vrsalovic M. Achieving collaboration in the construction supply chain: an onsite subcontractors' evaluation methodology. In: Bertelsen S, Formoso CT. *Proceedings of the 12th Annual Conference of the International Group for Lean Construction*. Helsingor, Denmark; 2004.
- [18] Laaksonen T, Jarimo T, Kulmala HI. Cooperative strategies in customer-supplier relationships: The role of interfirm trust. *Int. J. Prod. Econ.* 2009;120:79–87.
- [19] Blomqvist K. The many faces of trust. *Scand. J. Manag.* 1997;13:272–283.

Mobilizing corporate foresight potential among V4 countries – assumptions, rationales, and the methodology

Anna Sacio-Szymańska^a, Anna Kononiuk^b, Stefano Tommei^a

^aInstitute for Sustainable Technologies – National Research Institute, 6/10 K. Pułaskiego Str., 26–600 Radom, Poland

^bFaculty of Management, Białystok University of Technology, 45A Wiejska Str., Białystok, 15–351, Poland, e-mail: a.kononiuk@b.edu.pl

Abstract: The aim of the article is to describe the concept of the International Visegrad Fund project entitled “Mobilizing corporate foresight potential among V4 countries”. The goal of the project is to help companies of the region to advance their Futures Literacy (FL). The theoretical part of the article is devoted to the presentation of the FL notion and a theoretical framework that links the individual foresight capacity with the strategic foresight capacity of an organisation. A special emphasis in the article is put on a brief characteristic of the V4 region, scientific problem, purpose and the methodology employed in the project.

Keywords: corporate foresight; decision-making; foresight maturity; entrepreneurship; futures literacy; Visegrad region.

References

- [1] das Neves Morais RJ, Coelho GM, Simões J, Ferreira A. Entrepreneurship in Higher Education: Nascent Entrepreneurs and Their Enhancers Factors. *Conference Paper, Proceedings of the 9th European Conference on Innovation and Entrepreneurship*, Brussels 2014:338–345.
- [2] Miller R. Learning, the Future, and Complexity. An Essay on the Emergence of Futures Literacy. *European Journal of Education* 2015;50(4):513–523.
- [3] Bootz JP, Strategic foresight and organizational learning: a survey and critical analysis. *Technol Forecast Soc Chang* 2010;77:1588–1594.
- [4] Conway M. *Foresight Infused Strategy: A How-To Guide for Using Foresight in Practice*. Melbourne, Australia: Thinking Futures; 2016.
- [5] Kononiuk A, Sacio-Szymańska A. Assessing the maturity level of foresight in Polish companies – a regional perspective. *European Journal of Futures Research* 2015; 3:23.
- [6] Sacio-Szymańska A, Mazurkiewicz A, Poteralska B. Corporate foresight at the strategic research institutes. *Business: Theory and Practice / Verslas: Teorija ir Praktika* 2015;16(3):316–325.
- [7] Cornell University, INSEAD, WIPO. *The Global Innovation Index 2015: Effective Innovation Policies for Development*, Fontainebleau, Ithaca, Geneva; 2015.
- [8] Hiltunen E. *Foresight and Innovation. How Companies are Coping with the Future*. Palgrave Macmillan; 2013.
- [9] Nazarko J. *Regionalny foresight gospodarczy. Metodologia i instrumentarium badawcze [Regional economic foresight. Methodology and research instruments]*. Warszawa: ZPWIM; 2013.
- [10] Nazarko J, Brzostowski N, Ejdyś J, Glińska E, Gudanowska A, Halicka K, Kononiuk A, Kowalewska A, Krawczyk-Dembicka E, Łojkowski W, Nazarko Ł, Urban W, Paszkowski J, Pawluczuk A, Skorek A, Wasiluk A. *Podlaska strategia rozwoju nanotechnologii do 2020 roku. Przełomowa wizja regionu. [Podlaska nanotechnology development strategy to 2020. Groundbreaking vision for the region]* Białystok: Rozprawy Naukowe Nr 246, Biblioteka Nauk o Zarządzaniu, Politechnika Białostocka; 2013.

Neural model for assessing the value of social capital

Julia Siderska^a

^aFaculty of Management, Białystok University of Technology, 45A Wiejska Str., Białystok, 15–351, Poland, e-mail: j.siderska@pb.edu.pl

Abstract: The paper introduces an artificial neural network model for assessing the social capital value of IT companies. The main purpose of the research was to develop the most efficient model for such estimations. Algorithms proposed in the literature for the prediction of the value of intangible assets were discussed, and their fundamental constraints were indicated. The article presents the methodology for the selection of input variables. The optimal number of cases in the training set were also investigated. The theoretical model was formulated and implemented to elaborate on the model of an artificial neural network. The study concerned neural network structures with a different number of neurons in the hidden layer, activation functions in the hidden and output layer, learning algorithms, and error function. Finally, in the present case, a supervised learning was adopted. The network was trained with the backpropagation algorithm on the basis of the social capital values, calculated using the fundamental equation [1]. The empirical studies also allowed identifying variables most significantly affecting the value of the social capital. All computer simulations and assessments were conducted using software package Statistica Automated Neural Networks. The paper concludes with a discussion about potential users of the proposed method and proposals for further research.

Keywords: neural network model; multilayer perceptron; social capital; IT companies; assessing the value of social capital; fundamental equation; input variables.

References

- [1] Walukiewicz S. *Social Capital*. Warsaw: Polish Academy of Sciences, Systems Research Institute; 2012.
- [2] Sveiby KE. *The new organisational wealth. Managing and measuring knowledge – based assets*. San Francisco CA: Berret-Koehler Publishers Inc; 1997.
- [3] Kaplan RS, Norton DP. Using the Balanced Scorecard as a Strategic Management System. *Harvard Business Review* 1996;January/February:75–85.
- [4] Edvinsson L, Malone MS. *Intellectual Capital. The Proven Way to Establish your Company's Real Value by Measuring its Hidden Brainpower*. London: HarperBusiness; 1997.
- [5] Lula P, Paliwoda-Pękosz G, Tadeusiewicz R. *Metody sztucznej inteligencji i ich zastosowania w ekonomii i zarządzaniu [Artificial intelligence methods and their applications in economics and management]*. Kraków: Wydawnictwo Akademicki Ekonomicznej; 2007.
- [6] Rutkowska D, Piliński M, Rutkowski L. *Sztuczne sieci neuronowe, algorytmy genetyczne i systemy rozmyte [Artificial neural networks, genetic algorithms and fuzzy systems]*. Warszawa: Wydawnictwo Naukowe PWN; 1997.
- [7] Baron B, Pasierbek A. Porównanie wydajności algorytmów gradientu sprzężonego i quasi-newtonowskiego BFGS w zagadnieniu optymalizacji rozprzężu mocy w systemie elektroenergetycznym [Comparison of conjugate gradient and quasi-newton BFGS algorithms in the optimal power flow problem]. *Prace Naukowe Politechniki Śląskiej. Elektryka* 2009;3:49–68.
- [8] Tadeusiewicz R. *Sieci neuronowe [Neural networks]*. Warszawa: Akademicka Oficyna Wydawnicza; 1993.
- [9] Siderska J. Application of neural network for social capital analysis. *Technical Transactions – Automatic Control* 2013;2-AC:57–66.
- [10] Siderska J. Analiza możliwości zastosowania sieci neuronowych do modelowania wartości kapitału społecznego w firmach IT [Possibilities of applying artificial neural networks to model the value of social capital in IT companies]. *Economics and Management* 2013;5(1):84–97.

Springback behaviour of AA6082T6 tubes in the three-point bending operation

Mehmet Alper Sofuoğlu^a, Selim Gürgen^b, Fatih Hayati Çakır^b, Sezan Orak^a

^aDepartment of Mechanical Engineering, Eskişehir Osmangazi University, 26480, Eskişehir, Turkey, e-mail: asofuoglu@ogu.edu.tr

^bVocational School of Transportation, Anadolu University, 26470, Eskişehir, Turkey

Abstract: Springback is an inevitable phenomenon in bending operations. For the geometrical accuracy in manufacturing, springback should be predicted and a required compensation should be applied to the operation. The numerical method is a very popular approach to predict the material behaviour in the operations. This method provides the reduction in time, effort and costs in comparison with the trial and error method. In this study, springback in the three-point bending operation of AA6082T6 tubes is investigated. A numerical model is established, and results are compared with experimental outputs for verification of the model. Effects of the indenter travel distance and a wall thickness of a tube in springback are studied.

Keywords: three-point bending; aluminium tube; springback.

References

- [1] Cheng SH, Cao J. An Accelerated Springback Compensation Method. *International Journal of Mechanical Sciences* 2007;49:267–279.
- [2] Papeleux L, Ponhot P. Finite Element Simulation of Springback in Sheet Metal Forming. *Journal of Materials Processing Technology* 2002; 125–126:785–791.
- [3] Stelson KA, Lou H. Three Dimensional Tube Geometry Control for Rotary Draw Tube Bending Part1: Bend Angle and Overall Tube Geometry. *Journal of Manufacturing Science and Engineering* 2002;123:258–265.
- [4] Eggertsen PA, Mattiasson K. On the Modeling of the Bending–Unbending Behavior for Accurate Springback Predictions. *International Journal of Mechanical Science* 2009;51:547–563.
- [5] Chatti S. Effect of the elasticity formulation in finite strain on springback prediction. *Computers and Structures* 2010;88:796–805.
- [6] Palaniswamy H, Ngaile G. Optimization of Blank Dimensions to Reduce Springback in the Flexforming Process. *Journal of Materials Processing Technology* 2004;146:28–34.
- [7] Gan W, Wagoner RH. Die Design Method for Springback. *International Journal of Mechanical Sciences* 2004;46:1097–1113.
- [8] Wagoner RH, Li M. Simulation of Springback: Through-Thickness Integration. *International Journal of Plasticity* 2007;23:345–360.
- [9] Oliveira MC, Alves JL. Study on the Influence of Work-Hardening Modeling in Springback Prediction. *International Journal of Plasticity* 2007;23:516–543.
- [10] Esat V, Darendeliler H, Gokler MI. Finite Element Analysis of Springback in Bending of Aluminum Sheets. *Materials and Design* 2002;23:223–229.

Improving productivity in the business of construction

Tamlyn Snyman^a, John Smallwood^a

^aNelson Mandela Metropolitan University, PO Box 77000, Port Elizabeth, 6031, South Africa, e-mail:john.smallwood@nmmu.ac.za

Abstract: Productivity has a direct impact on profitability and is essential for the success and sustainability of any construction organisation. Consequently, productivity must be effectively managed at top and middle management levels, and not solely at the operational level. The objective of the study was to determine construction organisations' perceptions and practices relative to the productivity of their organisations, as opposed to the productivity of construction activities. The study was conducted among general contracting organisations in the Nelson Mandela Bay metropole in South Africa. Findings include, inter alia, that construction organisations are not fully productive due to the fact that there is a lack of strategic thinking, new technology and construction methods are not being fully utilised, and there is a lack of innovation and efficiency. Construction organisations can optimise their profits by increasing their profit and overhead mark-up on projects, ensuring a positive cash flow at all times, and utilising their resources in the most efficient and cost-effective way possible. Recommendations include, *inter alia*, that construction organisations should: review the manner in which they conduct business; opt for more advanced methods of construction and utilise new technology, and regularly prepare budgets, use financial indicators to review productivity, monitor cash flow, and review the skills of their employees.

Keywords: business; capital; construction; productivity; profitability.

References

- [1] AbouRizk SM, Leonard EB. *Managing performance in construction*. New Jersey: John Wiley & Sons, Inc.; 2010.
- [2] Myers D. *Construction economics: a new approach*. 3rd ed. London and New York: Routledge; 2013.
- [3] Zandin KB. *Maynards industrial engineering handbook*. 5th ed. New York: The McGraw-Hill Companies, Inc.; 2001.
- [4] Baiden BK, Edum-Fotwe FT, Ofori-Kurangu JK. Benchmarking UK construction firms value added and productivity performance. In: Proceedings The Construction, Building and Real Estate Research Conference of the Royal Institution of Chartered Surveyors. Paris: Dauphine University; 2–3 September 2010, United Kingdom: RICS; 2010, p. 1–17.
- [5] Hammad MS, Omran A, Pakir AHK. Identifying ways to improve productivity in the construction industry. *Acta Technica Corviniensis – Bulletin Of Engineering* 2011;4:47–49.
- [6] Peterson SJ. *Construction accounting and financial management*. 2nd ed. New Jersey: Pearson; 2009.
- [7] Netscher P. *Building a successful construction company: the practical guide*. Subiaco: Panet Publications; 2014.
- [8] Chatterjee B. *Improving business strategy and construction management in developing countries*. Bloomington: iUniverse, Inc.; 2013.
- [9] Stevens M. *Managing a construction firm on just 24 hours a day*. New York: McGraw-Hill; 2007.
- [10] Akintoye A, Goulding J, Zawdie G. *Construction innovation and process improvement*. West Sussex: Blackwell Publishing Ltd.; 2012.
- [11] Bennett J, Radosavljevic M. *Construction management strategies: a theory of construction management*. West Sussex: John Wiley & Sons, Ltd.; 2012.
- [12] Lavingia NJ. Improve profitability through effective project management and TCM. AACE International Transactions, ChevronTexaco Corp., San Ramon, CA, 2003.
- [13] Nazarko J, Chodakowska E. Measuring productivity of construction industry in Europe with Data Envelopment Analysis. *Procedia Engineering* 2015;122:204–212.
- [14] Liu Y, Zayed T. Cash flow modelling for construction projects. *Engineering, Construction and Architectural Management* 2014;21(2):170–189.
- [15] Al-Aomar R, Al-Joburi KI, Bahri ME. Analyzing the impact of negative cash flow on construction performance in the Dubai area. *American Society of Civil Engineers* 2012;28(4):382–390.

Enhancing aircraft maintenance services: a VSM-based case study

Dorota Stadnicka^a, R.M. Chandima Ratnayake^b

^a Faculty of Mechanical Engineering and Aeronautics, Rzeszow University of Technology, Rzeszow, AL. Powstancow Warszawy 12, 35-959 Rzeszow, Poland, e-mail: dorota.stadnicka@prz.edu.pl

^b Department of Mechanical and Structural Engineering and Materials Science, University of Stavanger, N4036, Stavanger, Norway

Abstract: Clients expect a short lead-time from aircraft maintenance services. In order to minimize the lead time, it is vital to analyse service processes related to maintenance tasks and identify existing problems such as bottleneck tasks and wastes related to different tasks. The value stream mapping (VSM) approach enables to visualize the value streams and possibility of investigating the waste. Hence, the VSM approach was used to investigate the maintenance services. The main purpose of the manuscript is to demonstrate the use of the VSM-based methodology together with other tools, which were used in aircraft maintenance processes in minimizing the lead-time of maintenance services and, subsequently, minimizing the costs of maintenance services. The manuscript illustrates the use of value stream mapping (VSM) in enhancing the process cycle efficiency (PCE) of maintenance services provided in an aircraft maintenance services providing firm (AMSPF). A world-class PCE value was selected in order to calculate the PCE improvement in the 'future state' (i.e. the use of FVSM) in relation to the 'current state' (i.e. use of CSVSM).

Keywords: aircraft maintenance; costs reduction; service processes; value stream mapping; time waste reduction.

References

- [1] Fraser K. Facilities management: The strategic selection of a maintenance system. *Journal of Facilities Management* 2014;12:18–37.
- [2] Pinjala SK, Pintelon L, Vereecke A. An empirical investigation on the relationship between business and maintenance strategies. *International Journal of Production Economics* 2006;104:214–229.
- [3] Bevilacqua M, Braglia M. The analytic hierarchy process applied to maintenance strategy selection. *Reliability Engineering & System Safety* 2000;70:71–83.
- [4] Mostafa S, Lee S-H, Dumrak J, Chileshe N, Soltan H. Lean thinking for a maintenance process. *Production & Manufacturing Research*, 2015;3(1):236–272.
- [5] Holweg M. The genealogy of lean production. *Journal of Operations Management* 2007;25(2):420–37.
- [6] Savhnay R, Kannan S, Li X. Developing a value stream map to evaluate breakdown maintenance operations. *Int. J. Industrial and Systems Engineering* 2009;4(3):229–240.
- [7] Smith R, Hawkins B. *Lean maintenance: Reduce costs, improve quality, and increase market share*. Burlington MA: Elsevier; 2004.
- [8] Clarke G, Mulryan G, Liggan P. Lean maintenance – A risk-based approach. *Pharmaceutical Engineering* 2010;30(5):1–6.
- [9] Ochalik P. *Value stream mapping of service processes*. Unpublished work under supervising of Dorota Stadnicka. Rzeszow; 2015.
- [10] Rother M, Schook J. *Learning to See: Value Stream Mapping to Add Value and Eliminate MUDA*. Brookline, Massachusetts: The Lean Enterprise Institute; 1999.

Quality of accommodation services. The memetic approach

Krzysztof Stepaniuk^a

^aFaculty of Management, Białystok University of Technology, 45A Wiejska Str., Białystok, 15–351, Poland, e-mail: k.stepaniuk@pb.edu.pl

Abstract: The main scientific objective of the article is to demonstrate, on the example of accommodation service, the possibility of applying the netnographic methodology and meme theory in the context of the analysis of the manner of perception of the quality of a service.

The study was carried out using the netnographic method and the method of quantitative and qualitative content analysis. The analysis included the comments left on the business profiles of agrotourism farms located in the vicinity of the selected national parks in Poland that can be found in the selected comparison websites of tourist offers. The content of the comments was related to the cognitive-perceptual attributes of the model of a tourist image [3]. These are the indicators enabling the decomposition of hotel service and the perception of the quality of the process from its perspective. In this perspective, the quality of the service is also reflected in, among others, the mental state of the recipient, which can be externalized and communicated. This latter feature makes it possible to examine the quality of services from the perspective of the memetic approach [4].

The practical result of the completed research is the description of the assumptions pertaining to the model of management of the quality of services in the perspective of the process.

The cause-and-effect relationship between the service quality, content analysis, and the formation of memetic transfer was defined, which, through the creation of specific consumer expectations, can contribute to the creation of a positive image of the service provider. The obtained results will provide a theoretical basis for an innovative model for the management of the quality of service according to the memetic approach.

Keywords: service quality; accommodation services; social networks; UGC; meme; meme transfer.

References

- [1] Urban W. Definicje jakości usług – różnice oraz ich przyczyny [Definitions of service quality – differences and their reasons]. *Problemy Jakości* 2007;3:4–9.
- [2] Juran M. *Juran on Quality by Design: The New Steps for Planning Quality into Goods and Services*. New York: The Free Press; 1992.
- [3] Baloglu S, McCleary KW. A model of destination image formation. *Ann Tourism Res* 1999;26(4):868–897.
- [4] Dawkins R. *The selfish gene*. Oxford: Oxford University Press; 1976.
- [5] Morton C, Caulfield B, Anable J. Customer perceptions of quality of service in public transport: Evidence for bus transit in Scotland, *Case Stud Trans Policy*, Available online 23 March (2016). <http://dx.doi.org/10.1016/j.cstp.2016.03.002>
- [6] Shifman L. Memes in a Digital World: Reconciling with a Conceptual Troublemaker. *J Comput Mediat Commun* 2013;18:362–377. <http://dx.doi.org/10.1111/jcc4.12013>
- [7] Su L, Swanson SR, Chen X. The effects of perceived service quality on repurchase intentions and subjective well-being of Chinese tourists: The mediating role of relationship quality. *Tour Manage* 2016;52:82–95. <http://dx.doi.org/10.1016/j.tourman.2015.06.012>
- [8] Smoleński M. Atrybutowość produktu hotelowego w trzyczynnikowej teorii satysfakcji [The attributiveness of hotel product according to the three-factor theory of customer satisfaction]. *Economics and Management* 2011;3(1):70–77.
- [9] Tosun C, Dedeoğlu BB, Fyall A. Destination service quality, affective image and revisit intention: The moderating role of past experience. *Journal of Destination Marketing & Management* 2015;4(4):222–234. <http://dx.doi.org/10.1016/j.jdmm.2015.08.002>
- [10] Jemielniak D. Netnografia, czyli etnografia wirtualna – nowa forma badań etnograficznych [Netnography, or virtual ethnography, as a new form of ethnographic research]. *Prakseologia* 2013;154:97–116.

Problem of language used to describe competences in the management of acceleration in the creation of knowledge resources in businesses

Maciej Szafrąński^a

^aPoznan University of Technology, Poznan 60–965, Poland, e-mail: maciej.szafranski@put.poznan.pl

Abstract: As a result of his scientific researches, the author proposed to distinguish a new process in businesses, i.e. the acceleration. He emphasized the role of using information systems in order to accelerate access to information about competences. In this article, the author presents an example of an information system (the Professionals System). The difficulty in understanding the language used to describe competences in businesses and by job candidates turned out to be a significant problem to develop the communication by system users. The scientific objectives of this article are to diagnose the causes of the problem and an attempt to determine a possible scope of its solution. Therefore, literature studies have been conducted as well as a directed analysis of data collected from own studies conducted in 2010–2014. The presented analysis extends the previously published general research results. Limitations in the language were identified, which will be difficult to eliminate if one wants to create competence dictionaries used in information systems meant to accelerate the remote communication between job seekers and employers. The article results in the expansion of knowledge about the influence of language used to describe competences on the fastness and accuracy of obtaining them for the purposes of efficient business operation. In the operational dimension, the works described in the article will result in easier improvement of the Professionals System whose functioning on the market has been planned at least until 2022.

Keywords: acceleration; competences; knowledge; language; process.

References

- [1] Szafrąński M. *Zarządzanie akceleracją tworzenia zasobów wiedzy w przedsiębiorstwach [Management of acceleration in the creation of knowledge resources in businesses]*. Poznań: Wydawnictwo Politechniki Poznańskiej; 2015.
- [2] Doucek P, Maryska M, Novotny O. Requirements on the competence of ICT managers and their coverage by the educational system – experience in the Czech Republic. *Journal of Business Economics and Management* 2014;15(5):1054–1077.
- [3] Al-Hakim LA, Hassan S. Core requirements of knowledge management implementation, innovation and organizational performance. *Journal of Business Economics and Management* 2016; 17(1):109–124.
- [4] Chu MT, Fardoei SR, Fallah H, Ghazinoory S, Aliahmadi A. Modeling national innovation system enabled by knowledge management. *Journal of Business Economics and Management* 2014; 15(5):964–977.
- [5] Tuomi I. *Corporate Knowledge. Theory and Practice of Intelligent Organizations*. Helsinki: Metaxis; 1999.
- [6] Prechtł P. *Wprowadzenie do filozofii języka [Introduction to language philosophy]*. Kraków: Wydawnictwo WAM; 2007.
- [7] Russel B. *Badania dotyczące znaczenia i prawdy [Researches on the meaning and the truth]*. Kraków: Wydawnictwo WAM; 2011.
- [8] Piłat R. Wyobrażenia, modele umysłowe, pojęcia [Imaginations, mental models, concepts]. In: Miłkowski M, Pozobut R, editors. *Przewodnik po filozofii umysłu [Philosophy of mind guide]*. Kraków: Wydawnictwo WAM; 2012, p. 253–310.
- [9] Mantura W. *Zarys jakościologii [Draft of Qualityology]*. Poznań: Wydawnictwo Politechniki Poznańskiej; 2010.
- [10] McIver D, Wang XA. Measuring knowledge in organizations: a knowledge-in-practice approach. *Journal of Knowledge Management* 2016;20(4):637–652.

User-Driven Innovation – the concept and research results

Elżbieta Szymańska^a

^aFaculty of Management, Białystok University of Technology, 45A Wiejska Str., Białystok, 15–351, Poland, e-mail: e.szymanska@pb.edu.pl

Abstract: The research problem discussed in the paper is the innovation process, called User-Driven Innovation (UDI). The aim of the study is to determine whether the UDI system is more effective in introducing innovations than the linear one. The following hypothesis was formulated: companies introducing UDI systems represent a higher level of innovativeness than companies introducing the linear process. The following methods were used: a questionnaire, a standardized interview, and the ranking method. The hypothesis has been verified. The research showed a relatively small role of the Management Board in relation to customers in the innovation processes at the enterprises surveyed.

Keywords: innovation; process of innovation; User Driven Innovation; service enterprises; medicine; tourism.

References

- [1] Aundretsch DB. Sustaining Innovation and Growth: Public Policy Support for Entrepreneurship. *Industry and Innovation* 2004;11:167–191.
- [2] Chesbrough H. *Open innovation. The New imperative for creating and profiting from technology*. Boston: Harvard Business School Press; 2003.
- [3] Chesbrough H. The era of open innovation. *MIT Sloan Management Review* 2003;44(3):35–41.
- [4] Kelley T. *Sztuka innowacji. Lekcja kreatywności z doświadczeń czolowej amerykańskiej firmy projektowej [The Art of Innovation: Lessons in Creativity from IDEO, America's Leading Design Firm – in Polish]*. Warsaw: Publishing House of MT Biznes sp. z o. o.; 2003.
- [5] Łobejko S. *Przedsiębiorstwo sieciowe. Zmiany uwarunkowań i strategii w XXI wieku [A networked enterprise. Changes in the drivers and strategies in the 21st century – in Polish]*. Warsaw: Warsaw School of Economics; 2010.
- [6] McGowan P. Innowacje i przedsiębiorczość wewnętrzna [Innovation and internal entrepreneurship]. In: Steward D, editor. *The Practice of Management. How to Manage Oneself, Others and the Company*, Warsaw: PWE; 1996, p. 581–582.
- [7] Nazarko J. *Regionalny Foresight Gospodarczy. Metodologia i instrumentarium badawcze [Regional Economic Foresight. Methodology and Research Tools – in Polish]*. Warsaw: Employers Association of Warsaw and Mazovia; 2013.
- [8] Östlund B, Oander E, Jonsson O, Frennert S. STS-inspired design to meet the challenges of modern aging. Welfare technology as a tool to promote user driven innovations or another way to keep older users hostage?. *Technological Forecasting & Social Change* 2015;93:82–90.
- [9] Popper R. Foresight Methodology. In: Georgioui L, Cassingena J, Keenan M, Miles I, Popper R, editors. *The Handbook of Technology Foresight, Cheltenham: Edward Elgar; 2008, p. 44–88.*
- [10] Roehrich G. Consumer innovativeness. Concepts and measurements. *Journal of Business Research* 2004;57:671–677.
- [11] Rogut A, Piasecki B. *Delphi. Technologie przyszłości Delphi [Technologies of the Future – in Polish]*. Łódź: SWSzPiZ; 2008.
- [12] Rothwell R. Towards the fifth-generation innovation process. *International Marketing Review* 1994;11(1):7–31.
- [13] Szymańska E. *Innowacyjność przedsiębiorstw turystycznych w Polsce [Innovativeness of tourism enterprises in Poland]*. Białystok: Publishing House of the Białystok University of Technology; 2009.
- [14] Szymańska E. *Procesy innowacyjne przedsiębiorstw świadczących usługi w zakresie organizacji imprez turystycznych [Innovation processes at providers of services related to the organisation of tourist events]*. Białystok: Publishing House of the Białystok University of Technology; 2013.
- [15] Urban W. Jakość usług współtworzona z klientem – koncepcja i wyniki badań jakościowych [The quality of services created together with the customer – the concept and results of qualitative research]. *Zeszyty Naukowe Szkoły Głównej Gospodarstwa Wiejskiego w Warszawie. Polityki Europejskie, Finanse i Marketing* 2013;58(9):577–587.

Importance of technological factors in the creation of cooperation

Anna Tomaszuk^a

^aFaculty of Management, Białystok University of Technology, 45A Wiejska Str., Białystok, 15–351, Poland, e-mail: annatomaszuk@wp.pl

Abstract: The complex environment of the contemporary business reality requires enterprises to have the skills not only to compete but also to cooperate. The ability to collaborate may lead to future joint problem solving, joint control over processes, and mutual learning. On the other hand, the existence of global competition necessitates the continuous introduction of effective technical, economic and organizational innovations. The chances of achieving high competitiveness are in the hands of companies, which emphasize the importance of new technologies and try to master them. The purpose of this article is to specify the values of technological factors in the formation of cooperation. The article uses the method of critical analysis of literature and statistical analysis of data obtained from a survey conducted in 381 Polish companies of leading Podlaskie industries: food, wood and furniture, construction, metal and machinery.

As a result of the literature analysis and discussions, the factors were determined that influence the cooperation between the operators with organisations of the business environment and science and research institutions. In relation to each kind of cooperation, several factors were specified, including factors related to technology management.

First of all, the importance of factors related to the management of technology in relation to the rest of the factors influencing the development of cooperation was analysed. The aspect of cooperation between directly competing enterprises was studied as well as between companies and organisations of the business environment and between enterprises and the sphere of scientific and technical support.

The results show that companies are interested in cooperation to a small degree. In addition, factors associated with the possibility of taking joint technology action are not essential for establishing such cooperation.

Keywords: cooperation; inter-company cooperation; areas of cooperation; Podlaskie; technological factors.

References

- [1] Strzyżewska M. *Współpraca między przedsiębiorstwami – odniesienie do polskiej praktyki* [Cooperation between enterprises – a reference to the Polish practice]. Warszawa: Oficyna Wydawnicza SGH; 2011.
- [2] Adamik A, Staniszweska K. Zarządzanie współpracą z partnerami biznesowymi z wykorzystaniem rozwiązań IT [Management of cooperation with business partners using IT solutions]. In: Lachiewicz S, Zakrzewska-Bielawska A, editors. *Zarządzanie przedsiębiorstwem w warunkach rozwoju wysokich technologii* [Business management in conditions of high technology development], Łódź: Politechnika Łódzka; 2008.
- [3] Zahra SA, Kirchoff BA. Technological resources and new firm growth: A comparison of start-up and adolescent ventures. In: Keister LA, editor. *Entrepreneurship. Research in the sociology of work*. Emerald Group Publishing Limited; 2005.
- [4] Nalebuff BJ, Brandenburger A. *Co-opetition*. London: Harper Collins Business; 1996.
- [5] Romanowska M, Trocki M. Przedsiębiorstwo partnerskie – w poszukiwaniu równowagi pomiędzy rywalizacją i współdziałaniem [Company affiliate – in the search for a balance between competition and interoperability]. *MBA* 2002;59(6):46–48.
- [6] Mazur J. Współpraca przedsiębiorstw w teorii i praktyce polskiej [The cooperation of companies in the theory and polish practice]. *Zeszyty Naukowe Kolegium Gospodarki Światowej* 2011;32:290–314.
- [7] Zakrzewska-Bielawska A, editor. *Kooperacja w rozwoju przedsiębiorstw high-tech. Determinanty i dynamika* [Cooperation in the development of high-tech enterprises. Determinants and dynamics], Warszawa: Placet; 2014.
- [8] Powell WW. Neither market nor hierarchy: Network form of organization. *Research in Organizational Behaviour* 1990;12:295–336.
- [9] Wasiluk A. Zaufanie i współpraca pomiędzy przedsiębiorstwami w perspektywie budowy i rozwoju struktur klastrowych [Trust and cooperation between companies in the perspective of cluster structures' formation and development]. *Economics and Management* 2013;4:49–66.
- [10] Cygler J. *Kooperacja przedsiębiorstw. Czynniki sektorowe i korporacyjne* [Cooperation of companies. Factors sectoral and corporate]. Warszawa: Oficyna Wydawnicza SGH w Warszawie; 2009.

Evaluation of employee creativity as a stimulator of company development

Kamila Tomczak-Horyń^a, Ryszard Knosala^a

^a Institute of Processes and Products Innovation, Opole University of Technology, Ozimska 75 Str., Opole, 45370, Poland,
e-mail: k.tomczak-horyn@po.opole.pl

Abstract: Creative thinking is an essential feature of employees and a source of innovation in the development of enterprises. It manifests in the activity of the employee, in the reporting of application rationalization, creative attitude and creative way of solving the problems that arise in the company. Undoubtedly, developing an appropriate methodology for innovation and creativity will facilitate and improve the decision-making for the manufacturing of an enterprise. Through the use of the creativity assessment system, each manager will be able to effectively motivate employees to submit innovative solutions, monitor the level of creativity of employees, and build the creative teams. Such action will contribute to the increase of innovation in the company and, thus, will affect its development. The article provides the methodology for the assessment of creativity of staff working in manufacturing enterprises. The article describes the developed tools for the support of the process used for the evaluation and their application in a selected production company. Furthermore, the article shows the stages of the study on the impact of the evaluation of the employee creativity on the formation of innovative solutions within an enterprise. The described problem is an important issue in the field of production engineering. An important related areas is the organisation and management of production and services, and innovation management.

Keywords: creativity of evaluation; Creative Attitude Questionnaire; ESPIR application.

References

- [1] Brzeziński M. *Organizacja kreatywna [Creative organization]*. Warszawa: PWN; 2009.
- [2] Kaliszczak L. Kreatywność i innowacyjność w kształtowaniu wartości rynkowej oraz przewagi konkurencyjnej przedsiębiorstw [Creativity and innovation in the development of the market value and competitive advantage]. In: Frejtag-Mika E, editor. *Przedsiębiorstwo i region [The company and region]*, Rzeszów: Uniwersytet Rzeszowski Katedra Ekonomiki i Zarządzania; 2013.
- [3] Kisielnicki J. *Systemy informatyczne zarządzania [Information Systems Management]*. Warszawa: Wyd. Placet; 2013.
- [4] Knosala R, Boratyńska-Sala A, Jurczyk-Bunkowska M, Moczala A. *Zarządzanie innowacjami [Innovation management]*. Warszawa: PWE; 2013.
- [5] Kłak M. *Zarządzanie wiedzą we współczesnym przedsiębiorstwie [Knowledge management in the modern enterprise]*. Kielce: Wyd. Wyższej Szkoły Ekonomii i Prawa w Kielcach; 2010.
- [6] Luecke R. *Managing creativity and innovation*. Boston: Harvard Business School Press; 2003.
- [7] Proctor T. *Creative Problem Solving for Managers*. New York: Routledge; 2005.
- [8] Szewc A. *Racjonalizacja w zakładzie pracy, Poradnik dla racjonalizatorów i przedsiębiorców [Rationalisation in the workplace, Guide for Innovators and Entrepreneurs]*. Warszawa: Polska Agencja Rozwoju Przedsiębiorczości; 2007.
- [9] Tomczak-Horyń K, Knosala R. Ocena kreatywności w procesie rekrutacji kandydata do pracy [Evaluation of creativity in the process of recruiting a candidate to work]. In: Knosala R, editor. *Innowacje w Zarządzaniu i Inżynierii Produkcji [Innovation in Management and Production Engineering]*, t. 7, Opole: Oficyna Wydawnicza Polskiego Towarzystwa Zarządzania Produkcją; 2016, p. 228–235.
- [10] Tomczak-Horyń K, Knosala R. Projekt systemu oceny kreatywności pracowników przedsiębiorstw produkcyjnych [The system design of evaluation the creativity of staff in manufacturing enterprises]. *Zarządzanie Przedsiębiorstwem* 2016;2:34–39.

Interpretive structural modelling in action – a preliminary exploration of AIDS pandemic in South Africa

Nien-Tsu Tuan^a

^aUniversity of Cape Town, Private Bag X3, Rondebosch 7701, South Africa, e-mail: nien-tsu.tuan@uct.ac.za

Abstract: Approximately 12% of South Africans are living with HIV/AIDS. This disease impacts on South Africa's labour force, plagues its economy, and threatens its growth. After the implementation of many AIDS prevention projects, South Africa's HIV prevalence still remains high. This study presents a preliminary exploration of the drivers leading to the AIDS pandemic in South Africa. Interpretive Structural Modelling (ISM) is used as a mechanism for revealing the drivers leading to AIDS pandemic in South Africa. The modelling process embodies the following steps: 'generating ideas resulting in AIDS', 'clarifying the generated ideas', 'using Interpretive Structural Modelling software to construct a diagraph displaying the interrelationships of the generated ideas' and 'interpreting the produced model'. The produced model reveals that two major factors lead to the AIDS pandemic in South Africa. They are 'poverty' and 'lack of knowledge of AIDS'. The two factors exacerbate other problems, such as 'gender inequality', 'stigma and discrimination' and 'unprotected sex with partner'. Tackling the two drivers ought to be given priority. However, addressing the problem of 'poverty' requires cross-functional collaboration.

Keywords: HIV/AIDS; Systemic Approach; Interpretive Structural Modelling; Interaction; Root Problem.

References

- [1] Arndt C, Lewis JD, The macro implications of HIV/AIDS in South Africa: a preliminary assessment. *S. Afr. J. Econ.* 2000;68:380–392.
- [2] Ellis LL. The economic impact of HIV/AIDS on small, medium and large enterprises. *S. Afr. J. Econ.* 2006;74:682–701.
- [3] Ndlovu N, Daswa R. Review of progress and expenditure on the comprehensive plan for HIV and AIDS for South Africa. *S. Afr. J. Econ.* 2008;76:S34–S51.
- [4] Bentar S.R. Health care reform and the crisis of HIV and AIDS in South Africa. *N. Engl. J. Med.* 2004;351:81–92.
- [5] Flood R. The relationship of 'systems thinking' to action research. *Syst Pract Action Res* 2010;23:269–284.
- [6] Tuan N, Shaw C. Consideration of ethics in systemic thinking. *Syst Pract Action Res* 2016;29:51–60.
- [7] Warfield JN. *Social Systems: Planning Policy and Complexity*. New York: Wiley; 1976.
- [8] Tuan N. On the complex problem: a study of interactive management. *Kybernetes* 2004;33:62–79.
- [9] Pfohl H, Gallus P, Thomas D. Interpretive structural modelling of supply chain risks. *Int. J. Phys. Distrib. Logist. Manag.* 2011;41:839–859.
- [10] Churchman CW. *The Systems Approach and Its Enemies*. USA: Basic Books; 1979.

System of amoebas as a remedy for employee engagement deficits – a conceptual deliberation

Wiesław Urban^a

^aFaculty of Management, Białystok University of Technology, 45A Wiejska Str., Białystok, 15–351, Poland, e-mail: w.urban@pb.edu.pl

Abstract: The study is focused on the vital management problem of employee engagement. For a company, it is a true challenge to have employees taking full responsibility for their work and making every effort. The study examines the system of amoebas, developed at Kyocera, from the viewpoint of employee engagement. It aims to figure out the challenges for the implementation of the Amoeba System in a traditionally managed bureaucratic company. The study takes a conceptual research approach. It proposes a list of four of the most challenging issues that arise while introducing the amoeba management approach in a company. They are: (1) giving small teams real autonomy, (2) designing a new accounting system, (3) introducing a system of inner prices, and (4) developing a set of clear organisational principles. The study also proposes directions for future research.

Keywords: workforce engagement; Amoebas System; Inamori; Kyocera.

References

- [1] Kahn WA. Psychological conditions of personal engagement and disengagement at work. *Acad Management J* 1990;33:692–724.
- [2] Meyer JP, Allen NJ. A Three-component Conceptualization of Organizational Commitment, *Human Resource Man Rev* 1991;1:61–89.
- [3] Juchnowicz M. *Zaangażowanie pracowników. Sposoby oceny i motywowania [Employees engagement. Means of assessment and motivation]*. Warsaw: Polskie Wydawnictwo Ekonomiczne; 2012.
- [4] Moczyłowska JM. Employees' commitment management in the assessment of managers (based on the results of quality research). In: Borkowski S, Stasiak-Betlejewska R, editors. *Toyotarity. People, processes, quality improvement*. Alba Iulia: Aeternitas Publishing House; 2013, p. 29–39.
- [5] Adler RW, Hiromoto T. Amoeba Management: Lessons From Japan's Kyocera. *MIT Sloan Man Rev* 2012;54:83–89.
- [6] Takeda H, Boyns T. Management, accounting and philosophy. *Accounting, Auditing & Accountability J* 2014;27:317–356.
- [7] Inamori K. *Amoeba Management. The Dynamic Management System for Rapid Market Response*. Boca Raton: CRC Press; 2013.
- [8] Hamada K, Monden Y. Profit management at Kyocera Corporation: the amoeba system. In: Monden Y, Sakurai M, editors. *Japanese Management Accounting – A World Class Approach to Profit Management*. Cambridge: Productivity Press; 1989, p. 197–210.
- [9] Blahová M. *Effective Strategic Action: Creating Dynamic Performance Framework Based on the Utilization of Synergy Effects of Bata, Japanese and Amoeba Management Systems*. Doctoral thesis. Tomas Bata University in Zlín, Faculty of Management; 2013.
- [10] Lere JC. Activity-based costing: a powerful tool for pricing. *J Bus Industrial Mark* 2000;15:23–33.

Methods of determining the region's investment strategy

Leonas Ustinovichius^a, Andželika Komarowska^b, Robert Komarowski^b

^aFaculty of Management, Białystok University of Technology, 45A Wiejska Str., Białystok, 15-351, Poland, e-mail: leonas959@gmail.com

^bVilnius district municipality, 50 Rinktonės Str., LT-09318 Vilnius, Lithuania

Abstract: The region's macro environment analysis identifies the measures that would improve the investment environment in the region and help to create an effective direct domestic and foreign investment promotion system. The investment climate analysis includes the examination of the potential of the region, business development opportunities, and the preparation of territorial planning documents. Given the solutions provided in the prepared documents, their goals, and objectives, the development of economic and commercial activities of the territory, the contents and the deadline for documents to be prepared are established.

The investment strategy analysis includes the examination of potential strategic development directions and the region's SWOT analysis. Based on the findings of the integrated analysis, in the decision-making stage the investment direction is selected, the implementation of which will allow achieving the stated goal. The alternatives for the implementation of the investment direction are formed. Alternatives are described using the efficiency criteria and are assessed using MCDM1 multi-criteria methods.

The article presents the creation of the theoretical model of determination of the investment strategy in the context of sustainable development. The study includes an integrated regional analysis using Vilnius district as an example.

Keywords: sustainable development of regions, region's investment strategy, multicriteria methods.

References

- [1] Allen WL. We are Sitting on a Time Bomb: A Multiperspectival Approach to Inter-National Development at an East African Border. *Geopolitics* 2015;20:381–403.
- [2] Vaz DM, Matos MJ. Regional Polycentrism in a Mountainous Territory: The Case of Covilha (Portugal) and Alpine Cities. *European Planning Studies* 2015;23:379–397.
- [3] Fan Z, Ma J, Tian P. A subjective and objective integrated approach for the determination of attribute weights. *European Journal of Operational Research* 1999;112:397–404.
- [4] Hwang CL, Yoon K. *Multiple attribute decision making – methods and applications, A State of the Art Survey*; Berlin, New York: Springer Verlag; 1981.
- [5] Ustinovichius L. Determination of Efficiency of Investments in Construction. *International Journal of Strategic Property Management* 2004;8:25–44.
- [6] Suzuki K. Optimal switching strategy of a mean-reverting asset over multiple regimes. *Automatica* 2016;67:33–45.
- [7] Crescenzi R, Rodríguez-Pose A. Infrastructure and regional growth in the European Union. *Papers in Regional Science* 2012;91:487–513.
- [8] Wróblewski Ł. Creating an image of a region – Euroregion Beskydy and Euroregion Cieszyn Silesia examples. *Economics and Management* 2016;8:91–100.
- [9] Szuster M, Szymczak M. Innovation, knowledge and information management in supply chains. *Economics and Management* 2016;8:26–36.
- [10] Gajzler M. Usefulness of mining methods in knowledge source analysis in the construction industry. *Archives of Civil Engineering* 2016;LXII:99–110.

Effect of biofuel production on sustainability of agriculture

Andrzej Leonard Wasiaś^a

^aFaculty of Management, Białystok University of Technology, 45A Wiejska Str., Białystok, 15-351, Poland, e-mail: a.wasiak@pb.edu.pl

Abstract: The article investigates the influence of energy efficiency achieved in biofuel production on the potential fulfilment of agricultural energy demand, and consequently on the sustainability of agricultural processes. The mathematical model of energy efficiency in biofuel production is extended to a more general form aiming to describe the effects of exclusion of a fraction of crops from food production towards satisfying the industrial demands.

The derived model gives quantitative relations between energy efficiency of “energetic plantations”, energetic efficiency of industrial biofuel processing plants, and energy demand for other types of agricultural production.

Keywords: railway transport infrastructure; transport policy; Eastern Poland; regional development; transport accessibility.

References

- [1] Nigam PS, Singh A. Production of liquid biofuels from renewable resources. *Progress in Energy and Combustion Science* 2011;37:52–68.
- [2] Bharathiraja B, Chakravarthy M, Ranjith Kumar R, Yuvaraj D, Jayamuthunagai J, Praveen Kumar R, Palani S. Biodiesel production using chemical and biological methods – A review of process, catalyst, acylacceptor, source and process variables. *Renewable and Sustainable Energy Reviews* 2014;38:368–382.
- [3] Abnisa F, Wan Daud WMA, HusinWNW, Sahu JN. Utilization possibilities of palm shell as a source of biomass energy in Malaysia by producing bio-oil in pyrolysis process. *Biomass and Bioenergy* 2011;35:1863–1872.
- [4] Russo D, Dassisti M, Lawlorb V, Olabib AG. State of the art of biofuels from pure plant oil. *Renewable and Sustainable Energy Reviews* 2012;16:4056–4070.
- [5] Talens L, Villalba G, Gabarrell X. Exergy analysis applied to biodiesel production. *Resources, Conservation and Recycling* 2007;51:397–407.
- [6] Liao W, Heijungs R, Huppes G. Is bioethanol a sustainable energy source? An energy-, exergy-, and emergy-based thermodynamic system analysis. *Renewable Energy* 2011;36:3479–3487.
- [7] Schneider UA, Smith P. Energy intensities and greenhouse gas emission mitigation in global agriculture. *Energy Efficiency* 2009;2:195–206.
- [8] Singh KP, Prakash V, Srinivas K, Srivastva AK. Effect of tillage management on energy-use efficiency and economics of soybean (Glycine max) based cropping systems under the rainfed conditions in North-West Himalayan Region. *Soil & Tillage Research* 2008;100:78–82.
- [9] Krajnc D, Glavic P. Indicators of Sustainable Production. In: Sikdar SK, Glavic P, Jain R, editors. *Technological Choices for Sustainability*, Berlin: Springer Verlag; 2004, p. 395–414.
- [10] Arodudu O, Ibrahim E, Voinov A, Duren I. Exploring bioenergy potentials of built-up areas based on NEG-EROEI indicators. *Ecological Indicators* 2014;47:67–79.
- [11] Mediavilla M, de Castro C, Capellán I, Miguel LJ, Arto I, Frechoso F. The transition towards renewable energies: Physical limits and temporal conditions. *Energy Policy* 2013;52:297–311.
- [12] Field C, Campbell J, Lobell DID. Biomass energy: the scale of the potential resource. *Trends in Ecology and Evolution* 2007;23:65–72.
- [13] Pimentel D, Marklein A, Thoth MA, Karpoff MN, Paul GS, McCormack R, Kyriazis J, Krueger T. Food versus biofuels: environmental and economic costs. *Human Ecology* 2010;37:1–12.
- [14] Wasiaś A, Oryńcz O. Formulation of a model for energetic efficiency of agricultural subsystem of biofuel production. *IEEE International Energy Conference: ENERGYCON 2014*, Dubrovnik, Croatia, 2014;1333–1337.
- [15] Wasiaś A. Technology Sensitive Indicators of Sustainability. In: Sikdar SK, Glavic P, Jain R, editors. *Technological Choices for Sustainability*, Berlin: Springer Verlag; 2004, p. 229–238.
- [16] Oryńcz O. The influence of tillage technology on energy efficiency of rapeseed plantation. 7th International Conference of Engineering, Project and Production Management; Białystok 2016; submitted to *Procedia Engineering* 2016.
- [17] Wasiaś A, Oryńcz O. The effects of energy contributions into subsidiary processes on energetic efficiency of biomass plantation supplying biofuel production system. *Agriculture and Agricultural Science Procedia* 2015;7:292–300.

System for stimulating the technical problem solutions

Barbara Wasilewska^a

^a*Opole University of Technology, 75 Ozimska Str., Opole, 45–370, Poland, e-mail: b.wasilewska@po.opole.pl*

Abstract: The article presents possibilities of using fields of creative problem solving for engineering issues. The article characterizes the individual construction steps of a system that assists in non-routine decision-making – a program designed to select stimulation methods in an optimal manner according to the user requirements. The aim of the tool is to assist the user in decision-making: it shows a possible outcome, but requires thinking. An effective use of the stimulation methods requires engineers to tediously go through many stages that often differ, depending on the selected method. This special program helps engineers search for and select numerous complex data.

Keywords: creativity; stimulating methods; case study; innovation management.

References

- [1] Dessler G. *Management: Leading People and Organisations in the 21st Century*. New York: Prentice Hall, Englewood Cliffs; 1998.
- [2] Nystrom H. *Technological and market innovation: strategies for product and company development*. Chichester: Wiley; 1990.
- [3] Shneiderman B. Creating creativity: User interfaces for supporting innovation. *ACM Transactions on Computer – Human Interaction* 2000;7(1):114–138.
- [4] Howard TJ, Culley SJ, Dekoninck E. Describing the creative design process by the integration of engineering design and cognitive psychology literature. *Design Studies* 2008;29:160–180.
- [5] López-Ortega O. Computer-assisted creativity: Emulation of cognitive processes on a multi-agent system. *Expert Systems with Applications* 2013;40:3459–3470.
- [6] Hsiao SW, Chou JR. A creativity-based design process for innovative product design. *International Journal of Industrial Ergonomics* 2004;34:421–443.
- [7] Oldham GR, Da Silva N. The impact of digital technology on the generation and implementation of creative ideas in the workplace. *Computers in Human Behavior* 2015;42:5–11.
- [8] Carayannis EG, Gonzalez E. Creativity and innovation ¼ competitiveness? When, how, and why. In: Shavinnia LV, editor. *The International Handbook of Innovation*, Amsterdam: Pergamon Press; 2003, p. 587–606.
- [9] Cilliers P. *Complexity and postmodernism: understanding complex systems*. London: Routledge; 1998.
- [10] Karlińska B, Knosala R. Model procesu twórczego a rozwój innowacji procesowych [Model of the creative process and the development of process innovations]. *Zarządzanie Przedsiębiorstwem* 2012;3:22–28.

Pro-innovative prerequisites for establishing the cooperation between companies (in the perspective of creation and development of clusters)

Anna Wasiluk^a

^aFaculty of Management, Białystok University of Technology, 45A Wiejska Str., Białystok, 15–351, Poland, e-mail: a.wasiluk@pb.edu.pl

Abstract: Scientific aim: The aim of the analysis carried out in this text was to identify the level of cooperation in the surveyed companies with the competition in the area of innovative activities as well as their readiness to strengthen it in the near future. Methodology: Quantitative studies covered 381 companies. To interpret the results of the research, the following statistical measures were used: measures of dispersion – the coefficient of variation and measures of central tendency – dominant, mean, and median. To indicate the strength of interdependence between the assessments, the Spearman rank correlation was used and with the t-Student test, its significance was examined. To identify statistically significant differences between assessments of companies, the Kruskal-Wallis test was used. The main results and findings of the research: The impact of the identified, pro-innovation factors, on both the level of current cooperation and readiness to strengthen it in the near future was weak. There were no statistically significant differences in the assessments of respondents operating in three different industry sectors. Differentiation of assessments within the same industry remained at a low or moderate level. Conducted Spearman's rank correlation indicates a high correlation between the assessment of current cooperation and possibilities for enhancing it in the future. Conclusion: From the perspective of formation and development of effective cluster links, the results are not optimistic. It should be firmly stressed that the mere creation of a cluster does not release its innovative potential. To make it happen, the real, and not only declared, openness to establish cooperation with all its actors, including competitors, is necessary.

Keywords: companies; cooperation; business cluster; networks of companies.

References

- [1] van Dijk MP, Sverrisson Á. Enterprise clusters in developing countries: mechanisms of transition and stagnation. *Entrepreneurship & Regional Development* 2003;15(3):183–206.
- [2] Lis AM, Lis A. Zarządzanie kapitałami w klastrach: kapitał społeczny, kulturowy, ekonomiczny i symboliczny w strukturach klastrów [Capital management in clusters: social, cultural, economic and symbolic capital in cluster structures]. Warszawa: Difin; 2014.
- [3] Porter ME. Porter o konkurencyjności [Porter about competitiveness]. Warszawa: PWE; 2001.
- [4] Martin R, Sunley P. Deconstructing clusters: chaotic concept or policy panacea?. *Journal of Economic Geography* 2003;3(1):5–35.
- [5] Andersson T, Schwaag Serger S, Sörvik J, Hansson EW. *The Cluster Policies Whitebook*. Malmö: International Organization for Knowledge Economy and Enterprise Development; 2004.
- [6] Wasiluk A, Daniluk A. *The possibilities of creating cross-border clusters*, Vilnius: Vilnius University Publishing House; 2013.
- [7] Wasiluk A. Prerequisites for undertaking and developing cooperation by industrial and construction companies, In: Stankevičienė J, Lankauskienė T, editors. *The 9th International Scientific Conference Business and Management 2016: Conference Proceedings*, Vilnius; 2016.
- [8] *Program Operacyjny Innowacyjna Gospodarka 2007–2013 [Innovative Economy Operation Programme 2007–2013]*. Warszawa: Ministerstwo Rozwoju Regionalnego; 2006.
- [9] *Innowacyjna przedsiębiorczość w Polsce. Odkryty i ukryty potencjał polskiej innowacyjności. Raport [Innovative entrepreneurship in Poland. Revealed and hidden potential of Polish innovativeness. Report]*. Warszawa: Polska Agencja Rozwoju Przedsiębiorczości; 2015.
- [10] Wasiluk A. Zaufanie a współpraca pomiędzy podmiotami gospodarczymi a instytucjami samorządowymi [Trust and cooperation between economic entities and local government institutions]. In: Lubas B, Hryszkiewicz D, Borowik M, editors. *Kierunki doskonalenia koncepcji zarządzania organizacją publiczną. Teoria i praktyka [Directions for public organization management concept development. Theory and practice]*, Szczecin: Wyższa Szkoła Policji w Szczecinie; 2016.

Evaluation of batch production processes based on seven criteria

Marek Wirkus^a, Alicja Kukułka^a

^aGdansk University of Technology, 11/12 Gabriela Narutowicza Str., Gdańsk, 80–233, Poland, e-mail: kukułka.alicja@gmail.com, mwir@zie.pg.gda.pl

Abstract: Researchers focused on the dilemma of measurement and evaluation of batch processes. The developed method allows synthetic and complex evaluation of these processes, and additionally, it might be used for further process improvement. Researchers searched literature in order to gain the theoretical background and performed a case study, during which a production company was analysed, paying special attention to batch production measurement methods and the opportunity to use multi-criteria rating. The case studies were further enriched with participating observation, non-participating observation, interviews, and the analysis of historical data.

As a result of their work, researchers developed a concept of a multi-criteria evaluation method for the batch processes, with each criterion containing a group of indicators. The authors developed a model of batch process rating based on the following criteria: market, economical, ecological, social, technological, planning and general development. For each among these seven criteria, the authors performed the selection of indicators, which enable the evaluation of the process. As an example, for the technological criterion, the following indicators were chosen: machine failure frequency, reparation time, time workers spend on working posts and elements of the overall equipment effectiveness. Indicators assigned to the market criterion were the ratio described by the overall reclamation quantity, time of order realization, punctuality of supply. The chosen indicators are characterized by various scales of values and various units; therefore, the researchers developed the standardization function for each indicator, in order to be able to compare the output results. The developed conception allows performing a complex and synthetic evaluation of batch processes.

Keywords: multi-criteria rating; batch process; production measurement; technological rating.

References

- [1] Brzeziński M. *Organizacja i sterowanie produkcją, Projektowanie systemów produkcyjnych i procesów sterowania produkcją [Organization and production control design of production systems and production control processes]*. Warszawa: Agencja Wydawnicza PLACET; 2002.
- [2] Durlik I. *Inżynieria Zarządzania, Strategia i projektowanie systemów produkcyjnych [Management engineering, strategy and design of production systems]*. Warszawa: Agencja Wydawnicza PLACET; 2005.
- [3] Hansen RC. *Overall Equipment Effectiveness: A Powerful Production Maintenance Tool for Increased Profits*. New York: Industrial Press Inc; 2001.
- [4] Kosieradzka A. Metoda wielokryterialnej oceny produktywności [Multicriteria Productivity Measurement Method]. *Zarządzanie Przedsiębiorstwem* 2004;2:37–45.
- [5] Kubiński W. *Inżynieria i technologie produkcji [Engineering and technology of production]*. Kraków: Uczelniane Wydawnictwa Naukowo-Dydaktyczne; 2008.
- [6] Kukułka A, Wirkus M. Zagadnienie opracowania i stosowania wielokryterialnego miernika oceny przebiegu procesu niepotokowego [Issue of multi-criterion measurer development and application in rating of batch production process course]. In: Knosala R, editor. *Innowacje w Zarządzaniu i Inżynierii Produkcji [Innovations in Management and Production Engineering]*, Opole: Oficyna Wydawnicza Polskiego Towarzystwa Zarządzania Produkcją; 2016, p. 621–631.
- [7] Mączyński W. Miernik OEE, MTBF i MTTR – czy to coś więcej niż wartości bezwzględne? [OEE, MTBF and MTR measurers – the absolute values, or something more?]. *Utrzymanie Ruchu* 2011;1:28–30.
- [8] Pająk E. *Zarządzanie produkcją Produkt, technologia, organizacja [Production management Product, technology, organisation]*. Warszawa: Wydawnictwo Naukowe PWN; 2006.
- [9] The Productivity Press Development Team, *OEE for Operators: Overall Equipment Effectiveness*. Portland Oregon: ProdPress.com; 1999.
- [10] Wirkus M, Kukułka A. Ocena przebiegu procesów produkcyjnych [Rating of production processes course]. In: Knosala R, editor. *Innowacje w Zarządzaniu i Inżynierii Produkcji [Innovations in Management and Production Engineering]*, Opole: Oficyna Wydawnicza Polskiego Towarzystwa Zarządzania Produkcją; 2015, p. 654–663.

Issues of measuring the course of batch production processes

Marek Wirkus^a, Alicja Kukułka^a

^aGdansk University of Technology, 11/12 Gabriela Narutowicza Str., Gdańsk, 80–233, Poland, e-mail: kukulka.alicja@gmail.com, mwir@zie.pg.gda.pl

Abstract: Along with the development of manufacturing processes and production systems, there is a growing need to improve the means to control production processes. Methods provided by the current literature are not always sufficient for modern production processes. This fact is even more accurate with regard to batch production. It was noticed that the rating methods for the realistic course of a process are especially insufficient. It became imperative to develop new criteria and indicators that would allow a multiple aspect and realistic rating of process courses. It is necessary not only to set new measurement criteria but also appropriate indicators, which would include specific aspects of batch production.

The goal of this paper is to present the correlation between production processes measurement, its rating, and production control. Additionally, benefits of using the multicriteria method during a process rating were presented. Authors performed literature studies in the field of batch process characteristics, general rules of production control and construction of multicriteria rating indicators. The studies were followed by an analysis of production enterprise. The analysis was carried out using case study methods. Its main target was to analyse how various ways of production process ratings and multicriteria ratings work in practice. A multicriteria rating of the batch process method was designed. This method uses a group of indicators assigned to seven criteria: economical, ecological, social, technological, market, planning, and general development. The method is meant to provide the management with data used in order to maintain production control.

Keywords: batch production; multicriteria measurement; feedback; control system; batch process.

References

- [1] Brzeziński M. *Organizacja i sterowanie produkcją, Projektowanie systemów produkcyjnych i procesów sterowania produkcją [Organization and production control design of production systems and production control processes]*. Warszawa: Agencja Wydawnicza PLACET; 2002.
- [2] Kubik S. *Gniazdo Produkcyjne. Przepływ jednej sztuki dla zespołów roboczych [Cellular Manufacturing. One-Piece Flow for Workteams]*. Wrocław: ProdPublishing; 2010.
- [3] Kubiński W. *Inżynieria i technologie produkcji [Engineering and technology of production]*. Kraków: Uczelniana Wydawnictwa Naukowo-Dydaktyczne; 2008.
- [4] Kuczera K. Zasilanie materiałowe w przedsiębiorstwach o niepotokowej formie organizacji produkcji i usług [Material supply in companies with batch production and services organization form]. *Logistyka* 2002;3:53–55.
- [5] Pająk E, Trojanowska J. Planowanie i sterowanie produkcją wieloasortymentową [Planning and control over multi-assortment production]. In: Knosala R, editor. *Innowacje w Zarządzaniu i Inżynierii Produkcji, [Innovations in Management and Production Engineering]*, Opole: Oficyna Wydawnicza Polskiego Towarzystwa Zarządzania Produkcją; 2012, p. 317–327.
- [6] Wirkus M, Kukułka A. Ocena przebiegu procesów produkcyjnych [Rating of production processes course]. In: Knosala R, editor. *Innowacje w Zarządzaniu i Inżynierii Produkcji [Innovations in Management and Production Engineering]*, Opole: Oficyna Wydawnicza Polskiego Towarzystwa Zarządzania Produkcją; 2015, p. 654–663.
- [7] Kukułka A, Wirkus M. Zagadnienie opracowania i stosowania wielokryterialnego miernika oceny przebiegu procesu niepotokowego [Issue of multi-criterion measurer development and application in rating of batch production process course]. In: Knosala R, editor. *Innowacje w Zarządzaniu i Inżynierii Produkcji [Innovations in Management and Production Engineering]*, Opole: Oficyna Wydawnicza Polskiego Towarzystwa Zarządzania Produkcją; 2016, p. 621–631.
- [8] Winands EMM, Kok AG. Case study of a batch-production and inventory system. *Interfaces* 2009;39:552–554.
- [9] Kuikka S. *A batch process management framework*. VTT Technical research centre of Finland, ESP00; 1999.
- [10] Zipkin PH. Models for design and control of stochastic multi-item batch production systems. *Operations Research* 1986;1:91–104.

Packaging as a source of information about food products

Joanna Wyrwa^a, Anetta Barska^a

^aFaculty of Economics and Management, University of Zielona Gora, 50 Podgorna Str., 65-246 Zielona Gora, Poland, e-mail: a.barska@wez.uz.zgora.pl

Abstract: Purpose: The aim of this article is to identify the role of packaging in the process of buying food, with particular emphasis on the importance of certain packaging features and their information value.

Methodology: The analysis of the literature and selected results of own empirical studies were used in the research process. The following databases were reviewed using keywords Web of Science and EBSCO. The frequency analysis allowed supplementing theoretical deliberations and evaluating available studies regarding packaging. A questionnaire survey was conducted in a group of 372 respondents. The study was conducted in the Lubusz Voivodship. The main goal of the field research was to examine attitudes and behaviours of consumers towards packaging of food products.

Results: Packaging plays a significant role in the process of buying food products. Above all, it has a promotional and information value in a critical moment of the decision-making process. The analysis of the results showed that the most important features of packaging for consumers are the comfort of use and durability; whereas, the most important data on packaging are the expiration date, price, and composition of the product.

Theoretical contribution: interest in safe and high-quality food and new preferences of consumers contribute to the change in the approach to food packaging methods. Food packaging is a significant marketing tool, and its importance can be seen both in its functions and the process of making the buying decisions by a consumer. The issue of expectations of buyers towards packaging of products offered on the Polish market was a subject of many studies. The study described in this article enabled to hierarchize features of packaging from the consumer's point of view.

Practical implications: The results of the study can be used by food producers in their marketing strategies. A consumer survey is an important part of the packaging design procedure. It is a part of a detailed analysis of the market situation that allows designing packaging, which will be interesting to a potential buyer and will contribute to success in the market.

Keywords: packaging; information; food product; consumer; survey.

References

- [1] Czajkowska K, Kowalska H, Piotrowski D. Rola konsumenta w procesie projektowania nowych wyrobów [The role of consumer in the process of new food products design]. *Zeszyty Problemowe Postępów Nauk Rolniczych* 2013;575:23–32.
- [2] Bialkova S, Sasse L, Fenko A. The role of nutrition labels and advertising claims in altering consumers' evaluation and choice. *Appetite* 2016;96:38–46.
- [3] Dörnyei KR, Gyulavári T. Why do not you read the label? – an integrated framework of consumer label information search. *International Journal of Consumer Studies* 2016;40:92–100.
- [4] Magnier L, Schoormans J, Mugge R. Judging a product by its cover: Packaging sustainability and perceptions of quality in food products. *Food Quality and Preference* 2016;53:132–142.
- [5] Soederberg Miller LM, Cassidy DL. The effects of nutrition knowledge on food label use. A review of the literature. *Appetite* 2015;92:207–216.
- [6] Verbeke W, Frewer LJ, Scholderer J, De Brabander HF. Why consumers behave as they do with respect to food safety and risk information. *Analytica Chimica Acta* 2007;586(1–2):2–7.
- [7] Mahalik NP, Nambiar AN. Trends in food packaging and manufacturing systems and technology. *Trends in Food Science & Technology* 2010;21(3):117–128.
- [8] Silayoi P, Speece M. The importance of packaging attributes: a conjoint analysis approach. *European Journal of Marketing* 2007;41(11/12):1495–1517.
- [9] Ampuero O, Vila N. Consumer perceptions of product packaging. *Journal of Consumer Marketing* 2006;23(2):100–112.
- [10] Ankiel-Homa M. *Wartość komunikacyjna opakowań jednostkowych [Communication value of unit packages]*. Poznań: Wydawnictwo Uniwersytetu Ekonomicznego; 2012.

Mirages of lean manufacturing in practice

Magdalena Krystyna Wyrwicka^a, Beata Mrugalska^a

^aFaculty of Engineering Management, Poznan University of Technology, 11 Strzelecka Str., Poznan, 60–965, Poland,
e-mail: beata.mrugalska@put.poznan.pl

Abstract: The origins of lean thinking derive from Toyota's Production System; however, it became a worldwide known concept through the book "The Machine that Changed the World" written by Womack, Jones and Roos at the end of the 20th century. In spite of this fact, its practical implementation is still often an obstacle and causes a variety of misunderstandings, i.e. mirages. This paper presents the most often indicated problems with lean practice in industries. The research, which was carried out in a large Polish factory showed that in spite of high assessment of the level of implementation of particular lean tools, the expected effects of waste elimination did not appear. Comparing the results received from the analysis of assumed effects of waste elimination in the factory and the percentage level of implementation of particular tools, it was noticed that the degree of implementation does not influence the elimination of particular types of waste. In order to make better use of implemented Lean tools, the overall equipment effectiveness (OEE) was used. However, there is no certainty that its implementation will not reveal other production problems in the investigated enterprise.

Keywords: lean concept; lean practice; effects of lean implementation.

References

- [1] Wyrwicka M, editor. *Marnotrawstwo. Przejawy i sposoby minimalizacji [Wastes. Symptoms and ways of elimination]*. Poznan: Publishing House of Poznan University of Technology; 2009.
- [2] James T. Wholeness as well leanness. *Manufacturing Engineer* 2006;85(5):14–17.
- [3] Liker J, Hoseus M. *Toyota culture: the heart and soul of the Toyota way*. New York: McGraw-Hill; 2008.
- [4] Cusumano MA. The limits of lean. *Sloan Management Review* 1994; Summer:27–32.
- [5] Yang P, Yu Y. The barriers to SMEs' implementation of lean production and countermeasures – based on SMEs in Wenzhou. *International Journal of Innovation, Management and Technology* 2010;1(2):220–225.
- [6] Liker JK, Hoseus M. Human resource development in Toyota culture. *International Journal of Human Resources Development and Management* 2010;10(1):34–50.
- [7] Neuhaus R. TPS, Lean, Produktionssysteme und kein Ende der Missverständnisse? Eine Betrachtung der vergangenen 20 Jahre [TPS, lean, production system and no end misunderstanding?]. *Betriebspraxis&Arbeitsforschung* 2013;215(3):16–25.
- [8] Fischer JW, Stowasser S. Industrial engineering and lean product development. *Industrial Engineering. Fachzeitschrift des REFA-Verbandes* 2013;66(2):20–27.
- [9] Khan JG, Dalu RS. Awareness of lean manufacturing in plastic pipe industries – a survey. *International Advanced Research Journal in Science, Engineering and Technology* 2016;3(1):205–209.
- [10] Kumar A. The challenges to the implementation of lean manufacturing. *International Journal of Engineering Science & Advanced Technology* 2014; 4(4):307–312.



AGENCY FOR RESTRUCTURING AND MODERNIZATION OF AGRICULTURE

The Agency for Restructuring and Modernisation of Agriculture (ARMA) has endorsed activities for the development of agriculture and rural areas since 1994. In the first period of its activity it provided support mainly from national resources, in the form of subsidies to interest on working capital and investment loans. After the Polish accession to the EU, both the scale of assistance, as well as the number of available instruments of support have increased. The key task of ARMA is the disbursement of direct payments and funds of EU programs for the development of Polish rural areas.

ARMA operates under the Act of 9 May 2008 on the Agency for Restructuring and Modernisation of Agriculture (Journal of Laws of 2014, item 1438, as amended). ARMA is supervised by the Minister of Agriculture and Rural Development, and in terms of financial management - by the Minister of Finance.

Currently, ARMA is the implementing entity for most of the actions covered by the RDP 2014-2020 and the paying agency for the assistance instruments financed from the EU funds provided for the period 2014-2020, i.e.:

- European Agricultural Guarantee Fund (EAGF), under which the Agency continues to implement the aid instruments of the First Pillar of the CAP (direct support schemes, common organization of fruit and vegetables markets);
- European Agricultural Fund for Rural Development (EAFRD), which finances all activities relating to rural development within RDP 2014-2020 and the commitments made in the framework of the actions implemented within RDP 2004-2006 and RDP 2007-2013 (Second Pillar of the CAP);
- European Fisheries Fund (EFF), which finances the activities of the Sustainable Development of Fisheries and Coastal Fishing Areas Operational Programme 2007-2013;
- European Maritime and Fisheries Fund (EMFF), which replaces the EDF, and which will finance the activities of the Fisheries and the sea Operational Programme 2014-2020;
- state budget.

In addition, ARMA is the institution:

- implementing the national assistance instruments (in particular subsidies to investment and disaster preferential loans);
- running a register of marked livestock (IRZ system);
- running and updating the land parcel identification system (LPIS), and GIS spatial data.

The main beneficiaries of ARMA are farmers, agri-food sector entrepreneurs, rural residents, agricultural producer groups, local government units, and representatives of the fisheries sector.

From the projects co-financed by the Agency benefit broad social groups. The outcomes of the projects can be noticed and measured on a local as well as the national level of economy.

ORGANIZERS

Organizers



Co-Organizers

PATRONAGE



Media Patronage



Partners

