

**11th International Conference on
ENGINEERING, PROJECT
AND PRODUCTION MANAGEMENT
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Book of Abstracts

Edited by Anna Kononiuk, Andrzej Magruk, Dorota Leończuk

19-21 September 2021, On-line



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Table of contents

Foreword	11
Peter Adekunle, Cliton Aigbavboa, Opeyemi Akinradewo Intervention of Biomimicry for Sustainable Construction: The Use of Bio-Concrete	13
Malik I. Alamayreh, Ali Alahmer, Subhi M. Bazlamit, Mai Bani Younes Energy Analysis and Refrigerant Replacement in Pre-Cooling Concrete System in Massive Concrete Structures	14
Nimra Afzal, Aamer Hanif Which Has Greater Impact on Project Performance in Emerging Construction Firms? Focus on Customers or Processes?	15
Babatunde Oluwaseun Ajayi, Thanwadee Chinda Dynamics of Pertinent Project Delay Variables in the Thai Construction Sector: Mathematical Analysis	16
Rami Alawneh, Ismael Jannoud, Hesham Rabayah, Farid E Mohamed Ghazali Prioritizing Risks in Sustainable Building Projects using Analytical Hierarchy Process and Relative Importance Index	17
Nadiya Bakalo Digital Marketing in Tourism	18
Ehsan Bakhtiarizadeh, Wajiha M. Shahzad, Mani Poshdar, James O.B. Rotimi Applicability of Blockchain Technology in New Zealand's Prefabricated Construction Industry: A Potential Solution	19
Blanka Bartova, Vladislav Bina A novel data mining approach for defect detection in printed circuit board manufacturing process	20
Natalia Bezrukova, Vitalii Svichkar Brand Management of National Companies in the World Market	21
Liudmyla Boldyrieva, Yuriy Kharchenko, Alina Chaikina Digitisation of Ukraine as a Mechanism of Economic Growth in the Context of Globalization	22
Alona Buriak, Daria Ovcharenko Global Investment Flows Transformation During the Covid-19 Pandemic	23
Iryna Chernysh, Kateryna Chelembiienko The State of Environmental Entrepreneurship in Ukraine	24
Iryna Chernysh, Viktoriia Makhovka The Essence and Characteristics of Event Tourism	25
Kseniia Chichulina Enterprise Resources: Concept and Their Composition, Resource Utilization Indicators	26
Thanwadee Chinda Long-term Trend of Electric Vehicle Sales in Thailand	27
Marina Chizhevskaya, Svitlana Shcherbinina The Main Approaches to Determining the Structure of the Economic Potential of the Enterprise	28
Ewa Chodakowska, Joanicjusz Nazarko Practical Use of Collaborative Robots in Packing Tasks	29
Ewa Chodakowska, Joanicjusz Nazarko, Łukasz Nazarko ARIMA Models in Electrical Load Forecasting and Their Robustness to Noise	30

Iryna B. Chychkalo-Kondratska, Iryna V. Novytska, Daria S. Kondratska Approaches to the Choice of a Promotion Strategy on the Foreign Market of Organic Products	31
Sandiso Cosa, Edoghogho Ogbeifun, Jan-Harm C Pretorius Managing Inter-Departmental Project Delivery to Enhance Customers' Satisfaction	32
Mirosława Czerniawska, Joanna Szydło Traditionalism, Modernism, Postmodernism – Worldview Analysis in the Context of Values	33
Marek Ćwiklicki, David M. Herold, Jasmin Mikl, Kamila Pilch The Attitude-Behaviour Gap in Young Adults' Sustainable Consumption	34
Łukasz Dragun Process Dynamics of a Large European Project on the Basis of Information Activity in Social Media	35
Anna Dyhdalewicz, Justyna Grześ-Bukłaho Competences of innovation brokers – experiences of the GoSmart BSR project	36
Joanna Ejdys Factors that Influence the Behavioral Intention to Use E-learning at University Level	37
Joanna Ejdys, Aleksandra Gulc Factors Influencing the Intention to Use Assistive Technologies by Older Adults	38
Mathusha Francis, Thanuja Ramachandra Investigating the Readiness Towards Practicing Dispute Avoidance Strategies in Sri Lankan Construction Industry	39
Bartłomiej Gładysz, Krzysztof Krystosiak, Krzysztof Ejsmont, Aldona Kluczek, Aleksander Buczacki Sustainable Printing 4.0 – Insights from the Survey in Poland	40
Ewa Glińska, Halina Kiryluk, Katarzyna Anna Kuźmicz, Ewa Rollnik-Sadowska, Urszula Ryciuk Directions of Mobility Improvement in Remote Areas Attractive to Tourists	41
Alicja Gudanowska, Anna Kononiuk Futures – Future Laboratories for Professional and Personal Development	42
Małgorzata Gulewicz Digital twin technology in research and literature	43
Małgorzata Gulewicz, Katarzyna Halicka Agile and Hybrid Management Methodologies in R&D Projects	44
Sameera Gunathilake, Thanuja Ramachandra, Dilakshi Madushika Carbon Footprint Analysis Through an Input-Output Table for Construction Activities of Sri Lanka	45
Nick Hadjinicolaou, Mohamad Kader, Ibrahim Abdallah Strategic Innovation, Foresight and the Deployment of Project Portfolio Management under Mid-Range Planning Conditions in Medium-Sized Firms	46
Katarzyna Halicka, Dariusz Surel Gerontechnology – New Opportunities in the Service of the Elderly	47
Katarzyna Halicka, Dariusz Surel Smart City in the Context of Aging Society	48
Nuchjarin Intalar, Kwanchanok Chumnumporn, Chawalit Jeenanunta, Apinun Tunpan Digital Transformation of Traditional Safety Shoes Manufacturer in Thailand: A Development of Production Tracking	49

Svitlana Ishchuk, Luybomyr Sozanskyy, Ryszard Pukała Optimization of Structural Parameters of the Industry by the Criterion of Product Innovation	50
Svitlana Ivanitska, Tetiana Halaida Socially Responsible Marketing as a Tool for Regulating Social and Labor Relations in Ukrainian Companies	51
Arkadiusz Jurczuk Barriers to Implementation of Business Process Governance Mechanisms	52
Najavadh Kaeo-Tad, Chawalit Jeenanunta, Kwanchanok Chumnumporn, Thanapatra Nitisahakul, Vararat Sanprasert Resilient Manufacturing: Case Studies in Thai Automotive Industries during COVID-19 Pandemic	53
Sun Ketudat, Chawalit Jeenanunta The Impact of COVID-19 PANDEMIC on Logistic Firms and their Resilience: Case Studies in Thailand	54
Olena Khrystenko, Mariya Hunchenko Improving the Process of Strategic Planning in the Risk Management System	55
Mateusz Kikolski Determinants of the Selection of Optimization Methods in Planning the Layout of Workstations	56
Chien-Ho Ko Application of Lean Ideas in Architectural Design	57
Olha Komelina, Mariya Hunchenko, Maryna Korsunska Creative Management as a Factor in the Formation of Organizational Culture	58
Anna Kononiuk The Impact of Foresight Maturity on Organisational Ambidexterity	59
Anna Kononiuk, Alicja E. Gudanowska The Application of the Modified SERVQUAL Model for the Diagnosis of the Educational Offerings in the Field of Career Guidance Training: Industry 4.0 Challenges	60
Robertas Kontrimovičius, Leonas Ustinovičius Creation of the Mathematical Model Prototype to Optimize the Planning of Construction Site, Using BIM and Engineering Geological Cross Sections	61
Justyna Kozłowska Multi-Criteria Analysis in Technology Selection Problems – Systematic Literature Review Results	62
Siwaporn Kunnapapdeelert, James Vincent Johnson, Passarin Phalitnonkiat Green Last-Mile Route Planning for Efficient E-commerce Distribution	63
Rimmon Labadan, Kriengsak Panuwatwanich, Sho Takahashi Awareness of the Prevention through Design (PtD) Concept among Design Engineers in the Philippines	64
Joanna Labeledzka Industry 4.0 – Alternative Approaches to Efficient Implementation in SMEs	65
Andrzej Magruk The Desirable Systemic Uncertainty in Complex IoT Sensor Networks – General Anticipatory Foresight Perspective	66
Andrzej Magruk Uncertainty and Foreknowledge of Emerging Technologies in the Context of Fourth Industrial Revolution	67

I. Masunungure, Edoghogho Ogbeifun, Jan-Harm C Pretorius Realizing the objectives of infrastructure master plan: The role of internal operatives	68
Inna Miniaienko, Volodymyr Byba Methods for Evaluating and Ensuring the Efficiency of the Energy Saving System in the Enterprise	69
Franco Muleya, Natasha Muwila, Chipozya Kosta Tembo, Alice Lungu Partial Replacement of Cement with Rice Husk Ash in Concrete Production: A Cost Benefit Exploratory Analysis for Low-Income Communities	70
Joanicjusz Nazarko, Ewa Chodakowska, Lukasz Nazarko Modelling and Monitoring the State of Transition Towards the Circular Economy in the European Union	71
Lukasz Nazarko Responsible Innovation in Polish Enterprises	72
Edoghogho Ogbeifun, Jan-Harm C Pretorius Delays in the Execution of Construction Projects are Beyond Adequate Funding	73
Abdeen Omer Design and Operation of Low Energy Consumption Passive Human Comfort Solutions	74
Babatunde Omoniyi Odedairo Personnel Utilisation in Project Management Office: A Real- World Application	75
Volodymyr Onyshchenko, Anna Cherviak The Forecasting Role in the Financial Institutions' Economic Security System	76
Antonis Panas, Maria Kalogiannaki, John-Paris Pantouvakis Comparative Assessment of Deterministic Methodologies for Estimating Excavation Productivity	77
Iryna Pasichna Some Aspects of Disciplinary Liability for Corruption Offenses	78
Eliilvani Periyannan, Thanuja Ramachandra, Dilakshi Madushika Significant Green Retrofit Technologies: A Perspective of Sustainability Pillars	79
Eugeniusz Piechoczek, Jan Kaźmierczak Model of Decision-Making Instrument for Alternate Technical Means in the Area of Aerial Work	80
Beata Poteralska Support for the Development of Technological Innovations at an R&D Organisation	81
Beata Poteralska, Marzena Walasik Technology Commercialisation Processes at R&D Organisations	82
Liana Ptashchenko, Daria Korniienko Threats to the Security of Foreign Trade in the Context of the Global Pandemic	83
Rusl Abu Qalbin, Hesham Rabayah Assessment of Construction Risks in Projects Funded by External Sources in Jordan During the COVID-19 Pandemic	84
Safwan M. Al-Qawabah, Adnan I. O. Zaid, Mahmoud El-Banna Effect of Zirconium Addition on the Wear Resistance of Aluminum Grain Refined by Ti-B: A Three Dimensional Presentation	85

José Daniel Rodrigues Terra, Fernando Tobal Berssaneti, José Alberto Quintanilha Challenges and Barriers to Connect Manufacturing Continuous Improvement Processes to Industry 4.0 Paradigms	86
Urszula Ryciuk Ambidextrous Governance Impact on Supply Chain Performance – Buyer and Supplier Perspective	87
Ibrahim Sabry Exercising Hybrid Statistical Tools GA-ANN and GA-ANFIS to Optimize Underwater Friction Stir Welding Process Parameters for Tensile Strength Improvement	88
Ibrahim Sabry Extended EDAS and VIKOR Method for Fuzzy Multi-Criteria Decision-Making: An Application to Underwater Friction Stir Welding	89
Janindu Samaranayake, Thanuja Ramachandra, Dilakshi Madushika Significant Factors Affecting the Life Cycle Cost Elements of a Building	90
Björn Sautter Thinking and Shaping Industrie 4.0 Ecosystems for Sustainable and Resilient Futures	91
Nabeel Abu Shaban, Ibrahim Abu Alshaikh, Nabil Beithou Exact Solution of a Variable Temperature Plate in a Porous Medium	92
Shilpi Sharma Multidimensional Aspects of Risk-Taking in Entrepreneurs: a Global Study	93
Mithun Sharma, Shilpi Sharma Critical Evaluation into the Practical Utility of the Design of Experiments	94
Julia Siderska The Adoption of Robotic Process Automation Technology to Ensure Business Processes during the COVID-19 Pandemic	95
Dariusz Siemieniako, Paweł Kaliszewski What Can We Learn from Critical Incident Technique in Investigating the Factors of Power Dynamics in Dyadic Business-to-Business Relationships?	96
Theodora Spyropoulou, Antonis Panas, John-Paris Pantouvakis Formulation of Change Management Model for Achieving Business Excellence in Large Organizations	97
Ronald Sukwadi, Alexander Caesar An Integrated Approach for Supply Chain Risk Management	98
Lyudmyla Svystun The Prospects for Housing Energy-Efficient Renovation in Ukraine	99
Danuta Szpilko, Ewa Bondar Waste Management in the Smart Cities: a Bibliometric Analysis	100
Danuta Szpilko, Joanna Ejdys European Green Deal – Research Directions. Systematic Literature Review	101
Danuta Szpilko, Ewa Glińska, Karolina Ilczuk Foresight as a Tool for Participatory City Management. Evidence from Poland	102
Katarzyna Szum IoT-Based Smart Cities: a Bibliometric Analysis and Literature Review	103

Elżbieta Szymańska, Zofia Kołoszko-Chomentowska, Krzysztof Stepaniuk Innovative Mobility Solutions in Baltic Sea Region Rural Areas	104
Ewelina Julita Tomaszewska Barriers related to the implementation of intelligent transport systems in cities – the Polish local government's perspective	105
Wanit Treeranurat, Suthathip Suanmali Determination of Blackspots by Using Accident Equivalent Number and Upper Control Limit on Rural Roads of Thailand	106
Anon Na Thalang, Thanwadee Chinda Inventory Management of the Air Conditioner Industry Utilizing the System Dynamics Modelling Approach	107
Katarzyna Tworek, Agnieszka Bieńkowska, Kamila Ludwikowska, Anna Koszela Turnover-Mitigating Servant Leadership Influence on Job Performance	108
Pilada Wangphanich, Nattapong Kongprasert An Innovative Design Approach to Meet the Customer Requirements: A Case Study of Charcoal Briquettes Packaging	109
Cezary Winkowski Factors Determining the Development of Printing Technologies in Poland in Long-Term Perspective	110
Warit Wipulanusat, Kriengsak Panuwatwanich, Rodney A. Stewart, Jirapon Sunkpho, Poomporn Thamsatitdej Towards Achieving Engineers' Career Satisfaction in the Australian Public Sector: Integrated Structural Equation Modeling and Bayesian Networks Approach	111
Martyna Wilczewska, Joanicjusz Nazarko, Hao Wang Adaptation of Polish Regions to the Challenges and Opportunities of the Belt and Road Initiative	112
Berco Venter, Sams Pfukani Ngobeni, Hendri du Plessis Factors Influencing the Adoption of Building Information Modelling (BIM) in the South African Construction Built Environment (CBE), from a Quantity Surveying Perspective	113
Natalia Zhovnir, Olena Shevchenko Visual Control Methods Utilization in Modern Management	114
Patryk Zwierzyński Analysis of Simulation of Different Forms of Production Organization	115
Agnieszka Żyra, Sebastian Skoczypiec Selected Aspects of Inconel Alloy Green EDM Machining Development	116

Foreword

On behalf of the Scientific Committee and the Organising Committee, we are pleased to welcome you to the 11th International Conference on Engineering, Project and Production Management hosted by the Faculty of Engineering Management, Bialystok University of Technology. The interdisciplinary nature of the conference provides an excellent opportunity to present knowledge at the interface of social sciences and industrial engineering. The thematic scope of the conference is mainly devoted to logistics and supply chains, technology and production management, foresight and innovation management, entrepreneurship, industrial engineering and construction industry. The conference has a multidisciplinary character, as engineering, project and production engineering can be approached from many perspectives. "The Book of Abstracts" comprises 104 abstracts – presented in an alphabetical order – that have been carefully selected on the basis of a peer review process. The articles present both the theoretical and practical aspects of the main concepts related to the thematic scope of the conference. The authors of this year's conference have carried out theoretical discussions, empirical studies, data analyses, case studies, and demonstrated industrial practices, with particular emphasis on the construction industry.

On behalf of the conference hosts, we would like to express our gratitude to the Conference Chairs, members of the Scientific Committee, members of the Organising Committee, the Keynote Speakers and all the Authors for their effort and willingness to take part in the 11th International Conference on Engineering, Project and Production Management. We hope that this particular conference will foster exchange of new ideas and promote new contacts between researchers interested in engineering, project and production management. We hope that these two days of the conference will be full of scientific debate and networking.

Editors of the Book of Abstracts – EPPM 2021

Anna Kononiuk, Andrzej Magruk, Dorota Leończuk

Intervention of Biomimicry for Sustainable Construction: The Use of Bio-Concrete

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Abstract

Biomimicry construction is defined as the science and art of solving human's construction difficulties through emulating best biological propositions of nature. The benefits of biomimicry includes environmental and aesthetic factors. The use of materials such as bio-concrete increases environmental impacts exponentially. One of the major benefits of bio-concrete is that it is self-healing and it increases the effectiveness of any project design. Sustainable construction implies the use of materials that can be renewed and recycled, as well as the reduction of waste and energy consumption during construction of new buildings. To examine this intervention, this study employs a systematic literature review and site observation of how the use of bio-concrete can be adopted for the construction of buildings in the construction industry. Findings from this study revealed that biomimicry has helped to aid the development of sustainable construction. The use of bio-concrete which is a by-product of biomimicry will enable buildings to last for decades and also reduce maintenance cost. The usage of bio-concrete will also reduce concrete negative impact on the environment. The study concluded that the cost of producing bio-concrete is lesser than that of traditional abiotic reinforced concrete. By using bio-concrete for construction, assurance of a healthy environment is achievable.

Keywords: biomimicry, bio-concrete, bacteria, self-healing, sustainability, environment.

References

- [1] Aginum C. H., Chidolue C.A., Nwakire L. *Investigating the Effects of Coarse Aggregate Types on the comprehensive strength of concrete*. IJERA 2013, Vol. 3(4), pp. 1140-1144.
- [2] Spelter A., Bergmann S., Bielak J., Heggari J. *Long-term Durability of carbon-reinforced concrete: An Overview and Experimental Investigations*. Applied Sciences 2019, Vol. 9(8), 1651, pp.1-14.
- [3] Bell G. *Evolutionary rescue and limits of adaptation*. Philosophical Transactions of the Royal Society B: Biological Sciences 2013, Vol. 368 (1610), pp. 1-6.
- [4] Bertelsen I.M., Ottosen L.M., Fischer G. *Influence of Fibre Characteristics on plastic Shrinkage cracking in cement-based materials: A review*. Construction Building Materials 2020, Vol. 230, pp. 1-17.
- [5] Bing-Jie N., Lai P., Yingyu L., Jianhua G., Zhiguo Y. *Modeling of Nitrous Oxide Production by Autotrophic Ammonia-Oxidizing Bacteria with multiple Production pathways*. EST 2014, Vol 48, 3916-3924.
- [6] Castainer S., Metayer-Levrel G.L., Pertuisot A. *Bacteria roles in the precipitation of carbonate minerals*. In: Microbial Sediments; Riding, R.E., Awramik S.M. Eds.; Springer, Berlin Heideberg, Germany, 2000; pp. 32-39.
- [7] Cherreddy S.S., Neretla R., Madduru S.C., Chava V. *Performance Studies on rate of self-healing in bio-concrete*. MTP 2020 , Vol. 27(1), pp. 158-162.
- [8] Chrisna D.O. *Agenda 21 for Sustainable construction in developing countries*. CSIR Report BOU E, 2002, nr 2/01.
- [9] Donella H.M., Demis L.M., Jorgen R., William W.B. *The limits to growth*. In Green Planet Blues: Critical Perceptions on Global Environmental Policies, Sixth edition; Conca K., Dabelko G. D. Eds.; Routledge, Taylor & Francis: Milton Park, Abingdon-on-Thames, Oxfordshire, England, 2020; pp 38-53.
- [10] El-zeing R.M. *Biomimicry as a problem solving methodology in interior Architecture*. ASEAN Conference on Environment-Behaviour Studies, Bangkok, Thailand, 2012; pp. 502-512
- [11] Emily K., Daphne F., Boi-kai H., Peter H.N., Matthew K. *Biomimicry: A path to Sustainable Innovation*. Design Issues 2015, Vol. 31(3), pp. 66-73.

Energy Analysis and Refrigerant Replacement in Pre-Cooling Concrete System in Massive Concrete Structures

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Abstract

Several methods are developed to cool the mass concrete structures in order to improve the integrity of structures and to reduce the impact of the cement hydration which is the responsible for thermal cracking of concrete. This work focusses on the design of the cooling systems, initial investment, the impact of the alternative refrigerants on the performance of the cooling system and the design of aggregate bed cooler. In massive concrete structures like dams, cooling can be accomplished by cooling aggregates using cooled air from an air conditioning duct system or by using chilled water. The energy efficiency of aggregate bed cooler employed to evaluate the energy performance as a function of the particles size, time and temperature. The experimental analysis shows the relation between the coefficient of performance COP as a function of the evaporator temperature, cooling capacity and refrigerant mass flow rate. The experimental results used in verification of a numerical model developed using EES software. The performance of the vapor compression of the cooling systems was compared using alternative refrigerants namely R22, R32, and R410a at different operating conditions. This study revealed that the coefficient of performance of R22 refrigerant is more than R32 and R410A, while the cooling capacity for R32 is the most superior.

Keywords: design cooling massive concrete system, energy efficiency of aggregate cooling system, refrigerant replacement, initial investment.

References

- [1] Jemaa R.B., Mansouri R., Boukholda I. Bellagi A. Energy and exergy investigation of R1234ze as R134a replacement in vapor compression chillers. *International Journal of Hydrogen Energy* 2017, Vol. 42(17), pp.12877-12887.
- [2] Alahmer A., Wang X., Al-Rbaihat R., Alam K.A., Saha, B.B. *Performance evaluation of a solar adsorption chiller under different climatic conditions*. *Applied Energy*, 2016 Vol. 175, pp. 293-304.
- [3] Alahme A., Ajib S. 2020. *Solar cooling technologies: State of art and perspectives*. *Energy Conversion and Management* 2020, Vol. 214, p. 112896.
- [4] Alabdulkarem A., Eldeeb R., Hwang Y., Aute V., Radermacher R. Testing, simulation and soft-optimization of R410A low-GWP alternatives in heat pump system. *International Journal of Refrigeration* 2015, Vol. 60, pp.106-117.
- [5] Vali S.S., Sett T.P., Babu A. 2018. Analytical computation of thermodynamic performance parameters of actual vapour compression refrigeration system with R22, R32, R134a, R152a, R290 and R1270. In *MATEC Web of Conferences*, Vol. 144, p. 04009. EDP Sciences.
- [6] Xu X., Hwang Y., Radermacher R. *Performance comparison of R410A and R32 in vapor injection cycles*. *International Journal of Refrigeration* 2013, Vol. 36(3), pp.892-903.
- [7] Abdel-Raheem M., Quintana O., Morales M., Marroquin-Villa Y., Ramos D., Hernandez S. Construction methods used for controlling temperature in mass concrete structure. In *Creative Construction Conference 2018*, pp. 139-146; Budapest University of Technology and Economics, 2018.

Which Has Greater Impact on Project Performance in Emerging Construction Firms? Focus on Customers or Processes?

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Abstract

This research study explores the relationship between customer focus and performance of construction projects undertaken by small companies. Additionally, process management in these companies has been studied as a mediator in explaining the relationship between customer focus and project performance. A moderated mediation model has thereby been proposed to investigate the role of strategic planning along with its effects on project outcome. Data was gathered from 326 staff members working at different levels of management in some of Pakistan's emerging construction companies owned by young entrepreneurs. The study's findings revealed a positive relationship between customer focus and project performance mediated by process management. Moderation analysis indicates a significant relationship between process management and project performance when moderated by strategic planning. Constraints to the study have been identified and suggestions for future research have been suggested.

Keywords: emerging construction firms, customer focus, process management, strategic planning, project performance.

References

- [1] Heravi G., Faeghi S. *Group Decision Making for Stochastic Optimization of Time, Cost, and Quality in Construction Projects*. Journal of Computing in Civil Engineering 2014, Vol. 28(2), pp. 275-283.
- [2] Mehrabioun Mohammadi M., Jalali A., Hasani A. *Success and failure factors in implementing quality management systems in small- and medium-sized enterprises: a mixed-method study*. International Journal of Quality and Reliability Management 2021.
- [3] Oschman J. J. *The role of strategic planning in implementing a total quality management framework: An empirical view*. Quality Management Journal 2017, Vol. 24(2), pp. 41-53.
- [4] Suárez E., Roldán J. L., Calvo-Mora A. *A structural analysis of the EFQM model: an assessment of the mediating role of process management*. Journal of Business Economics and Management 2014, Vol. 15(5), pp. 862-885.
- [5] Toke L. K., Kalpande, S. D. *Strategic planning to investigate the decision index of organization for effective total quality management implementation – in context of Indian small and medium enterprises*. Journal of Engineering, Design and Technology 2021.
- [6] Zhang H., Kang F., Hu S. *Senior leadership, customer orientation, and service firm performance: the mediator role of process management*. Total Quality Management and Business Excellence 2020, Vol. 31(13-14), pp. 1605-1620.
- [7] AlQershi N. *Strategic thinking, strategic planning, strategic innovation and the performance of SMEs: The mediating role of human capital*. Management Science Letters 2021, Vol. 11, pp. 1003-1012.
- [8] Calvo-Mora, A., Picón-Berjoto, A., Ruiz-Moreno, C., & Cauzo-Bottala, L. (2015). *Contextual and mediation analysis between TQM critical factors and organisational results in the EFQM Excellence Model framework*. International Journal of Production Research, Vol. 53(7), pp. 2186-2201.
- [9] Gates L. P. *Strategic Planning with Critical Success Factors and Future Scenarios: An Integrated Strategic Planning Framework*. Carnegie Mellon University, 2010.
- [10] Al-Gasawneh J. A., Anuar M. M., Dacko-Pikiewicz Z., Saputra J. *The impact of customer relationship management dimensions on service quality*. Polish Journal of Management Studies 2021, 23(2), pp. 24-41.

Dynamics of Pertinent Project Delay Variables in the Thai Construction Sector: Mathematical Analysis

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Abstract

Project completion behind schedule has been a phenomenon contending with the construction sector, opposing time, cost, and quality. This investigation is necessitated owing to lingering nature of the menace of project delay despite several extant investigations. This study collates experts' opinion from the Thai construction sector on salient construction delay variables and their influence on each other for DEMATEL-SD analysis. The collated data are analyzed and found consistent with a Cronbach's alpha of 0.939. Thereafter, DEMATEL technique is adopted to establish the influence weight of factors for system dynamics (SD) analysis. It is discovered that minimizing design error at the preconstruction stage significantly reduces the magnitude of delay. Increasing values of design error and change order increase the rework profile. Furthermore, minimizing the threat of design error, design change, change order, rework, productivity problem and improvement in project management help deliver the project within the scheduled time of 232 weeks. This study which adopts a hybrid mathematical system to holistically examine the menace construction delay by comprehensively exploring the dynamics of the influencing variables and investigating their impact of the project scheme helps project parties to arrive at effective decision to subjugate the menace of delay thus minimizing the problem of cost overrun and improve quality.

Keywords: construction delay, DEMATEL analysis, system dynamics, preconstruction, project management.

References

- [1] Abbasi O., Noorzai, E., Jafari K. G., Golabchi M. *Exploring the causes of delays in construction industry using a cause-and-effect diagram: Case study for Iran*. Journal of Architectural Engineering 2020, Vol. 26(3), pp. 1-16.
- [2] Bounhipphasert S., Shozo N., Toshihiro O., Takafunmi N. *Causes of delays in road construction projects in Laos*. The Global Journal of Research in Engineering 2020, Vol. 20(3), pp. 1-15.
- [3] Chandrusa S., Basha, M. *Rework management in construction projects and comparison with time and cost*. International Journal of Engineering Science and Computing 2017, Vol. 7(6), pp. 13020-13025.
- [4] Enshassi A., Sundermeier M. Zeiter M. A. *Factors contributing to rework and their impact on construction projects performance*. International Journal of Sustainable Construction Engineering & Technology 2017, Vol. 8(1), pp. 12-33.
- [5] Jussila J., Lahtinen K. *Effects of institutional practices on delays in construction- views of Finnish homebuilder families*. Housing Studies 2019, Vol. 35(7), pp. 1167-1193.
- [6] Khahro S. H., Memon Z. A. *Non excusable delays in construction industry: A causal study*. Engineering Technology Applied Science Research 2018, Vol. 8(6), pp. 3561-3564.
- [7] Moradi S., Nasirzadeh F., Golkhoo F. *Modelling labor productivity in construction projects using hybrid SD-DES approach*. Scientia Iranica 2017, Vol. 24 (6), pp. 2752-2761.
- [8] Paray, W. A., Kumar, C. *Delay analysis in construction projects*. International Research Journal of Engineering and Technology (IRJET) 2020, Vol. 7(10), pp. 477-479.
- [9] Shamsudeen M., Obaju, N. B. *Effects of design errors on construction projects*. International Journal of Science and Engineering Research 2016, Vol. 7 (2), pp. 1099-1114.
- [10] Wu H. H., Tsai, Y. N. (2011). *A DEMATEL method to evaluate the causal relations among criteria in auto spare parts industry*. Applied Mathematics and Computation 2011, Vol. 218, pp. 2334-2342.

Prioritizing Risks in Sustainable Building Projects using Analytical Hierarchy Process and Relative Importance Index

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Abstract

Sustainable building projects are riskier than conventional construction projects. This research aims to identify and analyse risks associated with sustainable building projects to assist project participants in managing these risks effectively. Risks related to sustainable construction projects were identified through a review of the literature. Questionnaire surveys were conducted using the analytic hierarchy process (AHP) and the Relative Importance Index (RII) methodologies. Risks were assessed according to their severity and likelihood of occurrence. After that, the identified risks were prioritized based on their severity. The proposed framework is robust to prioritize risks affecting sustainability in building construction projects, which helps increase sustainability due to the high uncertainty surrounding sustainability-related risks.

Keywords: sustainable building, risks, Analytical Hierarchy Process, Relative Importance Index, construction project.

References

- [1] Hwang B.G., Shan M., Phua H., Chi S. *An exploratory analysis of risks in green residential building construction projects*. The case of Singapore. *Sustainability* 2017, Vol. 9(7), 1116.
- [2] Qaz, A., Shamayleh A., El-Sayegh S., Formanek S. *Prioritizing risks in sustainable construction projects using a risk matrix-based Monte Carlo Simulation approach*. *Sustainable Cities and Society* 2021, Vol. 65, 102576.
- [3] Hossen M.M., Kang S., Kim, J. *Construction schedule delay risk assessment by using combined AHP-RII methodology for an international NPP project*. *Nuclear engineering and technology* 2015, Vol. 47(3), pp. 362-379.
- [4] El-Sayegh S.M., Manjikian S., Ibrahim A., Abouelyousr A., Jabbour R. *Risk identification and assessment in sustainable construction projects in the UAE*. *International Journal of Construction Management* 2021, 21(4), 327-336.
- [5] Karakhan A.A., Gambatese J.A. *Identification, quantification, and classification of potential safety risk for sustainable construction in the United States*. *Journal of Construction Engineering and Management* 2017, Vol. 143(7), 04017018.

Digital Marketing in Tourism

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Abstract

This study aims to reveal the essence and importance of digital marketing in tourism. The article includes, among other things, statistical analyses and statistical evaluation of indicators. The peculiarity of promoting global marketing policy of a travel company, based on optimal efforts, provides a coordinated set of practical actions based on specific programmes. The data show that about 4 billion people in the world are active users of the Internet and use it in various forms (such as search engine, e-mail, social networks, booking portal, payment portal, etc.). In the process of developing digital information today, the importance of digital marketing for the tourism business has increased, and the travel industry has taken advantage of this opportunity. The author of the article found that consumer behaviour changed dramatically in the tourism industry, and this is mainly due to the development of the Internet, so it was appropriate to focus on the development of information marketing. Therefore, marketing activities in tourism enterprises are an important part of its operation, given the specifics of tourism firms.

Keywords: digital marketing, marketing policy, digital information, tourism enterprises.

References

- [1] Nilead, Digital Marketing in Travel and Tourism Industry. Available online: <https://nilead.com/article/digital-marketing-in-travel-and-tourism-industry> (accessed February 27, 2019).
- [2] TrekkBlog, Travel Statistics to Know about in 2018 And 2019. Available online: <https://www.treksoft.com/en/blog/65-travel-tourism-statistics-for-2019> (accessed February 27, 2019).
- [3] Travel statistics. Available online: <https://www.treksoft.com/en/blog/65-travel-tourism-statistics-flog-2019> (accessed 2019).
- [4] WildWeb, The Importance of Tourism Marketing. Available online: <https://www.wildweb.co.za/blog/the-importance-of-tourism-marketing/> (accessed February 26, 2019).
- [5] Buhalis D., Wagner R. (2013), *E-destinations: Global best practice in tourism technologies and applications*. In Information and Communication Technologies in Tourism; L. Cantoni, Z. Xiang, Eds.; Springer Verlag, Vienna, Austria, 2013, pp. 119-130.
- [6] Kasemsap K. (2015). *The Role of Marketing Strategies in the Tourism Industry*. Emerging Innovative Marketing Strategies in the Tourism Industry 2015, pp. 174-194.
- [7] Novelus, Marketing Tourism. Available online: <https://novelus.eu/industries/tourism-marketing> (accessed February 27, 2019).
- [8] TourismReview (2019), The Importance of Content Marketing for Tourism Industry. Available online: <https://www.tourism-review.com/content-marketing-is-growing-in-importance-news10268> (accessed February 27, 2019).
- [9] Shankar V., Venkatesh A., Hofacker C., Naik P. *Mobile marketing in the retailing environment: Current insights and future research avenues*. Journal of Interactive Marketing 2010, Vol. 24(2), pp. 111-120.

Applicability of Blockchain Technology in New Zealand's Prefabricated Construction Industry: A Potential Solution

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Abstract

Different industries are modernising their systems and introducing innovations to their management practices. However, the construction industry is recognised for its lack of technological systems on which the success of this sector is deemed to be heavily dependent. Previous studies have focused on enhancing the off-site construction supply chain. However, studies on the importance and utilisation of technology in this sub-sector are scarce, predominantly where the efficiency of off-site supply chain management is stalled as a consequence of the slow implementation of technology. Thus, this article employs an exploratory approach by providing insight into the applicability of blockchain technology in New Zealand's off-site construction and demonstrates the benefits associated with the adoption of this technology. Literature review was used to identify stakeholders' interrelationships in different stages of prefabrication projects. Then, a pilot interview from industry experts followed by a questionnaire survey was used to determine the involvement of stakeholders in different phases and the benefits that blockchain technology can bring to this industry. The results indicate that using blockchain as a secure information management system could improve the integration of prefabrication supply systems by producing a collaborative atmosphere amongst the organisations involved.

Keywords: prefabrication, supply chain, blockchain, information integration, New Zealand.

References

- [1] Bakhtiarizadeh, E., Shahzad, W., & Rotimi, J. O. B. (2019). A process map for supply chain relationships in prefabricated construction. 43rd AUBEA Conference, Australia, pp. 112-123.
- [2] Bankvall L., Bygballe L.E., Dubois A., Jahre, M. *Interdependence in supply chains and projects in construction*. Supply Chain Management 2010, Vol. 15(5), pp. 385-393.
- [3] Behera P., Mohanty R.P., Prakash A. *Understanding Construction Supply Chain Management*. Production Planning & Control 2015, Vol. 26(16), pp. 1332-1350.
- [4] Bell P. Kiwi prefab: Prefabricated housing in New Zealand: An historical and contemporary overview with recommendations for the future. Master's Thesis, Victoria University of Wellington 2009. Retrieved from <http://researcharchive.vuw.ac.nz/handle/10063/1111>
- [5] Biernacki, P., Waldorf, D. J. *Snowball sampling: Problems and techniques of chain referral sampling*. Sociological Methods and Research 1981, Vol. 10(2), pp. 141-163.
- [6] Black C., Akintoye A., Fitzgerald E. *An analysis of success factors and benefits of partnering in construction*. International Journal of Project Management 2000, Vol. 18(6), pp. 423-434.
- [7] Briscoe G., Dainty A. R. J., Millett S. *Construction supply chain partnerships: skills, knowledge and attitudinal requirements*. European Journal of Purchasing & Supply Management 2001, Vol. 7(4), pp. 243-255.
- [8] Cai S., Jun M., Yang Z. *Implementing supply chain information integration in China: The role of institutional forces and trust*. Journal of Operations Management 2010, Vol. 28(3), pp. 257-268.
- [9] Casino F., Dasaklis T. K., Patsakis C. *A systematic literature review of blockchain-based applications: current status, classification and open issues*. Telematics and Informatics 2018, Vol. 36, pp. 55-81.
- [10] Chou David C. (2004). *Web technology and supply chain management*. Information Management & Computer Security 2004, Vol. 12(4), pp. 338-349.
- [11] Chowdhury M.J.M., Colman A., Kabi M.A., Han J., Sarda P. Blockchain Versus Database: A Critical Analysis. 17th IEEE International Conference On Trust, Security And Privacy In Computing And Communications/ 12th IEEE International Conference On Big Data Science And Engineering (TrustCom/BigDataSE), 2018.

A novel data mining approach for defect detection in printed circuit board manufacturing process

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Abstract

This research aims to propose an effective model for defect Printed Circuit Boards (PCB) detection on the output stage from the Surface-mount technology (SMT) line. The emphasis is placed on increasing the classification accuracy, reducing the algorithm training time, and further improvement of the final product quality.

This approach combines Principle Component Analysis (PCA) feature extraction technology and Support Vector Machine (SVM) classification algorithm with previously applied Automated Optical Inspection (AOI). Different types of SVM algorithms (linear, kernels, and weighted) were tuned to get the best accuracy of the resulting algorithm for separating high-quality products from defective ones.

A novel automated defect detection approach for the PCB manufacturing process is proposed. The data from the real manufacturing process of PCB were used for this experimental study. The resulting PCA-LWSVM model has achieved 100% accuracy in the PCB defect detection task.

In this article, a potentially unique model has been proposed for accurate defect detection in the PCB industry. A combination of methods PCA, LWSVM together with AOI technology is an original and effective solution.

The proposed model can be used in various manufacturing companies as a post-processing step on SMT line with AOI, either for accurate defect detection or for preventing false calls.

Keywords: quality management, defect detection, AOI, PCA, PCB, SVM

References

- [1] Banjoko, A. W., Yahya, W. B., Garba, M. K., Abdulazeez, K. O. Weighted support vector machine algorithm for efficient classification and prediction of binary response data. *Journal of Physics: Conference Series* 2019, Vol. 1366.
- [2] Bártová, B., Bina, V., & Vachova, L. A PRISMA-driven systematic review of data mining methods used for defects detection and classification in the manufacturing industry. *Production* 2022, Vol. 32, e20210097.
- [3] Ghosh, A., Guha, T., Bhar, R. B., Das, S. Pattern classification of fabric defects using support vector machine. *International Journal of Clothing Science and Technology* 2010, Vol. 23(2/3), pp. 142-151.
- [4] Hu, B., Wang, J. Detection of PCB Surface Defects With Improved Faster-RCNN and Feature Pyramid Network. *IEEE Access* 2020, Vol. 8, pp. 108335-108345.
- [5] Kim, Y.-G., Park, T.-H. SMT Assembly Inspection Using Dual-Stream Convolutional Networks and Two Solder Regions. *Applied Sciences* 2020, Vol. 10(13).
- [6] Mahfuz, R. A., M., Hoque, R., Pramanik, B. K., Hamid, E., Ali Moni, M. SVM Model for Feature Selection to Increase Accuracy and Reduce False Positive Rate in Falls Detection 2020. <https://doi.org/10.1109/IC4ME247184.2019.9036529>
- [7] Zakaria, S. S., Amir, A., Yaakob, N., Nazemi, S. (2020). Automated Detection of Printed Circuit Boards (PCB) Defects by Using Machine Learning in Electronic Manufacturing: Current Approaches. *Materials Science and Engineering* 2020, Vol. 767.
- [8] Wang, S. yuan, Zhao, Y., Wen, L. (2016). PCB welding spot detection with image processing method based on automatic threshold image segmentation algorithm and mathematical morphology. *Circuit World* 2016, Vol. 42(3), pp. 97-103.

Brand Management of National Companies in the World Market

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Abstract

The article considers the purpose of the brand development from a management perspective. Problems of brand formation and expansion in Ukrainian companies are analysed. It is proved that branded goods are more competitive in today's world market. Prerequisites for the formation and development of Ukrainian brands and their promotion on the world market are outlined. There are also demonstrated the negative trends that hinder the formation of brands in Ukraine. It is proved that the brand is a necessary condition for achieving sustainable and long-term business success in the global market.

Keywords: brand, brand management, foreign market, management, world market.

References

- [1] Kotler Ph. Armstrong G. *Principles of Marketing*, 17th ed.; Pearson Education Limited, London, UK, 2017.
- [2] Anees-ur-Rehman M., Wong H.Y., Hossain M. *The progression of brand orientation literature in twenty years: A systematic literature review*. *Journal of Brand Management* 2016, Vol. 23(6), pp. 612-630.
- [3] Anees-ur-Rehman M., Wong H., Sultan P., Merrilees B. *How brand-oriented strategy affects the financial performance of B2B SMEs* *Journal of Business & Industrial Marketing* 2018, Vol 33(3), pp. 303-315.
- [4] Aspara J., Tikanen H. *Significance of corporate brands for business-to-business companies*. *The Marketing Review*, 2008, Vol. 8(1), pp. 43-60.
- [5] Kavaratzis M., Hatch M.J. *The dynamics of place brands: An identity-based approach to place branding theory*. *Marketing Theory* 2013, Vol.13(1), pp. 69-86.
- [6] Carlson J., Wyllie J., Rahman M.M., Voola R. *Enhancing brand relationship performance through customer participation and value creation in social media brand communities*. *Journal of Retailing and Consumer Services* 2019, Vol. 50, pp. 333-341.
- [7] Filurin A. *Branding and Marketing: Feel the Difference*. *Marketing* 2017, Vol. 4, pp. 71-77.
- [8] Fatma M., Khan I., Rahman Z. *How does corporate association influence consumer brand loyalty? Mediating role of brand identification*. *Journal of Product & Brand Management* 2016, Vol. 25(7), pp.629-641.
- [9] Pustotin V. *Features of creating brand leaders*. *Marketing* 2020, Vol. 1, pp. 22-29.
- [10] *Session of the "round table" on the problem: "Formation and development of brands in Ukraine: features and trends"*. *Marketing and advertising* 2018, Vol. 82, pp. 19-23.

Digitisation of Ukraine as a Mechanism of Economic Growth in the Context of Globalization

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Abstract

The article presents the peculiarities of the digital economy and its connection with the so-called economy on-demand. There was studied cardinal transformation of participants' production relations, the result of which is the integration of products and services into a single digital system. The authors of the article analysed the main segments of the digital economy. It was proved that the development of technology and automation has a profound effect on the labour force of any country. There were also studied the adaptation strategies used by governments around the world to mitigate future societal shocks, namely: stimulating the creation of new types of jobs; legislative slowdown in the spread of technology; unconditional basic income (UBI). The article also presents the level of digitalisation of the Ukrainian economy. The share of some digital services in Ukraine and the European Union was demonstrated.

Keywords: adaptation, development, strategies, digital economy, digitalization, digital technologies.

References

- [1] Negroponte N. *Being Digital*; Knopf, New York 1995.
- [2] Pyshchulina O. *Digital economy: trends, risks and social determinants*; Zapovit Publishing House, Kyiv, Ukraine, 2020.
- [3] Mesenbourg T.L. Measuring the Digital Economy. U.S. Bureau of the Census. Available online: <http://www.census.gov/content/dam/Census/library/working-papers/2001/econ/digitalecon.pdf>
- [4] Digital Adoption Index, Worldbank. Available online: <https://www.worldbank.org/en/publication/wdr2016/Digital-Adoption-Index>
- [5] Dannikov O.V., Sichkarenko K.O. *Conceptual principles of Ukraine's economy digitalization*. Market infrastructure 2018, Vol. 17.
- [6] Tarnoff B. *The data is ours! What is big data? And how do we democratize it?* Logic Magazine 2018.
- [7] UNESCO's Internet Universality Indicators: A Framework for Assessing Internet Development. Paris. 2019.
- [8] Weber S. *Data, development, and growth*. Business and Politics 2017, Vol. 19(3), pp. 397-423.
- [9] WIPO Technology Trends 2019: Artificial Intelligence. World Intellectual Property Organization. Geneva. 2019.
- [10] World Trade Report 2018: The Future of World Trade – How Digital Technologies are Transforming Global Commerce. World Trade Organization, Geneva. 2018.

Global Investment Flows Transformation During the Covid-19 Pandemic

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Abstract

The article investigates the impact of the coronavirus pandemic on investment decisions in international economic activity and the concepts of capital flight and net capital inflows. There were systematised the sources of investments, from which companies could obtain resources to improve their work. Among the main sources of investment foreign aid in the form of grants, loans, etc. was considered as a rather controversial category, as there were cases when state foreign aid had a positive impact on the economy of the recipient country and along with them there were many examples of failure to use such aid. Currently, there is an intensification of the global investment movement, as the number of countries that have increased financial resources and, as a result, have a surplus, is increasing every year. A well-established investment movement has significant positive effects not only for the enterprise that receives them, but also for a state as a whole. Coronavirus has negatively affected global investment flows, leading to a decline in key economic indicators in all countries. During the crisis caused by the pandemic, the rules of the game in the investment field have changed significantly – there have been other priority areas of investment and the criteria by which investors choose objects for financing.

Keywords: foreign direct investment, investment market, globalization, COVID-19, world economy.

References

- [1] Foreign Direct Investment Statistics: Data, Analysis and Forecasts The World Bank Group. Available online: <https://www.oecd.org/corporate/mne/statistics.htm>.
- [2] Foreign direct investment, net inflows (BoP, current US\$). Available online: <https://data.worldbank.org/indicator/BX.KLT.DINV.CD.WD>.
- [3] Official site of United Nations Conference on Trade and Development. Available online: www.unctad.org.
- [4] PwS UK. Available online: <https://www.pwc.co.uk/>.
- [5] The World Bank. Global Economic Prospects. Available online: <https://www.worldbank.org/en/publication/globaleconomic-prospects> (accessed 2020)
- [6] UNCTAD. TheWorldBank. Available online: <https://unctad.org/>.
- [7] UNCTAD, FDI/MNE database. Available online: www.unctad.org/fdistatistics.
- [8] World Investment Report 2020. Available online: <https://unctad.org/webflyer/world-investment-report-2020>.
- [9] Statista. Available online: <https://www.statista.com>.
- [10] Post COVID-19: investment promotion agencies and the “new normal”. Available online: https://docs.google.com/document/d/1X9al08uzY5tcfb6DJLL0kcYyNwU8Hi_ZCygKvVnmVcM/edit.

The State of Environmental Entrepreneurship in Ukraine

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Abstract

Ecological entrepreneurship is one of the driving factors of sustainable development and responsible consumption. To date, there is no clear legislation in Ukraine that would regulate environmental entrepreneurship, but there are a number of laws that regulate the activities of enterprises in relation to the environment. Ukraine has recently enacted the Law on Waste Management, which specifically identifies large industrial enterprises with more than 50 tons of waste per year documents. Permits and issued licenses are available in the public domain on the website of the Ministry of environmental protection and natural resources of Ukraine. The ministry's website also publishes news about the refusal to issue a license to a specific company. An important step of enterprises to the ecological model of doing business is ecological labelling.

Keywords: ecological entrepreneurship, factors, environment, ecological model.

References

- [1] Kupalova H.I. *Ekolohichne pidpriemnytstvo yak nevidiemna skladova staloho rozvytku Ukrainy*. Visnyk Kyivskoho natsionalnoho universytetu imeni Tarasa Shevchenka. Viiskovo-spetsialni nauky 2011, Vol. 26, pp. 35-39.
- [2] Pecheniuk A.V. *Perspektyvy rozvytku ekolohichnoho pidpriemnytstva v Ukraini*. Innovatsiina ekonomika 2013, Vol. 3, p. 172.
- [3] Bobkova A.H.; Pavliuchenko, Yu.M. *Shchodo vidpovidalnosti za porushennia pry zdiisnenni ekolohichnoho pidpriemnytstva*, 2017.
- [4] Bezzub R.Yu. *Ekolohichne Pidpriemnytstvo yak innovatsiinyi chynnyk staloho rozvytku*. In: Finansova infrastruktura v zabezpechenni staloho rozvytku: Zbirnyk naukovykh materialiv Mizhnarodnoi naukovo-praktychnoi konferentsii. Kyiv, Ukraine, 2019.
- [5] Krakovska A.Ye. *Shchodo pryntsyviv derzhavnoi polityky u sferi ekolohichnoho pidpriemnytstva*. Redaktsiina kolehiia, 2017.
- [6] Kyrychenko, V. *Ekolohichne pidpriemnytstvo yak nevidiemna skladova staloho rozvytku Ukrainy*. Materialy III Mizhnarodnoi studentskoi naukovo-tekhnichnoi konferentsii Pryrodnychi ta humanitarni nauky. Aktualni pytannia 2020, pp. 207-208.
- [7] Kosovych B.I. *Ekolohizatsiia yak napriam innovatsiinoho rozvytku pidpriemnytstva. pidpriemnytstvo ta innovatsii*, 2021.
- [8] Mykhailova Ye.O. *Pryntsyvy vprovadzhenia ekolohichnoho markuvannia produktsii*. Komunalne gospodarstvo mist. Serii: Tekhnichni nauky ta arkhitektura 2018, pp. 43-50.
- [9] Levytska, D.R. *Rozvytok ekolohichnoho markuvannia v Ukraini*. In: Naukovi rozrobky molodi na suchasnomu etapi. Kyivskiy natsionalnyi universytet tekhnolohii ta dizainu, 2019.

The Essence and Characteristics of Event Tourism

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Abstract

Event tourism is a quite young and one of the most promising types of tourism today. The main purpose of event tourism is to attend thematic events, celebrations and events. Every year on all continents there are various sports competitions, conferences, concerts, festivals, parades, fairs and thematic celebrations, which tourists seek to get, regardless of distance and money. Tourists who come to attend themed events bring significant profits to the host countries or cities and spend money. Therefore, all mass and interesting events for people are becoming relevant and very promising business today. Events are important motivators of tourism and occupy a prominent place in the development and marketing plans of most areas. The role and consequences of the planned event in tourism have been well documented and are important for the competitiveness of these areas. However, only a few decades ago, "event tourism" became established in the tourism industry. Therefore, the further development of this type of tourism can be described only as impressive.

Keywords: event tourism, tourism, events, tourist events.

References

- [1] Builenko V.F. *Turyzm: navch. posibnyk vuziv*; Feniks, Rostov-na-Donu, 2012.
- [2] Byrzhakov M.B. *Vvedennia v turyzm*; SPb.: Vydavnychiy dim Herda, Ukraine, 2001.
- [3] Getz D. *Event Tourism – Definition, Evolution and Research*; Elsevier Calgary, Canada 2008, pp. 403-428.
- [4] Hernández-Mogollón J.M., Fernández J.A.F., Duarte P.A.O. *Event tourism analysis and state of the art*. European Journal of Tourism, Hospitality and Recreation 2014 Vol. 5(2), pp. 83-102.
- [5] Kaurova O.D. *Orhanizatsiia sfery turyzmu*; SPb.: Vydavnychiy dim Herda, Ukraine, 2013.
- [6] Kyfiak V.F. *Orhanizatsiia turyzmu*; Chernivtsi: Knyhy – KhKhI. 2008.
- [7] Ofitsiinyi sait World Tourism Organization. UNWTO. Available online: <http://www2.unwt>.
- [8] Shapovalova Y. *Budushchee event-marketynha*. Available online: <http://www.advertology.ru/article17171.htm>.
- [9] Tyshchenko P.V. *Teoretychni aspekty ta rozvytok podiiivoho turyzmu rehionu*. Naukovyi visnyk Uzhhorodskoho universytetu 2011, Vol. 33. pp. 124-128.
- [10] Ukrainskyi turystychnyi portal UkrTuryzm. Available online: <http://www.ukrtourism.com>.

Enterprise Resources: Concept and Their Composition, Resource Utilization Indicators

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Abstract

In modern market conditions, manufacturers are faced with an acute task of finding ways to ensure a high level of competitiveness, which requires the introduction of measures designed to improve the efficiency of using all the components of the enterprise's economic system. In order to improve the use of resources, it is necessary to identify and evaluate the factors that affect the indicators of their use: fund intensity, fund return, labour productivity, to name but a few. The purpose of the work is to study the features of the efficiency of using enterprise resources, increasing their reserves. Research objectives revolved around the following issues: the definition of the concept and composition of enterprise resources; the identification of reserves and directions of efficient use of resources; the search for the main reserves, the assessment and analysis of indicators of the use of resource efficiency of PJSC "Elektromotor"; the determination of measures for the effective use of resources of PJSC "Elektromotor". The object of research in this work is the resources of PJSC "Elektromotor" and the directions of their effective use. The subject of the research is a system of theoretical, methodological and practical aspects related to resources and the efficiency of their use.

Keywords: efficiency, usage, resources, reserves, enterprise.

References

- [1] Chichulina K. *Analysis of the concept "resources" and the mechanism of their effective formation*. Economy and region 2020. Vol. 4(79), pp. 43-53.
- [2] Chichulina K., Byba V., Skryl V. *Study tutorial "The challenges of energy efficiency: cooperation of Ukraine with the EU" for students of the second level of Higher Education by specialty 076 "Entrepreneurship, trade and stock market", 101 "Ecology", 192*. In. Construction and civil engineering, National University Yuri Kondratyuk Poltava Polytechnic, Poltava, Ukraine, 2021.
- [3] Zhang G., Zhao S., Xi Yu., Liu N., Xu X. *Relating science and technology resources integration and polarization effect to innovation ability in emerging economies: An empirical study of Chinese enterprises*. Technological Forecasting and Social Change 2018, Vol. 135, pp. 188-198.
- [4] Shirazi B. *Towards a sustainable interoperability in food industry small & medium networked enterprises: Distributed service-oriented enterprise resources planning*. Journal of Cleaner Production 2018, Vol. 181, pp. 109-122.
- [5] Cheah J., Amran A., Yahya S. *Internal oriented resources and social enterprises' performance: How can social enterprises help themselves before helping others?*, Journal of Cleaner Production 2019, Vol. 211, pp. 607-619.
- [6] Abo Abdo S., Aldhoiena A., Al-Amrib H. *Implementing Enterprise Resource Planning ERP System in a Large Construction Company in KSA*. Procedia Computer Science 2019, Vol. 164, pp. 463-470.
- [7] Farkas M., Kersting L., Stephens W. *Teaching and educational notes Modern Watch Company: An instructional resource for presenting and learning actual, normal, and standard costing systems, and variable and fixed overhead variance analysis*. Journal of Accounting Education 2016, Vol. 35, pp. 56-68.
- [8] Aslan B., Stevenson M., Hendry L.C. *Enterprise Resource Planning systems: An assessment of applicability to Make-To-Order companies*, Computers in Industry 2012, Vol. 63(7), pp. 692-705.
- [9] Aslan B., Stevenson M., Hendry L.C. *The applicability and impact of Enterprise Resource Planning (ERP) systems: Results from a mixed method study on Make-To-Order (MTO) companies*. Computers in Industry, 2015, Vol. 70, pp. 127-143.
- [10] Cheah J., Amran A., Yahya S. *External oriented resources and social enterprises' performance: The dominant mediating role of formal business planning*. Journal of Cleaner Production 2019, Vol. 236.

Long-term Trend of Electric Vehicle Sales in Thailand

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Abstract

This research study aims at examining the long-term trend of EV sales in Thailand, utilising the system dynamics (SD) modelling approach. This approach is commonly used to model complex systems with causal relationships among key factors within the system. The developed SD model consists of five key factors affecting electric vehicle (EV) sales, namely, the environment, economy, charging infrastructure, government support, and battery maintenance. The simulation results show the increase in EV sales by ten times in the next 20 years with implementation plans related to the five key factors. The government support factor is the most important in enhancing EV sales in the short term. Several government support plans should be initiated to attract more EV consumers, such as subsidies and tax reductions. The environment and charging infrastructure factors are crucial to increasing EV sales in the long term. The enforcement of the CO2 tax and the provision of charging stations all around the country should be established to achieve a sustainable EV market in the long term. This research study contributes to the Thai government and automotive industry to better understand the complex relationships among key factors affecting EV sales. The related sectors may use the study results to plan for EV campaigns to promote the use of EVs and achieve a sustainable EV market.

Keywords: electric vehicle, system dynamics modelling, trend, Thailand

References

- [1] Feng Y. Y., Chen S., Zhang L. System dynamics modelling for urban energy consumption and CO2 emission: a case study of Beijing, China. *Ecological Modelling* 2013, Vol. 252, pp. 44-52.
- [2] Goncalves D., Bergquist M., Bunk R., Alänge S. Cultural aspects of organizational agility affecting digital innovation. *Journal of Entrepreneurship, Management and Innovation* 2020, Vol. 16, No. 4, pp. 13-46.
- [3] Kaeo-tad N., Jeenanunta C., Chumnumporn K., Nitisahakul T., Sanprasert V. Resilient manufacturing: case studies in Thai automotive industries during the Covid-10 pandemic. *Engineering Management in Production and Services* 2021, Vol. 13, No. 3, pp. 99-113.
- [4] Kumnerdpetch K. Factors affecting consumers' decision to buy battery electric vehicles in Bangkok and metropolitan area. *Journal of Community Development Research (Humanities and Social Sciences)* 2020, Vol. 13, No. 3, pp. 96-109.
- [5] Mendoza P. JR. Electric vehicle uptake in the Kingdom of Thailand: analysis using analytic hierarchy process. Master Thesis, Sripatum University, Bangkok, Thailand, 2018.
- [6] Promphat S., Deebhijarn S. Intention to purchase electric passenger vehicles among drivers in Thailand: a structural equation modeling analysis. *Asia-Pacific Social Science Review* 2019, Vol. 19, No. 3, pp. 119-127.
- [7] Thananusak T., Rakthin S., Tavewatanaphan T., Punnakitikashem P. Factors Affecting the Intention to Buy Electric Vehicles: Empirical Evidence from Thailand. *International Journal of Electric and Hybrid Vehicles* 2017, Vol. 9, No. 4, pp. 361-392.

The Main Approaches to Determining the Structure of the Economic Potential of the Enterprise

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Abstract

The paper investigates the main approaches to determining the structure of the economic potential of the enterprise. The economic potential of the enterprise should be understood as a combination of available resources and the ability to transform them to achieve economic benefits. The article also discusses the structure of economic potential of the enterprise. Structuring the economic potential of an enterprise is the foremost condition for the distinguishing of its leading characteristics to apply, develop, reproduce and extend capacity, the formation of its state in accordance with the objectives. The study results provide an opportunity to comprehensively assess the enterprise state, its resources, the efficiency of the use of existing economic potential, taking into account the selected components, as well as finding opportunities for its growth, to justify the managerial decisions that are made. The enterprise should be considered as a complex system that is influenced by factors that are constantly changing and evolving. The effectiveness of management decisions depends on the analysis conducted.

Keywords: structure, economic potential, resources, approaches, methods.

References

- [1] Lapin Ye.V., Economic potential of industrial enterprises: formation, evaluation, management: dis. Dr. Econ. Science: 08.07.01, Nat. tech. University Khark. Polytechnic Inst, 2006.
- [2] Fedonin O.S., Riepina I.M., Oleksiuk O.I., *Enterprise potential: formation and evaluation: teaching method. way. for independent study of the discipline*; Ministry of Education and Science of Ukraine, Kyiv National Economic University. Kyiv: KNEU, Ukraine, 2005.
- [3] Balatskyi O.F., Lapin Ye.V., Akulenko V.L., *Economic potential of administrative and production systems*. Sumy State University Library, Sumy, Ukraine, 2006.
- [4] Sabatino M. *Economic crisis and resilience: resilient capacity and competitiveness of the enterprises*. Journal of Business Research 2016, Vol. 69, pp. 1924-1927.
- [5] Prokhorov V., Tarasyuk D. *Forming the Economic Potential of an Enterprise: Theoretical Aspect*. Economy and Region 2015, Vol. 4, pp. 35-39.
- [6] Velichko O. *The Essence of the Economic Potential of an Enterprise*. Actual Problems of Economics 2015, Vol. 9, pp. 15-20.
- [7] Azhaman I., Zhidkov O. *The essence and structure of the economic potential of the enterprise*. Economy and State 2018, Vol. 4, pp 22-25.
- [8] Christopher O. *A Systematic Approach to Assessing the Internal Capacity and Competitiveness of Rail Transport as a Basis for Creating a Balanced Scorecard*. Transport Economics 2014, Vol. 8, pp. 31-41.
- [9] Tkachova O. *The Saati Method in Managerial Decision Making*. States and Regions 2015, Vol. 4, pp. 92-96.
- [10] Muzychenko M. *The Use of the Verhulst Logistic Function as a Desirability Function for Normalizing the Indicators of Security of Natural Gas Supply*. Economics and Society 2017, Vol. 9, pp. 83-88.

Practical Use of Collaborative Robots in Packing Tasks

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Abstract

Implementation of robotic solutions has affected practically every area of human activity, improving efficiency, bringing higher quality and repeatability, as well as economic benefits by lower production costs. According to World Robotics 2020 – Service Robots report, the market value of logistics robots sold or leased rose from 0.9 to 1.9 billion U.S. dollars in 2019, and it is predicted to reach 7.5 in 2023. Robotic solutions in logistics systems in manufacturing and non-manufacturing environments are mainly automated guided vehicles (AGVs), Autonomous Mobile Robots (AMR), cargo handling, personal transportation. Collaborative robots are designed for direct interaction with a human. In logistics, their main applications are pick and place activities, palletizing and assembling tasks, support for AGV/AMR. The paper presents the possibilities of using collaborative robots in packaging and palletizing operations. Collaborative robotic systems have great potential to improve the productivity of palletizing operations. The article describes the process, algorithm, and program for a demonstration system developed with the use of the UR3 robot. A set of experiments is designed and performed to investigate the assumed scenarios and use cases of packing rules and the performance of the proposed models. The aim is to examine and review the potential of collaborative robots in the process of packaging finished parts.

Keywords: collaborative robot, robot, cobot, programming, packing, palletizing, Universal Robots (UR).

References

- [1] International Federation of Robotics. Available online: <https://ifr.org/> (accessed on 27.04.2021).
- [2] Maurtua I.; Ibarburen A.; Kildal J.; Susperregi L.; Sierra B. *Human-Robot Collaboration in Industrial Applications: Safety, Interaction and Trust*. International Journal of Advanced Robotic Systems 2017, Vol. 14, pp. 1-10.
- [3] Atzeni G., Vignali G., Tebaldi L., Bottani E. *A Bibliometric Analysis on Collaborative Robots in Logistics 4.0 Environments*. Procedia Computer Science 2021, Vol. 180, pp. 686-695.
- [4] Lamon E., Leonori M., Kim W., Ajoudani A. Towards an Intelligent Collaborative Robotic System for Mixed Case Palletizing. In Proceedings of the 2020 IEEE International Conference on Robotics and Automation (ICRA); IEEE: Paris, France, May 2020; pp. 9128-9134.
- [5] Universal Robots. Available online: <https://www.universal-robots.com/> (accessed on 27.04.2021)

ARIMA Models in Electrical Load Forecasting and Their Robustness to Noise

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Abstract

The paper addresses the problem of insufficient knowledge on the impact of noise on the auto-regressive integrated moving average (ARIMA) model identification. The work offers a simulation-based solution to the analysis of the tolerance to noise of ARIMA models in electrical load forecasting. In the study, an idealized ARIMA model obtained from real load data of the Polish power system was disturbed by noise of different levels. The model was then re-identified, its parameters were estimated, and new forecasts were calculated. The experiment allowed us to evaluate the robustness of ARIMA models to noise in their ability to predict electrical load time series. It could be concluded that the reaction of the ARIMA model to random disturbances of the modeled time series was relatively weak. The limiting noise level at which the forecasting ability of the model collapsed was determined. The results highlight the key role of the data preprocessing stage in data mining and learning. They contribute to more accurate decision making in an uncertain environment, help to shape energy policy, and have implications for the sustainability and reliability of power systems.

Keywords: ARIMA; electricity load; forecasting; model identification; tolerance to noise; robustness; simulation

References

- [1] Box, G.E.P., Jenkins, G.M. Time Series Analysis: Forecasting and Control; Holden-Day series in time series analysis and digital processing; Rev. ed.; Holden-Day: San Francisco, CA, USA, 1976.
- [2] Cheba, K., Bąk, I. Environmental Production Efficiency in the European Union Countries as a Tool for the Implementation of Goal 7 of the 2030 Agenda. *Energies* 2021, Vol. 14, 4593.
- [3] Chodakowska, E., Nazarko, J. Assessing the Performance of Sustainable Development Goals of EU Countries: Hard and Soft Data Integration. *Energies* 2020, Vol. 13, 3439.
- [4] Chodakowska, E., Halicka, K., Kononiuk, A., Nazarko, J. Prognozowanie cen energii elektrycznej na Towarowej Giełdzie Energii SA z wykorzystaniem modeli ARIMA in: Kiełtyka, L., Nazarko, J. (Eds), *Technologie informatyczne i prognozowanie w zarządzaniu: wybrane zagadnienia*, Wydawnictwo Politechniki Białostockiej, Białystok, Poland, 2005.
- [5] Deb, C., Zhang, F., Yang, J., Lee, S.E., Shah, K.W. A Review on Time Series Forecasting Techniques for Building Energy Consumption. *Renew. Sustain. Energy Rev.* 2017, Vol. 74, pp. 902-924.
- [6] Ejdys, J., Nazarko, Ł. Foresight gospodarczy - instrumentem orientacji na przyszłość, *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu* 2014, Vol. 340, pp. 651-664.
- [7] Kao, Y.-S.; Nawata, K.; Huang, C.-Y. Predicting Primary Energy Consumption Using Hybrid ARIMA and GA-SVR Based on EEMD Decomposition. *Mathematics* 2020, Vol. 8, 1722.
- [8] Nafil, A., Bouzi, M., Anoune, K., Ettalabi, N. Comparative Study of Forecasting Methods for Energy Demand in Morocco. *Energy Rep.* 2020, 6, pp. 523-536.
- [9] Nazarko, J., Chodakowska E., Labour efficiency in construction industry in Europe based on frontier methods: data envelopment analysis and stochastic frontier analysis, *Journal of Civil Engineering and Management* 2017, Vol. 23 Issue 6, pp. 787-795.
- [10] Nazarko, Ł., Melnikas, B. Operationalising Responsible Research and Innovation – tools for enterprises, *Engineering Management in Production and Services* 2019, Vol. 11 (3), pp. 21-28.
- [11] Nti, I.K., Teimeh, M., Nyarko-Boateng, O., Adekoya, A.F. Electricity Load Forecasting: A Systematic Review. *J. Electr. Syst. Inf Technol* 2020, Vol. 7, 13.
- [12] Soliman, S.A., Alkandari, A.M. *Electrical Load Forecasting: Modeling and Model Construction*; Butterworth-Heinemann: Burlington, MA, USA, 2010.
- [13] Trull, O., García-Díaz, J.C., Peiró-Signes, A. Forecasting Irregular Seasonal Power Consumption. An Application to a Hot-Dip Galvanizing Process. *Appl. Sci.* 2020, Vol. 11, 75.

Approaches to the Choice of a Promotion Strategy on the Foreign Market of Organic Products

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Abstract

The article analyses production of organic products dynamics aimed at exports in Ukraine. The top 10 countries of importers of Ukrainian organic products were identified. The main criteria and conditions for choosing a strategy for promoting domestic organic products on the foreign market are described. In general, the choice of how to enter foreign markets can be made according to the following criteria: the form of capital movements; the level of costs associated with entering a foreign market; the investing attractiveness degree; the market control; the level of risk, and the possibility of exiting the market. According to another classification, there are internal and external factors. Internal factors include: product characteristics, corporate policy, competitive positions, resource opportunities. External factors comprise: national government policy, financial and price parameters of the market, geo-cultural environment, market opportunities, the level of economic development and economic situation, political environment. A SWOT analysis of the export potential of the Ukrainian producers of organic products was conducted. Based on the identified external environment opportunities and the strengths of domestic producers of organic products, the four highest priority strategies for promoting these products on the foreign market and the development of export potential were identified.

Keywords: organic products, promotion, strategy, foreign market.

References

- [1] Zolotarevskij A.V. *Stvorennya strategii ekonomichnogo rozvitku pidpriemstva*. Formuvannya rinkovih vidnosin v Ukraini 2014. Vol. 11(162). pp. 107-113.
- [2] Laguta YA.M., Mihajlenko N.V. *The state and prospects of development of the market of organic products in the context of corporate social responsibility*. Ekonomika ta upravlinnya pidpriemstvami. Prichornomors'ki ekonomichni studii 2017, Vol. 18(7), pp. 79-82.
- [3] On the basic principles and requirements for organic production, circulation and labeling of organic products AgroRolit. Available online: <https://agropolit.com/zakonodavstvo/788-pro-vimogi-do-organichnogo-virobnitstva-obigu-ta-markuvannya-organichnoyi-produktsiyi>
- [4] Prishlyak N.V. *Current state and prospects of development of the market of organic products in Ukraine*. Ekonomika. Finansi. Menedzhment: aktual'ni pitannya nauki i praktiki 2018. Vol. 5. pp. 25-36.
- [5] World Organic Statistics 2019. Available online: <http://organicinfo.ua/numbers.html>
- [6] Trofimceva O. Development of organic agricultural production is one of the priorities of our work. Available online: <http://minagro.gov.ua/node/25937>
- [7] Kucher O.V., Hoffman M.O. *Formation of principles of marketing sales policy of enterprises*. Bulletin of the Kamyanets-Podilsky National University named after Ivan Ogienko. Economic sciences 2015, Vol. 10. pp. 174-178.
- [8] Rossokha V.V. *Management of economic activity of agrarian enterprises and its sales policy*. Economics of agro-industrial complex 2016. Vol. 8. pp. 71-79.
- [9] Terentyeva N.V. *Principles and functions of sales*. Bulletin of Zaporizhia National University 2016. Vol. 1(29), pp. 127-138.
- [10] Kovalchuk S.V., Zaburmekha E.M. *Digital marketing technologies in research*. Marketing and digital technologies 2017, Vol. 1, pp. 34-51.

Managing Inter-Departmental Project Delivery to Enhance Customers' Satisfaction

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Abstract

The National Department of Public Works and Infrastructure (NDPWI) has the mandate from parliament to provide accommodation and other infrastructure to some public service departments. Each department communicate with NDPWI about their infrastructure requirements. However, between project briefing and actual delivery of the infrastructure takes considerable length of time. Therefore, it became imperative to evaluate the causes of delay and proffer solutions to enhance customers' satisfaction. The multiple sites case study method of qualitative research was adopted. The participants were officers in the rank of deputy directors and above, from three regional office of NDPWI in Bloemfontein, Cape Town and Kimberley, and the professional service department at the headquarter, in Pretoria. The Delphi technique was used as instrument for data collection and complemented with a focus group session. The findings revealed that NDPWI, as service provider, contributed the highest number factors responsible for the delays in project execution. Some of these factors include poor planning by project execution team (PET), ineffective monitoring of projects and over centralization of decision-making process. The theoretical contribution of this research is that efforts aimed at ameliorating the negative effects of delays in the execution of infrastructure development projects should embrace the concept of decentralisation of project governance, which could encourage semi-autonomy and innovation. NDPWI need to undertake skills audit, implement strategic employments in areas of deficiencies, be committed to continuous professional development and practice the concept of decentralisation of project governance. Therefore, this research recommended that the project manager should be adequately resourced and empowered, to effectively coordinate the PET members, in the delivery of projects on schedule.

Keywords: causes of delay, customers' satisfaction, Delphi technique, participants, project execution team.

Reference

- [1] Ahadzie D. K., Proverbs D. G., Olomolaiye P. O., Ankrah N. *Towards Developing Competency-based Measures for Project Managers in Mass House Building Projects in Developing Countries*. Construction Management and Economics 2009, Vol. 27(1), pp. 89-102.
- [2] Fillion G., Koffi V., Ekionea J-P. B. *Peter Senge's Learning Organization: A Critical View and the Addition of Some New Concepts to Actualize Theory and Practice*. Journal of Organizational Culture, Communications and Conflict 2017, Vol. 19(3), pp. 73-102.
- [3] Jafari A. *A Contractor Pre-qualification Model Based on the Quality Function Deployment Method*. Construction Management and Economics 2013, Vol. 31(7), pp. 746-760.
- [4] Ogbeifun E., Mbohwa C., Pretorius. J. H. C. *Complementing a Delphi Exercise with a Focus Group Session*, Proceedings of the 2016 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM), 4-7 Dec. 2016, Bali, Indonesia, 2016, pp. 1269-1273.
- [5] Oun T.A. *The Association of Knowledge Management and Project Management: An Enterprise-wide Approach Based on Stankosky's Four Pillar of Knowledge Management and PMI's Project Management Knowledge Areas* (Order No. 10148426). Available from ProQuest Central; ProQuest Dissertations & Theses Global. (1830478708), 2016, Vol. 1(1), pp. 1-243.
- [6] Rao B.P. *Delay Analysis of Construction Projects*. Journal of IT and Economic Development 2016, Vol. 7(1), pp. 15-24.

Traditionalism, Modernism, Postmodernism – Worldview Analysis in the Context of Values

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Abstract

This study aims to diagnose three worldviews, namely traditionalism, modernism and postmodernism (all of them relate to the stages of Western culture described by Bauman) and value systems (referring to the Rokeach theory). The constructs were measured according to the Borowiak Questionnaire “How do you view yourself and the world around you?” and the Rokeach Value Survey (RVS). The research was conducted on a sample of 368 Polish students. The authors sought answers to the question of which values – collectivist or individualistic – are associated with the indicated worldviews. It appeared that a worldview and values (giving a desired direction in life) are linked in the following manner: a traditionalist worldview is correlated with collectivist values, modernist and postmodernist worldviews – with individualist values (although these values do not overlap).

Keywords: traditional, modern, post-modern worldview, values, the Rokeach Value Survey (RVS).

References

- [1] Bauman Z. *Etyka ponowoczesna*; Wydawnictwo Naukowe PWN, Warszawa, Poland, 1996.
- [2] Borowiak A. *Światopogląd postmodernistyczny a postulat tolerancji*. In: Tolerancja i wielokulturowość. Wyzwania XXI wieku; A. Borowiak, P. Szarota Eds.; Wydawnictwo SWPS Academica, Warszawa, Poland, 2004.
- [3] Boski P. *Kulturowe ramy zachowań społecznych. Podręcznik psychologii międzykulturowej*; Wydawnictwo Naukowe PWN, Wydawnictwo SWPS Academica, Warszawa, Poland, 2009.
- [4] Brzozowski P. *Skala Wartości (SW). Polska adaptacja Value Survey M. Rokeacha*; Polskie Towarzystwo Psychologiczne, Wydział Psychologii Uniwersytetu Warszawskiego, Warszawa, Poland, 1989.
- [5] Ciecuch J. *Czym jest światopogląd? Filozoficzny kontekst psychologicznego pojęcia*. Psychologia Rozwojowa 2005, Vol. 10(2), pp. 147-159.
- [6] Ciecuch J. *Pomiar wartości w zmodyfikowanym modelu Shaloma Schwartza*. Psychologia Społeczna 2013, Vol. 1(24), T. 8, pp. 22-41.
- [7] Czerniawska M. *Inteligencja a system wartości*; Trans Humana, Białystok, Poland, 1995.
- [8] Czerniawska M., Szydło J. *The worldview and values – analysing relations*, WSEAS Transactions on Business and Economics 2020, Vol. 17(58), pp. 594-607.
- [9] Gellner E. *Postmodernizm, rozum i religia*, Wydawnictwo PIW, Warszawa, Poland, 1997.
- [10] Golec de Zavala A., Van Bergh A. *Need for cognitive closure and conservative political beliefs: Differential mediation by personal worldviews*, Political Psychology 2007, Vol. 28(5), pp. 587-608.
- [11] Lyotard J.F. *Kondycja ponowoczesna. Raport o stanie wiedzy*; Fundacja Aletheia, Warszawa, Poland, 1997.
- [12] Rohan M.J. *A rose by any name? The values construct*. Personality and Social Psychology Review 2000, Vol. 4(3), pp. 255-277.
- [13] Rokeach M, *The nature of human values*; Free Press, New York, 1973.

The Attitude-Behaviour Gap in Young Adults' Sustainable Consumption

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Abstract

Numerous research indicate an urgent need for broadening theoretical explanations of consumer' intentions to adopt pro-environmental behaviours and consumption. Understanding sustainable consumption is crucial not only for companies transitioning towards Circular Business Model, but also for customers, who take into account social issues and are concerned about the environment. At the same time, emerging body of evidence suggests the value-action gap (what consumers think – how they behave) in the purchasing behaviour. Hence, there is a need for a multidimensional analysis of the factors affecting the green buying decisions of consumers. In this contribution we investigate the Millennial generation as this group is the most willing to pay extra for sustainable offerings and have potential to influence others towards sustainability and environmental protection. The aim of the research was to understand the perception of the concept of sustainable consumption by young consumers and to identify factors contributing to their pro-ecological behaviour. Understanding purchase motives will be presented using the example of Polish young consumers. A qualitative methodology was used, and online focus group interview was employed for the data collection. The data presented in this contribution allow to further unpack the understanding of the sustainable consumption from young consumers' perspective.

Keywords: pro-environmental behaviour, sustainable consumption, young consumers.

References

- [1] Alzubaidi H., Slade E.L., Dwivedi Y.K. *Examining antecedents of consumers' pro-environmental behaviours: TPB extended with materialism and innovativeness*. Journal of Business Research 2021, Vol. 122, pp. 685-699.
- [2] Cowe R., Williams S. *Who Are the Ethical Consumers?* Ethical Consumerism Report. Cooperative Bank, 2000.
- [3] Grimmer M., Bingham T. *Company environmental performance and consumer purchase intentions*. Journal of Business Research 2013, Vol. 66(10), pp. 1945-1953.
- [4] Henninger C.E., Singh P. *Ethical Consumption Patterns and the Link to Purchasing Sustainable Fashion*. In Sustainability in Fashion; C. E. Henninger, P. J. Alevizou, H. Goworek, D. Ryding Eds.; Springer International Publishing, Switzerland, 2017; pp. 103-126.
- [5] Krueger R.A., Casey M.A. *Focus groups: A practical guide for applied research* (5th edition). SAGE, 2015.
- [6] Lee K. *Opportunities for green marketing: Young consumers*. Marketing Intelligence & Planning 2008, Vol. 26(6), pp. 573-586.
- [7] Lukman R., Lozano R., Vamberger T., Krajnc M. *Addressing the attitudinal gap towards improving the environment: A case study from a primary school in Slovenia*. Journal of Cleaner Production 2013, Vol. 48, pp. 93-100.
- [8] Moisander J. *Motivational complexity of green consumerism*. International Journal of Consumer Studies 2007, Vol. 31(4), pp. 404-409.
- [9] Nguyen N., Lobo A., Nguyen B. *Young consumers' green purchase behaviour in an emerging market*. Journal of Strategic Marketing 2017, Vol. 26, pp. 1-18.
- [10] Nielsen. *The Sustainability Imperative*. Nielsen Report, 2015.
- [11] Papaoikonomou E., Ryan G., Ginieis M. (2011). *Towards a Holistic Approach of the Attitude Behaviour Gap in Ethical Consumer Behaviours: Empirical Evidence from Spain*. International Advances in Economic Research, 17(1), 77-88.
- [12] Uddin S.M.F., Khan M.N. *Exploring green purchasing behaviour of young urban consumers: Empirical evidences from India*. South Asian Journal of Global Business Research 2016, Vol. 5(1), pp. 85-103.
- [13] Waas T., Verbruggen A., Wright T. *University research for sustainable development: Definition and characteristics explored*. Journal of Cleaner Production 2010, Vol. 18(7), pp. 629-636.

Process Dynamics of a Large European Project on the Basis of Information Activity in Social Media

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Abstract

The purpose of the paper is to present the process dynamics of a large European project on the basis of its information activity in social media. Social media are a powerful means of reaching a wide audience, while activity in this sphere reflects the degree of organisation of project partners and their involvement in achieving the project's objectives. The paper makes use of the experience gained while promoting the results of the GoSmart BSR project via social media. The GoSmart BSR project is concerned with enhancing the low capacity for innovation in less developed Baltic Sea Regions (BSR) through mutual learning, translating smart specialisation strategies (S3) into practical joint activities of small and medium enterprises (SMEs), and applying best practices used in better developed regions. The project is fully integrated with 3S and aims at promoting efficient co-operation between the industrial sector, the R&D sector and the authorities, following a transnational approach. The obtained findings reveal a noticeable upward trend, as well as an interest on the part of various international projects, in making the accomplished results public via social media channels.

Keywords: GoSmart BSR, Interreg, project management.

References

- [1] Baccarella C. V., Wagner T. F., Kietzmann J. H., McCarthy I. P. *Social media? It's serious! Understanding the dark side of social media*. European Management Journal 2018, Vol. 36, pp. 431-438.
- [2] Borg E., Söderlund, J. *Liminality competence: an interpretative study of mobile project workers' conception of liminality at work*. Management Learning 2015, Vol. 46(3), pp. 260-279.
- [3] Buchnowska D. *Social CRM for customer knowledge management*. Contemporary Economy, Electronic Scientific Journal 2014, Vol. 5(4), pp. 65-80.
- [4] Carrillo P., Ruikar K., Fuller P. *When will we learn? Improving lessons learned practice in construction*. International Journal of Project Management 2013, Vol. 31(4), pp. 567-578.
- [5] Chaves M.S., Araújo C., Teixeira L.R., Glória Júnior I., Ros, D. Nogueira C.D. *A new approach to managing lessons learned in the PMBoK process groups: the Ballistic 2.0 Model*, International Journal of Information Systems and Project Management 2016, Vol. 4(1), pp. 27-45.
- [6] Geraldi J., Söderlund J. *Project studies and engaged scholarship*, International Journal of Managing Projects in Business 2016, Vol. 9(4), pp. 767-797.
- [7] Hardy B. W., Castonguay J. *The moderating role of age in the relationship between social media use and mental well-being: An analysis of the 2016 General Social Survey*, Computers in Human Behavior 2018, Vol. 85, pp. 282-290.
- [8] Seo Y., Primovic M.J., Jin Y. *Overcoming stakeholder social media fatigue: a dialogue approach*, Journal of Business Strategy 2019, Vol. 40(6), pp. 40-48.
- [9] Sutcliffe A.G., Binder J.F., Dunbar R. I. M. *Activity in social media and intimacy in social relationships*, Computers in Human Behavior 2018, Vol. 85, pp. 227-235.
- [10] Warner-Søderholm G., Bertsch A., Sawe E., Lee D., Wolfe T., Meyer J., Engel J., Fatilua U. N. *Who trusts social media?* Computers in Human Behavior 2018, Vol. 81, pp. 303-315.

Competences of innovation brokers – experiences of the GoSmart BSR project

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Abstract

The paper attempts to create a universal model of competences for international innovation brokers combining knowledge, skills and attitudes in the context of tasks aimed at internationalisation and development of innovation in SMEs. The article reviews the relevant literature, uses a bibliometric study identifying the brokers' attributes, innovation and competences using the VOSviewer tool, and presents qualitative research – a case study of the GoSmart BSR project. The paper resulted in a synthetic model of competences for international innovation brokers, taking a holistic approach to defining competences. The presented model is a synthesis of previous experiences with formulating competences for international innovation brokers. The elements of the model of competences and their components are equally significant for accelerating the internationalisation of SMEs and implementing innovations. This model is practical and universal, so it can be used in various organisations working towards the internationalisation and innovation of SMEs. Lessons learned from the GoSmart BSR project can be an inspiration to experiment and introduce new ideas and concepts. The identified competence elements can be considered universal and key in the work of an international innovation broker, but neither their list nor competence components are exhaustive. Therefore, the issues discussed in the article may form the basis for further research in this area.

Keywords: innovation brokers, internationalisation, GoSmart BSR project, competences.

References

- [1] Abraham S.E., Karns L.A., Shaw K., Mena M.A. *Managerial competencies and the managerial performance appraisal process*, Journal of Management Development 2001, Vol. 20, pp. 842-852.
- [2] Bhardwaj A., Punia B.K. *Managerial competencies and their influence on managerial performance: a literature review*, International Journal of Advanced Research in Management and Social Sciences 2013, Vol. 2(5), pp. 70-84.
- [3] Moczydłowska J.M., Serafin K. *Doskonalenie kompetencji zawodowych w profesjonalnie zarządzanej organizacji*, Katowice, Poland: Wydawnictwo Naukowe Sophia, 2016.
- [4] Mueller-Using S., Urban W., Wedemeier J. *Internationalization of SMEs in the Baltic Sea Region: Barriers of cross-national collaboration considering regional innovation strategies for smart specialization*, Growth and Change 2020, Vol. 51(4), pp. 1471-1490.
- [5] Prasanna R., Samarakoon J., Naradda Gamage S. K., Ekanayake E., Rajapakshe P., Abeyrathne G. *Sustainability of SMEs in the Competition: A Systemic Review on Technological Challenges and SME Performance*, Journal of Open Innovation: Technology, Market, and Complexity 2019, Vol. 5(100), pp. 1-18.
- [6] Szydło J., Grześ-Bukłaho J. *Relations between National and Organisational Culture - Case Study*, Sustainability 2020, Vol. 12(4), pp. 1-22.
- [7] van Eck N. J., Waltman L. *VOS: a new method for visualizing similarities between objects, studies in classification data analysis, and knowledge organization*, Berlin, Heidelberg, Germany: Springer, 2007.

Factors that Influence the Behavioral Intention to Use E-learning at University Level

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Abstract

The dynamic development of information and communication technologies (ICT) has brought significant changes in every aspect of social life, including education as well. The development of e-learning has provided an opportunity to meet the ever-growing needs of contemporary education by facilitating learning without time and space limitations. The outbreak and rapid spread of the coronavirus pandemic, further exposed the need to focus human activities towards ICT. According to UNESCO (2020), this decision affected 72.4% of learners from 177 countries. Ensuring the proper functioning and effectiveness of distance learning is a challenge for educational institutions and requires more complex and often different measures than in the case of traditional, stationary education. Regardless of the effort and commitment of educational institutions towards the popularization of new ICTs, the success of e-learning systems mainly depends on the level of acceptance and satisfaction of the final users. With the growing interest in e-education, particularly in the context of a pandemic situation, a greater number of studies have recently been undertaken to analyse and identify factors influencing the acceptance of e-learning tools. Identification of critical success factors in all stages of the e-learning technology adoption process seems to be an important element. The article aims to identify the factors and their interlinks that explain satisfaction and the future intention to use e-learning system by university students in Poland. Out of many factors analysed in the literature, the author examined the relationship between: facilitating conditions (FC), computer self-efficacy (CSE), satisfaction (S), and future intention to use of e-learning (FI). The selection of the studied variables for the model determining the future intention to use e-learning was based on the literature review on the application of technology acceptance models in relation to e-learning. The influence of two variables: facilitating conditions (FC), computer self-efficacy (CSE) on users' satisfaction from using e-learning tools and the influence of variable satisfaction (S) on future intention to use e-learning at university level (FI) were evaluated. The elaborated model made it possible to take into account, on the one hand, the internal factor reflecting the users' self-efficacy in using IT tools and, on the other hand, the external factor related to the expected external support of users by administration, IT staff.

Keywords: e-learning, future intention to use, acceptance model, self-efficacy, facilitation conditions

References

- [1] Baber H. Modelling the acceptance of e-learning during the pandemic of COVID-19-A study of South Korea. *The International Journal of Management Education* 2021, Vol. 19(2), pp. 100503-100503.
- [2] Duffin E. E-learning and digital education – Statistics & Facts, 2020, www.statista.com/topics/3115/e-learning-and-digital-education/ [Access: 1.03.2021].
- [3] Milićević V., Denić N., Milićević Z., Arsić L., Spasić-Stojković M., Petković D., Stojanović J., Krkić M., Milovančević N.S., Jovanović A. E-learning perspectives in higher education institutions. *Technological Forecasting and Social Change* 2021, Vol. 166, pp. 120618
- [4] The potential of Online Learning for adults: Early lessons from the COVID-19 crisis, OECD, 24 July 2020. www.oecd.org/coronavirus/policy-responses/the-potential-of-online-learning-for-adults-early-lessons-from-the-covid-19-crisis_ee040002/ [Access 06.04.2021].
- [5] Zardari B.A., Hussain Z., Arain A.A., Rizvi W.H., Vighio M.S. Development and Validation of User Experience-Based E-Learning Acceptance Model for Sustainable Higher Education. *Sustainability* 2021, Vol. 13, 6201.

Factors Influencing the Intention to Use Assistive Technologies by Older Adults

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Abstract

Society ageing is at an unprecedented pace worldwide making implications for the health and social care. Gerontechnology has been recognized as a solution to increase and support the independency and well-being of older adults at their home. The article aims to identify the success factors affecting the adoption of assistive gerontechnology by older adults. The object of the authors' interest was Robot Rudy – an AI-enabled mobile solution helping users remain physically healthy, mentally sharp, and socially connected. The data was collected among Polish citizens using the CATI technique reaching 824 returned questionnaires. The authors used Generalized Least Squares (GLS) of Structural Equation Modelling (GLS-SEM) to verify the hypotheses. The obtained results confirmed statistically significant relationships between the variables of perceived usefulness of Robot Rudy and attitude reflecting the willingness to use this technology, but also between perceived ease of use and perceived usefulness of robot. However, relationship between perceived ease of use and attitude to use this technology in future was not statistically significant. The conducted research confirmed that the functionality of the analysed Robot Rudy for older adults care positively influences their intention to use it in future for their own needs or by family members.

Keywords: assistive technologies, gerontechnology, technology acceptance model, robot; older adults.

References

- [1] Chu L., Chen H-W., Cheng P-Y., Ho P., Weng I-T., Yang P-L., Chien S-E., Tu Y-C., Yang C-C, Wang T-M., Fung H.H. Yeh S-L. *Identifying Features that Enhance Older Adults' Acceptance of Robots: A Mixed Methods Study*, Gerontology 2019, Vol. 65, pp. 441-450.
- [2] Davis F.D. *Perceived usefulness, perceived ease of use, and user acceptance of information technology*, MIS Quarterly 1989, Vol.3(3), pp. 319-334.
- [3] Halicka K., Kacprzak D., *Linear ordering of selected gerontechnologies using selected MCGDM methods*, Technol. Econ. Dev. Econ. 2021, Vol. 27(4), pp. 921-947.
- [4] Ke C., Lou V.W.Q., Tan K.C.K., Wai M.Y. and Chan L.L. *Changes in technology acceptance among older people with dementia: the role of social robot engagement*, Int. J. Med. Inform. 2020, Vol. 141, 104241.
- [5] Ma Q., Chan A-H.S. and Teh, P-L. *Insights into Older Adults' Technology Acceptance through Meta-Analysis*, Int. J. Hum.-Comput. Interact. 2021, Vol. 37(11), pp. 1049-1062.
- [6] Naneva S., Sarda Gou M., Webb T.L. Prescott T.J. *A Systematic Review of Attitudes, Anxiety, Acceptance, and Trust Towards Social Robots*, Int. J. Soc. Robot. 2020, Vol. 12, pp. 179-1201.
- [7] Rossi S., Conti D., Garramone F., Santangelo G., Staffa M., Varrasi S., Di Nuovo A. *The Role of Personality Factors and Empathy in the Acceptance and Performance of a Social Robot for Psychometric Evaluations*, Robotics 2020, Vol. 9(2), pp. 39.
- [8] Tsai H-Y-S., Rikard R.V., Cotten S.R. and Shillair R. (2019), *Senior technology exploration, learning, and acceptance (STELA) model: from exploration to use – a longitudinal randomized controlled trial*, Educ. Gerontol. 2019, Vol. 45(12), pp. 728-743.
- [9] Wu Y.H., Wrobel J., Cornuet M., Kerhervé H., Damnée S. and Rigaud A.S. *Acceptance of an assistive robot in older adults: A mixed-method study of human-robot interaction over a 1-month period in the living lab setting*. Clin. Interv. Aging 2014, Vol. 9, pp. 801-811.
- [10] Zhou J., Zhang B., Tan R., Tseng M.-L. and Zhang Y. *Exploring the Systematic Attributes Influencing Gerontechnology Adoption for Elderly Users Using a Meta-Analysis*. Sustainability 2020, Vol. 2, 2864.

Investigating the Readiness Towards Practicing Dispute Avoidance Strategies in Sri Lankan Construction Industry

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Abstract

Disputes become pertinent issue in the construction industry and often affect budget, time and quality of the projects. Disputes may end up with serious failures such as abandonment of project and bankruptcy of contractor. This encourages the construction industry to step towards dispute prevention which could begin at the early stage of a project. Therefore, this research investigates the readiness of Sri Lankan construction industry to adopt dispute avoidance strategies. A questionnaire survey was completed by seventy-eight professionals who were involved in construction disputes, recruited using the snowball sampling technique. The relative importance index was calculated to identify the dispute avoidance strategies in Sri Lanka. The literature review identified 31 strategies that were further evaluated in the questionnaire survey. The research revealed that strategies such as provision for dispute resolution and use of standard forms of contract are practiced highly in Sri Lankan construction projects. Most of the strategies (28) are found to be practiced at medium level. Therefore, the research suggests construction professionals to improve their skills in adopting measures for proactive ways to avoid disputes beforehand.

Keywords: disputes, avoidance, strategies, readiness, Sri Lanka.

References.

- [1] Allen M. *Global construction disputes*; ARCADIS, USA, 2014.
- [2] Ashworth A. *Contractual procedures in the construction industry* (5th ed.); Person Education Ltd., England, 2007.
- [3] Cakmak E., Cakmak P.I. *An analysis of causes of disputes in the construction industry using analytical network process*. Social and Behavioral Sciences 2014, Vol. 109, pp. 183-187.
- [4] Farooqui R.U., Azhar S. *Key Causes of Disputes in the Pakistani Construction Industry- Assessment of Trends from the Viewpoint of Contractors*. 50th ASC Annual International Conference Proceedings. Pakistan: Associated Schools of Construction, 2014.
- [5] Gerber P.A. *Dispute Avoidance Procedures ("DAPs") – The changing face of construction dispute management*. International Construction Law Review 2001, Vol. (1), pp. 123-129.
- [6] Hasanzadeh S.M., Hosseinalipour M., Hafezi M. *Collaborative procurement in construction projects performance measures, Case Study: Partnering in Iranian construction industry*. Social and Behavioral Sciences 2014, Vol. 119, pp. 811-818.
- [7] Jannadia M.O., Assaf S., Bubshait A.A., Naji A. *Contractual methods for dispute avoidance and resolution (DAR)*. International Journal of Project Management 2000, Vol. 18, Vol. 41-49.
- [8] Love P., Davis P., Jefferies M., Ward P., Chesworth B. *Dispute Avoidance and Resolution. Australia: Cooperative Research Centre for Construction Innovation*. CRC for Construction Innovation Rep, 1., 2007.
- [9] McGeorge D. *Dispute Avoidance and Resolution; A literature review*; Icon.Net Pty Ltd, Brisbane, 2004.
- [10] Ng H.S., Pena-mora F., Tamaki T. *Dynamic conflict management in large-scale design and construction projects*. Journal of Management in Engineering 2007, Vol. 23(2), pp. 252-266.

Sustainable Printing 4.0 – Insights from the Survey in Poland

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Abstract

The transformation trend towards digital technology to achieve sustainability targets and meet legal regulations has been visible in many industries. The printing sector has already been increasingly boosting sustainability performance through digitalization to automate workflows of processes. The goal of this paper is to initially diagnose a sustainable performance of Printing 4.0 (Industry 4.0 in the printing sector). To achieve this goal, qualitative interviews were carried out with representatives of eleven printing companies. Results of the diagnostic study demonstrated that advanced technologies have a positive impact on sustainability in the analysed printing companies due to the higher awareness of sustainability. It has been observed in the surveyed sample that interviewees confirmed such an assumption. These companies which tailor their operational activities toward digitalization, have more quickly noticed a positive effect on their sustainable businesses. This survey has served as a basis for more extensive research.

Keywords: Industry 4.0, digital technology, sustainable development, sustainability, sustainable printing, printing sector, interviews.

References

- [1] Baldwin Industry 4.0 for Printing, Packaging, Converting | Baldwin Technology Company. Available online: <https://baldwintech.com/industrial-iiot-for-printing-and-packaging> (accessed on 29 June 2021).
- [2] Baykina R.N., Lisovsky A.L., Yussuf A.A. Assessment of a Sustainable Development Potential of Printing Companies in the Digital Economy Environment, Inclusive Development of Society: Proceedings of the 6th International Conference on Management and Technology in Knowledge, Service, Tourism & Hospitality (SERVE 2018), Kuta, Bali, Indonesia, 6-7.10.2018; Ford Lumban Gaol; N. Filimonova, I. Frolova, Ignatova T. Vladimirovna, Eds.; CRC Press: Boca Raton, Florida, United States, 2020; pp. 22-26.
- [3] Calabrese A., Ghiron N.L., Tiburzi L. 'Evolutions' and 'Revolutions' in Manufacturers' Implementation of Industry 4.0: A Literature Review, a Multiple Case Study, and a Conceptual Framework. *Prod. Plan. Control.* 2021, Vol. 32, pp. 213-227.
- [4] Canon Industry 4.0: The Smart Print Factory. Available online: <https://pps.csa.canon.com/newsletter-article/book-printers-publishers/2018-12-01-000000/industry-40-smart-print-factory2018-12> (accessed on 29 June 2021).
- [5] Ejsmont K., Gladysz B., Kluczek A. *Impact of Industry 4.0 on Sustainability – Bibliometric Literature Review.* *Sustainability* 2020, Vol. 12, p. 5650.
- [6] FESPA Industry 4.0 Is Starting to Happen. Available online: <https://www.fespa.com/en/news-media/features/industry-4-0-is-starting-to-happen> (accessed on 29 June 2021).
- [7] Packaging Europe Print and Labelling: Focus on Industry 4.0 – Packaging Europe. Available online: <https://packagingeurope.com/print-and-labelling-focus-on-industry-4-0/> (accessed on 29 June 2021).
- [8] van Erp T., Obenaus M., Kunz S., Kohl H. *Industry 4.0 as Enabler for a Sustainable Development: A Qualitative Assessment of Its Ecological and Social Potential.* *Process Saf. Environ. Prot.* 2018, Vol. 118, pp. 254-267.

Directions of Mobility Improvement in Remote Areas Attractive to Tourists

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Abstract

This paper addresses the problem of transportation systems in remote areas, defined by a set of constraints deriving from sparse population, infrequent location of transportation means stops and cost-effectiveness of the system. Remote areas attractive to tourists additionally require transportation services designed with respect to changeable demand and necessity to provide transportation solutions limiting detrimental influence on environment. The outcomes of a Delphi method investigation pointing to the future of mobility in such areas conducted with experts representing universities and local government institutions from seven EU member states, Norway and Russia (participants of the project „MARA – Mobility and Accessibility in Rural Areas – New approaches for developing mobility concepts in remote areas”, implemented under the Programme Interreg Baltic Sea Region 2014-2020) are discussed. The experts evaluated and discussed the relevance of theses on the future of mobility in remote areas and assessed factors favouring or hindering the implementation of the theses and indicated time perspectives for their implementation. The selected aspects include: potential changes in travel preferences as a consequence of the Covid-19 pandemic, transport solutions adapted to older people with reduced mobility, the introduction of integrated intermodal systems, the use of electric or hydrogen-powered vehicles, or the improvement of transport infrastructure development through public policies intensifying cooperation between authorities at local, regional and national level in transport planning. The outcomes of the study comprise a contribution to a vibrant field of innovative transport solutions in line with sustainable development as well as a source of knowledge for bodies responsible for transport planning.

Keywords: mobility solutions, remote areas, transport system, sustainable transport, Delphi method.

References

- [1] Broderick A. *The Future of Rural Transportation and Mobility for Older Adults*, CITRIS and the Banatao Institute and Grantmakers In Aging (GIA), 2018.
- [2] Bruzzone F., Scorrano M., Nocer S. *The combination of e-bike-sharing and demand-responsive transport systems in rural areas: A case study of Velenje*, Research in Transportation Business & Management, in press.
- [3] Caroll P., Benevenuto R. Caulfield B. *Identifying hotspots of transport disadvantage and car dependency in rural Ireland*, Transport Policy 2021, Vol. 101, pp. 46-56.
- [4] Daganzo C., Ouyang Y. *A general model of demand-responsive transportation services: From taxi to ridesharing to dial-a-ride*, Transportation Research Part B 2019, Vol. 126, pp 213-224.
- [5] Mouncea R., Beecroft M., Nelson J.D. *On the role of frameworks and smart mobility in addressing the rural mobility problem*, Research in Transportation Economics 2020, Vol. 83, 100956.
- [6] Porru S., Misso F. E., Pani F. E., Repetto C. *Smart mobility and public transport: Opportunities and challenges in rural and urban areas*, Journal of Traffic and transport Engineering 2020, Vol. 7(1), pp. 88-97.
- [7] Schlüter J., Bossert A., Rössy F., Kersting M. *Impact assessment of autonomous demand responsive transport as a link between urban and rural areas*, Research in Transportation Business & Management, in press.
- [8] Sörensen L., Bossert A., Jokinen J.-P., Schlüter J. *How much flexibility does rural public transport need? Implications from a fully flexible DRT system*, Transport Policy 2021, Vol. 100, pp. 5-20.

Futures – Future Laboratories for Professional and Personal Development

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Abstract

The current global pandemic highlights precisely the importance of futures thinking, developing foresight and preparedness, but also an ability to embrace emergence, adapting to unforeseen circumstances that might impact participants' professional lives. The aim of the article is to present an European project entitled *Future laboratories for professional and personal development – FUTURES*. In particular, the project underlines the need to develop skills of young people, for anticipating and promptly reacting to scenario changes, and imagining professional career paths. A key theoretical and practical contribution of the project is the transfer of foresight to the individual level. The project aims to develop the innovative, future-oriented processes, tools, and methods that will foster personal and professional development among European university students, early stage researchers and high school students, including also those that aspire to enrol in University.

Keywords: foresight, Futures project, Futures Literacy, individual foresight.

References

- [1] Baškarada S., Shrimpton D., Ng S. Learning through foresight. *Foresight* 2016, Vol. 18(4), pp. 414-433.
- [2] Bell W. *The purposes of futures studies*. *The Futurist* 1997, Vol. 31(6), pp. 42-45.
- [3] Ejdys J., Gudanowska A., Halicka K., Kononiuk A., Magruk A., Nazarko J., Nazarko Ł., Szpilko D., Widelska U. *Foresight in Higher Education Institutions: Evidence from Poland*. *Foresight and STI Governance* 2019, Vol. 13(1), pp. 77-89.
- [4] Gheorghiu R., Andreescu L., Curaj A. *A foresight toolkit for smart specialization and entrepreneurial discovery*. *Futures* 2016, Vol. 80, pp. 33-44.
- [5] Kaivo-oja J.R.L., Lauraeus I.T. *The VUCA approach as a solution concept to corporate foresight challenges and global technological disruption*. *Foresight* 2018, Vol. 20(1), pp. 27-49
- [6] Kononiuk A., Pająk A., Gudanowska A., Magruk A., Rollnik-Sadowska E., Sacio-Szymańska A. *Foresight for Career Development*. *Foresight and STI Governance* 2020, Vol. 14(2), pp. 88-104.
- [7] Suleiman A., Abahre J. *Essential competencies for engineers from the perspective of fresh graduates*. *Engineering Management in Production and Services* 2020, Vol. 12(1), pp. 70-79.
- [8] Thomassen M.L., Middleton K.W., Ramsgaard M.B., Neergaard H., Warren L. *Conceptualizing context in entrepreneurship education: A literature review*. *International Journal of Entrepreneurial Behavior & Research* 2019, Vol. 26(5), pp. 863-886.

Digital twin technology in research and literature

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Abstract

Aiming to ensure current market needs, manufacturing companies search for tools and methodologies that would help them deliver their products efficiently, cost-effectively and enable them to become a part of Industry 4.0. Digital twins are a technology created based on the idea of the Fourth Industrial Revolution. The solution helps recreate physical devices in virtual space based on gathered data. It supports performance tests, configuration changes, and predictive maintenance without engaging existing machines. The research focused on market awareness of the described technology. It also examined how companies use employee suggestions to improve their organisations and the factors that influence process efficiency. The methods used for the research were literature review and cross-sectional survey, conducted with 50 employees of manufacturing and IT companies. The research showed the need to implement digital twins in enterprises. Half of the survey respondents replied that the technology would help improve the efficiency of the company's processes. The main benefit of the conducted research is identified awareness of the technology among industry representatives. In the future, the research will be extended to include the analysis of specific cases affecting the implementation of digital twins in enterprises.

Key words: Industry 4.0, digital twin, cyber-physical system, Internet of Things

References

- [1] Armendia M., Cugnon F., Berglind L., Oztruk E., Gil G., Selemi J. *Evaluation of Machine Tool Digital Twin for machining operations in industrial environment*, Procedia CIRP 2019, Vol. 82, pp. 231-236.
- [2] Barni A., Pietrarroia D., Züst S., West S., Stoll, O. *Digital Twin Based Optimization of a Manufacturing Execution System to Handle High Degrees of Customer Specifications*, Journal of Manufacturing and Materials Processing 2020, Vol. 4(4), p. 109.
- [3] Gudanowska, A.E. *A map of current research trends within technology management in the light of selected literature*, Management and Production Engineering Review 2017, Vol. 8(1), pp. 78-88.
- [4] Halicka K. (2016). *Innovative Classification of Methods of The Future-Oriented Technology Analysis*, Technological and Economic Development of Economy 2016, Vol. 22(4), pp. 574–597.
- [5] Kritzinger W., Karner M., Traar G., Henjes J., Sihm W. *Digital Twin in manufacturing: A categorical literature review*, IFAC PapersOnLine 2018, Vol. 51(11), 1016-1022.
- [6] Mi S., Fenga Y., Hao Zheng H., Wang Y., Gao Y., Tan J. *Prediction maintenance integrated decision-making approach supported by digital twin-driven cooperative awareness and interconnection framework*, Journal of Manufacturing Systems 2020, Vol. 58(B), pp. 329-345.
- [7] Yuik C. J., Perumal P.A., Feng C.J. (2020). *Exploring critical success factors for the implementation of lean manufacturing in machinery and equipment SMEs*, Engineering Management in Production and Services, 12(4), 77-91, doi:10.2478/emj-2020-0029.

Agile and Hybrid Management Methodologies in R&D Projects

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Abstract

The changing market conditions affect enterprises and scientific entities with increasing challenges related to the production of innovative products and services. An inseparable element of creating innovations is research and development activity (R&D). It includes several activities aimed at generating new knowledge and defining new applications for existing scientific achievements. It concerns both technical and management knowledge as well as knowledge about humankind, culture, and society. To fully exploit the opportunities arising from this process, it is necessary to introduce appropriate project management methodologies. The main objective of the conducted research was to identify, evaluate and develop the author's classification of methodologies used to manage research and development projects. Additionally, this study aimed to gain knowledge on the possibilities of using agile and hybrid methodologies in R&D projects and project areas where they can be implemented. The research took into account the nature of the work carried out (theoretical and empirical), the level of use of the methodology among representatives of science and industry and the factors that may limit the use of agile approaches in projects. Among the research methods used were surveys targeting project team members and academics, descriptive statistics methods, classification trees, and a literature review. The research demonstrated that the applicability of agile and hybrid approaches in research project management could provide benefits and increased flexibility in project delivery while minimizing the risk of project failure.

Keywords: research management, project management, agile.

References

- [1] OECD Frascati Manual. *Guidelines for Collecting and Reporting Data on Research and Experimental Development, The Measurement of Scientific, Technological and Innovation Activities*; OECD publishing, Paris, 2015.
- [2] Senabre Hidalgo E. *Management of a Multidisciplinary Research Project: A Case Study on Adopting Agile Methods*, Journal of Research Practice Journal of Research Practice 2018, Vol. 14(1), p. 1.
- [3] Senabre Hidalgo E. *Adapting the scrum framework for agile project management in science: case study of a distributed research initiative*, Heliyon 2019, Vol. 5(3), p. e01447.
- [4] Stare A. *Agile Project Management in Product Development Projects*, Procedia – Social and Behavioral Sciences 2014, Vol. 119, pp. 295-304.
- [5] Spundak M. *Mixed agile/traditional project management methodology – reality or illusion?* Procedia – Social and Behavioral Sciences 2014, Vol. 119, pp. 939-948.

Carbon Footprint Analysis Through an Input-Output Table for Construction Activities of Sri Lanka

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Abstract

The construction industry is one of the major contributors that emits carbon into the environment. However, there seems to be less focus on carbon emission studies in the Sri Lankan construction industry. Hence, this study aims to calculate the carbon footprint in the Sri Lankan construction industry through the input-output tables (IOTs) with a bottom-up approach and thereby propose strategies to minimise carbon emission. The required data were extracted through the government documentaries to carbon footprint calculations and questionnaires were presented to the forty-four experts who have sound knowledge about the carbon footprint to identify the effective strategies to minimise the carbon emission. The study concludes that cement-based activities (50%) and road and railways sector (40%) are the highest carbon emission activities and sector, respectively through Inter sector IOTs. Industry-by-industry IOTs exhibits that over 20 million tons of carbon dioxide emissions take place due to construction sector activities in the Sri Lankan construction industry. Finally, the study recommends the use of environmentally friendly energy technologies, education and training, and the adaptive re-use, recycle, and leasing of components as the most suitable carbon emission minimisation strategies that can be used in the Sri Lankan construction industry.

Keywords: carbon footprint, construction activities, input-output table, minimization strategies, Sri Lanka.

References

- [1] Klufallah M.M., Nuruddin M.F., Khamidi M.F., Jamaludin N. Assessment of Carbon Emission Reduction for Buildings Projects in Malaysia-A Comparative Analysis, 3S Web of Conferences, Vol. 3, no. 106, pp. 1-8, 2014.
- [2] Hertwich E.G., Peters G.P. *Carbon footprint of nations: A global, trade-linked analysis*, Environmental Science and Technology 2009, Vol. 43(16), p. 6414-6420.
- [3] Wiedmann T., Minx J. *A definition of "carbon footprint" - Chapter 1*. In Ecological Economics Research Trends; Pertsova C.C. Ed., Nova Publishers, New York, USA, 2008, p. 1-11.
- [4] Ding G. *Sustainable construction – The role of environmental assessment tools*, Journal of Environmental Management 2008, Vol. 86(3), pp. 451-464.
- [5] Finkbeiner M., *Carbon Footprinting Opportunities and Threats*, The International Journal of Life Cycle Assessment 2009, Vol. 14(2), pp. 91-94.
- [6] Huang Y.A., Lenzen M., Weber C.L., Murray J., Matthews H.S. *The Role Of Input-Output Analysis For The Screening Of Corporate Carbon Footprints*, Economic Systems Research 2009, Vol. 21(3), p. 217-242.
- [7] Lenzen M., Murray S.A. "A modified ecological footprint method and its application to Australia," Ecological Economics 2001, Vol. 37(2), p. 229-255.
- [8] Chan A.P., Chan A.P. *Key performance indicators for measuring construction success. Benchmarking*, An International Journal 2004, Vol. 11, no. 12, p. 203-221, 2004.

Strategic Innovation, Foresight and the Deployment of Project Portfolio Management under Mid-Range Planning Conditions in Medium-Sized Firms

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Abstract

The implementation of strategic innovation requires organizations to develop both a dynamic culture and flexible internal systems that yield to major external changes in their industry. Such changes could include supply – or value-chain adjustments, changes in consumer behaviour or the responses of competitors. This paper examines the planning and deployment of project portfolio management tools in organizations with a mid-range planning horizon who are required to innovate in a strategic context. It relates strategic foresight to the ability of the firm to adjust tactically including in the utilization and development of internal tools, processes, systems and culture. The paper further reviews project portfolio management models, the influence of organizational maturity and maintaining a balance between the utilization of organizational assets and the benefits achieved from this strategic agility. It argues that strategic innovation is closely tied with the ability not just to innovate, but to absorb this innovation within the organizational processes.

Keywords: strategic innovation, project portfolio management, organizational assets.

References

- [1] Baškarada S., Koronios A. *The 5S organizational agility framework: a dynamic capabilities perspective*. International Journal of Organizational Analysis 2018, Vol. 26(2), pp. 331-342.
- [2] Walter A.T. *Organizational agility: ill-defined and somewhat confusing? A systematic literature review and conceptualization*. Management Review Quarterly 2021; Vol. 71(2), pp. 343-391.
- [3] Burt G., Nair A.K. *Rigidities of imagination in scenario planning: Strategic foresight through 'Unlearning'*. Technological Forecasting and Social Change 2020, Vol. 153, p. 119927.
- [4] Baker D. *Complexity in the future: Far-from-equilibrium systems and strategic Foresight*. In The 21st century singularity and global futures. A Big History Perspective; Korotayev A., Snooks G., Lepoire D., T. Modis Eds.; Springer, Cham, Switzerland, 2020, pp. 397-417.

Gerontechnology – New Opportunities in the Service of the Elderly

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Abstract

Along with the increasingly visible trend of an ageing society, there is a need to create technologies supporting the functioning of the elderly. Therefore, more and more gerontechnologies are emerging that are designed to help the elderly in their daily functioning. The variety of technologies is large, from devices monitoring the health of an elderly person, through special trolleys improving the mobility of a senior, ending with special Virtual Reality devices, thanks to which an elderly person can actively learn. This article focuses on the analysis of which group of gerontechnologies is most desired by current and future users. Much attention was paid to individual assessments of the most desirable group of gerontechnologies in terms of various criteria. It was also important to investigate for which criterion the selected group of gerontechnologies was rated the highest. The authors distinguished 7 groups of criteria against which the gerontechnology group was assessed: technologies innovation, technology demand, social and ethical criteria, technology usability, technology functionality, technology ease of use and technology use risk. The survey was conducted in the form of a questionnaire, using the CAWI (Computer-Assisted Web Interview) and CATI (Computer-Assisted Telephone Interview) methods, and the research sample size was 1,152 people who were residents of Poland. It is worth adding that so far no studies have been conducted to evaluate this group of technologies in terms of the above-mentioned criteria.

Keywords: gerontechnology, technology, health; analysis, elderly.

References

- [1] Bixter M.T., Blocker K.A., Mitzner T.L., Prakash A, Rogers W.A. *Understanding the use and non-use of social communication technologies by older adults: A qualitative test and extension of the UTAUT model*, Gerontechnology 2019; Vol. 18(2), pp. 70-88.
- [2] Ejdys J. *Building technology trust in ICT application at a University*, IJoEM. 2018; Vol. 13(5), pp. 980-997.
- [3] Ejdys J., Halicka K. *Sustainable Adaptation of New Technology – The Case of Humanoids Used for the Care of Older Adults*, Sustainability 2018; Vol. 10, pp. 1-24.
- [4] Halicka K, Surel D. *Evaluation and Selection of Technologies Improving the Quality of Life of Older People*, Eur. Res. Stud. J. 2020; Vol. 23(2), pp. 592-611.
- [5] Hsu Y., Li Bai D. *The Future of Gerontechnology: Proposals from the new editor-in-chief*. Gerontechnology 2016; Vol. 15(3), pp. 125-129.
- [6] Nap H.H., Diaz-Orueta U., González M.F., Lozar-Manfreda K., Facal D., Dolničar V., Oyarzun D., Ranga M.M., de Schutter B. *Older people's perceptions and experiences of a digital learning game*. Gerontechnology 2014; Vol. 13(3), pp. 322-331.
- [7] Szpilko D. *Foresight as a tool for the planning and implementation of visions for smart city development*. Energies 2020; Vol. 13(7), 1782.

Smart City in the Context of Aging Society

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Abstract

The smart city concept consists of six dimensions: smart economy, smart mobility, smart environment, smart governance, smart living, and smart people. An important dimension of smart city in the context of an aging society is the dimension of smart living because the measure of smart living includes living conditions (health, safety, and housing). In the current perception of the smart city concept, there is a return to the needs and preferences of residents. They are at the centre of attention and technology is designed to pursue their interests. In the context of the emerging society, the development of gerontechnology is very important in the development of smart city. Therefore, it can be shown that gerontechnology is a technology that will meet the needs of city dwellers (aging society). The article aims to show the connection between smart city and technologies designed to support the functioning of older people on the basis of selected technologies.

Keywords: gerontechnology, smart city, ageing society, technology, smart living, older people.

References

- [1] Bibri S.E.; Krogstie J. *Smart Sustainable Cities of the Future: An Extensive Interdisciplinary Literature Review*. Sustain. Cities Soc 2017, Vol. 31, p. 184.
- [2] Winkowska J., Szpilko D., Pejic S. *Smart city concept in the light of the literature review*. Eng. Manag. Prod. Serv 2019, Vol. 11(2), pp. 70-86.
- [3] Manville C., Cochrane G., Cave J., Millard J., Pederson J.K., Thaarup R.K., Liebe A., Wissner M., Massink R.; Kotterink B. *Mapping Smart Cities in the EU, Study*, Directorate General for Internal Policies, Policy Department A: Economic and Scientific Policy, European Parliament, Brussels, January 2014.
- [4] Rudewicz J. *Industry and Technologies in the Context of Implementing Smart City Concept*. Studies of the Industrial Geography Commission of the Polish Geographical Society 2019, Vol. 33(4), p. 199.
- [5] Ejdy J., Halicka K. *Sustainable adaptation of new technology – The case of humanoid robots used for the care of older adults*. Sustainability 2018, Vol. 10(10), 3770.
- [6] Stawasz D., Sikora-Fernandez D. *Zarządzanie w polskich miastach zgodnie z koncepcją smart city*, Wydawnictwo Placet, Warszawa, Poland, 2015.
- [7] Winkler B. *An Implementation of an Ultrasonic Indoor Tracking System Supporting the OSGi Architecture of the ICTA Lab*, Master's thesis, University of Florida, 2002.
- [8] Szpilko D. *Foresight as a Tool for the Planning and Implementation of Visions for Smart City Development*, Energies 2020, Vol. 13, 1782, p. 2.
- [9] Czupich M., Kola-Bezka M., Ignasiak-Szulc A. *Czynniki i bariery wdrażania koncepcji Smart City w Polsce*, Studia Ekonomiczne. Zeszyty Naukowe Uniwersytetu Ekonomicznego w Katowicach 2016, Vol. 276, p. 224.

Digital Transformation of Traditional Safety Shoes Manufacturer in Thailand: A Development of Production Tracking

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Abstract

There are many challenges of digital transformation toward Industry 4.0 in Thailand, especially for the traditional manufacturing firms that have been operating without using digital technologies. This paper presents a case study of safety shoes manufacturer, CPL Group Public Company Limited, adopting digital technologies to transform its production system that has been operating for 40 years. We explore how the company changed the organization's mindset to embrace digital transformation and how they adopt AI and IoT technologies for the productivity improvement. This research uses inductive case study research design by interviewing the executive level and participating in the project development of digital tracking using IoT sensor and image processing. The findings reveal the key practical practices and recommendations for digital transformation in manufacturing, strategies required for development, and preliminary results of IoT implementation in the production line.

Keywords: digital transformation, manufacturing, IoT.

References

- [1] Vogelsang K., Liere-Netheler K., Packmohr S., Hoppe U. *Success factors for fostering a digital transformation in manufacturing companies*. Journal of Enterprise Transformation. 2018, Vol. 8(1-2), pp. 121-142.
- [2] Jones M.D., Hutcheson S., Camba, J.D. *Past, present, and future barriers to digital transformation in manufacturing: A review*. Journal of Manufacturing Systems. 2021 (in press).
- [3] Mourtzis D., Vlachou E., Milas N.J P.C. *Industrial big data as a result of IoT adoption in manufacturing*. Procedia CIRP 2016, Vol. 55, pp. 290-295.
- [4] Ghobakhloo M., Iranmanesh M. *Digital transformation success under Industry 4.0: a strategic guideline for manufacturing SMEs*. Journal of Manufacturing Technology Management. 2021 (in press).
- [5] Doyle F., Cosgrove J. *Steps towards digitization of manufacturing in an SME environment*. Procedia Manufacturing, 2019, Vol. 38, pp. 540-547.
- [6] Stoldt J., Trapp TU., Toussaint S., Süße, M., Schlegel, A., Putz, M. *Planning for digitalisation in SMEs using tools of the digital factory*. Procedia CIRP 2018, Vol. 72, pp. 179-184.
- [7] Kutnjak A., Pihiri I., Furjan M.T. *Digital Transformation Case Studies Across Industries-Literature Review*. In 2019 42nd International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO), Opatija, Croatia, 20-24 May 2019; IEEE.

Optimization of Structural Parameters of the Industry by the Criterion of Product Innovation

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Abstract

The industrial sector of the Polish economy plays an important role in ensuring the socio-economic development of the country. The Polish industry accounts for 24.1 per cent the country's employed population and 25.1 interest of the GVA. The aim of the article is to model the structural parameters of the industrial sector of Polish economy according to the criterion of increasing the level of product innovation on the basis of a comprehensive assessment of the performance of Polish industry in the regional context. The author's method of estimating the industrial sector of the economy at the macro and meso levels on a set of indicators of investment, innovation and labor activity as well as profitability. Using the methods of correlation-regression analysis, the author's hypotheses about the impact of product innovation on employment and wages in industry were proved. To optimize the structure of the industrial sector of Polish economy, an economic-mathematical model was developed, which was solved by the method of linear programming. The target functionality of this model is the level of product innovation at which the gross average monthly wage of Polish industry workers will double (to the EU average). The results of the simulation, which were based on data from the Central Statistical Office of Poland, provide an analytical basis for selecting industrial policy benchmarks of Poland.

Keywords: industry, efficiency, product innovation, production, models, structure, optimization.

References

- [1] Czech A., Lewczuk J. *Taxonomic and Econometric Analysis of Road Transport Development in Poland – The Voivodship Approach*. Engineering Management in Production and Services 2016, Vol. 8(3), pp. 79-88.
- [2] Ishchuk S.O. *Rating of the regions of Ukraine by the level of competitive advantages of industry*. Economics and law 2018, Vol. 2(50), pp. 92-102.
- [3] Ishchuk S., Sozansky L., Pukała R. *Optimization of relationship between structural parameters of processing industry as a factor influencing its effectiveness*. Engineering Management in Production and Services 2020, Vol. 12(2), pp. 7-20.
- [4] Pla-Barber J., Villar C. *Governance and competitiveness in global value chains: A comparative study in the automobile and textile industries*. Economics and Business Review 2019, Vol. 5(19)(3), pp. 72-91.
- [5] Sozansky L. *Grouping of regions of Ukraine is after level of economic activity of industry*. Ternopil: National Economic University. Journal of European Economy 2017, Vol. 16(1), pp. 121-133. Retrieved from <http://jeej.tneu.edu.ua/index.php/enjee/article/viewFile/911/897>.
- [6] Sozansky L. *Indicators of activity and efficiency of the industry of Lviv region and Podkarpackie voivodship*. SocioEconomic Problems and the State 2018, Vol. 1(18), pp. 129-136. Retrieved March 16 from <http://sepd.tntu.edu.ua/images/stories/pdf/2018/18slyapv.pdf>.
- [7] Sozansky L. *Evaluation of the results of industry functioning in Ukraine and Poland*. Socio-economic problems of the modern period of Ukraine 2018, Vol. 1(129), pp. 28-32. Retrieved March 16 from http://nbuv.gov.ua/UJRN/sepspu_2018_1_7.

Socially Responsible Marketing as a Tool for Regulating Social and Labor Relations in Ukrainian Companies

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Abstract

The article studies the problems and prospects for the formation of the modern concept of socially responsible marketing in the companies of Ukraine, which should become not only a tool for achieving business goals, but also becomes an effective instrument of regulation of social and labour relations between employers and employees. It is proved that socially responsible marketing is the embodiment of the concept of corporate social responsibility. The basic social programs and conditions of successful implementation of the concept of socially responsible marketing in the company were identified. As a result of the study, it was proved that the company's activities, in favour of its own employees, also provide the above-mentioned competitive advantages and form the image and brand of the employer in the labour market. The formation of social and labour relations of a new type requires the development of appropriate management strategies. It was determined that for the successful implementation of the concept of socially responsible marketing in the companies of Ukraine, it is necessary to ensure its promotion, renting and PR. The use of modern marketing technologies in the management of the company and its human resources management is one of the important factors in ensuring the competitiveness of companies on domestic and international markets and at the same time a factor shaping the image of the business and employer.

Keywords: marketing, social responsibility, social marketing, socially responsible marketing, social and labour relations, concept, company.

References

- [1] Корнійчук Д. Навіщо бізнесу соціальний маркетинг. Available online: <https://biz.nv.ua/ukr/experts/navishcho-biznesu-sotsialnij-marketingh-2495706.html>.
- [2] Kotler P., Zaltman G. *Social Marketing: An Approach to Planned Social Change* Journal of Marketing 1971, Vol. 35(3), pp. 3-12.
- [3] Freeman R.E. *A stakeholder theory of the modern corporation*. In *The corporation and its stakeholders*. University of Toronto Press, Toronto, Canada, 2016, pp. 125-138.
- [4] Carroll A.B. *The pyramid of corporate social responsibility: Toward the moral management of organizational stakeholders*. Business horizons 1991, Vol. 34(4), pp. 39-48.
- [5] Lantos G. *The Ethicality of Altruistic Corporate Social Responsibility*. Journal of Consumer Marketing 2002.
- [6] Горохова Т. Розвиток соціально відповідального маркетингу. Чому компаніям слід просувати себе відповідально? Available online: <http://iqholding.com.ua/articles/rosvitok-sotsialno-vidpovidalnogo-marketingu-chomu-kompaniyam-slid-prosuvati-sebe-%C2%ABvidpov-0> (accessed June 18, 2021).
- [7] Козин Л.В. *Соціально-відповідальний маркетинг і корпоративна соціальна відповідальність: зв'язок концепцій*. Глобальні та національні проблеми економіки 2016, Vol. 9. Pp. 316-320.
- [8] Калініченко О.О. Соціально-відповідальний маркетинг. Available online: <http://eprints.zu.edu.ua/25621/1/selection%20%28%29.pdf>
- [9] Белова Т.Г., Гулька В.І. *Застосування концепції соціально відповідального маркетингу в діяльності підприємства*. Вчені записки ТНУ імені В.І. Вернадського. Серія Економіка і управління 2019, Vol. 2(30)(69). С. 81985.
- [10] Kotler P. *What Consumerism Means for Marketers*. Harvard Business Review 1972, Vol. 50. pp. 48-57.

Barriers to Implementation of Business Process Governance Mechanisms

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Abstract

The changing market circumstances, including digitalisation, striving for customisation of products and services causes an increase in interest of organisations in building a competitive advantage using a process approach to management. One of the main challenges in implementing process-oriented management in the organization is establishing a process governance mechanism. It creates a coherent framework for the execution, management and perception of business processes, which is the foundation of consistent Business Process Management (BPM) in the organization. Process governance (PG) refers to an organisation's ability to manage its relationships with all process stakeholders and support the value chain for their customers. Its implementation involves establishing process regulation mechanisms and stakeholder-oriented criteria to support prioritisation, cascading, and management of change within BPM initiatives. A review of the domain literature reveals that while process governance has been discussed from several but separated perspectives (strategy, business roles, performance, and maturity), there are only a few studies identifying and synthesizing the barriers to its implementation in organisations. The main aim of the paper is to identify and classify the key barriers to the implementation of process governance. The author's approach refers to the six core elements of BPM capability and process governance frameworks. Results of the research confirm the significant role of empowerment, clear division of responsibilities, communication as well as end-to-end process understanding and monitoring. The research contributes to the literature on management through the identification of potential barriers to business process governance that constrain BPM initiatives. The PG challenges identified can provide a basis for developing a theoretical framework of Business Process Management success factors.

Keywords: business process management, process governance, success factors, barriers.

References

- [1] Braganza A., Lambert R. *Strategic integration: Developing a process-governance framework*. Knowledge and Process Management 2000, Vol. 7(3), pp. 177-186.
- [2] Ensslin L., Ensslin S.R., Dutra A., Nunes, N.A., Reis C. *BPM governance: a literature analysis of performance evaluation*. Business Process Management Journal 2017, Vol. 23(1), pp. 71-86.
- [3] Jurczuk A. *Wieloaspektowa identyfikacja i typologia źródeł niespójności procesów biznesowych [Multiaspectual identification and typology of the sources of business process inconsistencies]*; Oficyna Wydawnicza Politechniki Białostockiej, Białystok, Poland, 2019.
- [4] Kerpedzhiev G.D., König U.M., Röglinger M., Rosemann M. An exploration into future business process management capabilities in view of digitalization. *Business & Information Systems Engineering* 2020, pp. 1-14.
- [5] Rosemann M., vom Brocke J. *The six core elements of business process management*. In Handbook on business process management 1; Springer, Berlin, Heidelberg, Germany, 2015; pp. 105-122.
- [6] Santana A.F.L., Alves C.F., Santos H.R. M., Felix A.D.L.C. *BPM governance: an exploratory study in public organizations*. In Enterprise, Business-Process and Information Systems Modeling; Springer, Berlin, Heidelberg, Germany, 2011; pp. 46-60.
- [7] Schmiedel T., Recker J., vom Brocke J. *The relation between BPM culture, BPM methods, and process performance: Evidence from quantitative field studies*. *Information & Management* 2020, Vol. 57(2).
- [8] Spanyi A. *Business process management governance*. In Handbook on business process management 2; Springer, Berlin, Heidelberg, Germany, 2010; pp. 223-238.
- [9] Valenc, G., Alves C.F., Santana A.F.L., de Oliveira J.A.P., Santos H.R.M. *Understanding The Adoption Of BPM Governance In Brazilian Public Sector*. ECIS 2013 Completed Research 2013, Vol. 56.

Resilient Manufacturing: Case Studies in Thai Automotive Industries during COVID-19 Pandemic

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Abstract

The coronavirus pandemic is the most globally disruptive and contributes to global economic slowdown. The automotive industry is one of the major sectors that accounts for approximately 12% of the overall GDP in Thailand. In March 2020, when the first full lockdown in Thailand was announced, the sales and the automotive production amount was affected significantly and continued for several months later. However, a few Thai companies quickly recover from the crisis, while supply chain partners were still struggling. The objective of this research is to identify the key factors that keep these firms resilient to the pandemic. We selected three outstanding tier 1 firms to conduct case studies. The CEOs and general managers were interviewed by using semi-structured questions. The thematic analysis was conducted to identify the patterns of resilient activities and key success factors. The results and detailed analysis are presented in the paper.

Keywords: COVID-19, manufacturing, Thailand, resilient.

References

- [1] Belhadi A., Kamble S., Chiappetta Jabbour C. J., Gunasekaran A., Oly Ndubisi N., Venkatesh M. *Manufacturing and Service Supply Chain Resilience to the COVID-19 Outbreak: Lessons Learned from the Automobile and Airline Industries*. Technological Forecasting and Social Change 2021, Vol. 163, 120447.
- [2] Cai M., Jianwen L. 2020. *Influence of COVID-19 on Manufacturing Industry and Corresponding Countermeasures from Supply Chain Perspective*. Journal of Shanghai Jiaotong University (Science) 2020, Vol. 25(4), pp. 409-416.
- [3] Wu H., Zhang Z., Li W. 2021. *Information Technology Solutions, Challenges, and Suggestions for Tackling the COVID-19 Pandemic*. International Journal of Information Management 2021, Vol. 57, 102287.
- [4] Ishida S. 2020. *Perspectives on Supply Chain Management in a Pandemic and the Post-COVID-19 Era*. IEEE Engineering Management Review 2020, Vol. 48(3), pp. 146-152.
- [5] Lai C.C., Shih T.P., Ko W.C., Tang H.J., Hsueh P.R. *Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and coronavirus disease-2019 (COVID-19): The epidemic and the challenges*. International Journal of Antimicrobial Agents 2020, Vol. 55(3), 105924.
- [6] Lombardi S., Pina e Cunha M., Giustiniano L. 2021. *Improvising Resilience: The Unfolding of Resilient Leadership in COVID-19 Times*. International Journal of Hospitality Management 2021, Vol. 95, 102904.
- [7] Margherita A., Heikkilä M. *Business Continuity in the COVID-19 Emergency: A Framework of Actions Undertaken by World-Leading Companies*. Business Horizons, 2021.
- [8] Mentzer, J.T. 2008. *Global Supply Chain Risk Management*. Journal of Business Logistics 2008, Vol. 29(1), pp. 133-55.
- [9] Narayanamurthy, G., Guilherme T. 2021. *Impact of COVID-19 Outbreak on Employee Performance – Moderating Role of Industry 4.0 Base Technologies*. International Journal of Production Economics 2021, Vol. 234, 108075.

The Impact of COVID-19 PANDEMIC on Logistic Firms and their Resilience: Case Studies in Thailand

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Abstract

The novel Coronavirus (COVID-19) is an infectious disease causing challenges and opportunities in all sectors around the world. Logistic Industry plays a huge role to keep the countries intact, in which it is accounted for 13.4% of the overall GDP in Thailand. The purpose for this article is to justify and identify key factors for the successes and failures in the Logistic Industries brought upon by the Pandemic. During March to July 2021, which is in Phase 4 of the Pandemic, we conducted our research by means of semi-structured interviews with the top-managements of three companies. Then we analysed our findings through the thematic analysis to understand the key factors within the industry. We selected logistic companies with different sizes to be used as our case studies to identify the resemblance of the effects within and see the relationship between the companies on their resilience. The results and finding analysis are presented in the paper.

Keywords: COVID-19, logistic Industry, business continuity plan, thematic analysis, Thailand, resilient, cross-comparison.

References

- [1] Malyika B., Marimuthua S., M. Joya, A. Nadarja, E. S. Asirvathamb, L. Keyaseelan. *Forecasting COVID-19 epidemic in India and high incidence states using SIR and Logistic growth*. Clinical Epidemiology and Global Health 2020, Vol. 9, pp 26-23.
- [2] Aviv-Sharon E., Aharoni A. *Generalized logistic growth modeling of the COVID-19 pandemic in Asia*. Infectious Disease Modelling 2020, Vol. 5, pp 502-509.
- [3] Maneenop S., Kotcharin S. *The impacts of COVID-19 on the global airline industry: An event study approach*. Journal of Air Transport Management 2020, Vol. 89, 101920.
- [4] Ivanov D. *Predicting the impacts of epidemic outbreaks on global supply chains: A simulation-based analysis on the coronavirus outbreak (COVID-19/SARS-CoV-2) case*. Transportation Research Part E: Logistics and Transportation Review 2020, Vol. 136, 101922.
- [5] Li Z.-F., Zhou Q., Chen M., Liu Q. *The impact of COVID-19 on industry-related characteristics and risk contagion*. Finance Research Letters 2021, Vol. 39, 101931.
- [6] Amankwah-Amoah J. *COVID-19 pandemic and innovation activities in the global airline industry: A review*. Environment International 2021, Vol. 156, 106719.
- [7] Wen W., Yang S., Zhou P., Gao S.Z. *Impacts of COVID-19 on the electric vehicle industry: Evidence from China*. Renewable and Sustainable Energy Reviews 2021, Vol. 144, 111024.
- [8] Sharma Deep G., Thomas A., Paul J. *Reviving tourism industry post-COVID-19: A resilience-based framework*. Tourism Management Perspectives 2021, Vol. 37, 100786.
- [9] Barman A., Das R., and Kanti P.D. *Impact of COVID-19 in food supply chain: Disruptions and recovery strategy*. Current Research in Behavioral Sciences 2021, Vol. 2, 100017.

Improving the Process of Strategic Planning in the Risk Management System

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Abstract

The development of market relations in Ukraine makes new demands on the quality level of enterprise management, the nature of the tasks to be solved, as well as the methods for their solution. This applies to some extent to all self-employed entities. A new management concept is needed that adequately reflects changes in the economy. Such a new concept for the Ukrainian economy is strategic management, the basis of which is strategic planning taking into account the increased risks. In modern enterprises, the process of short-term, operational planning is usually quite well established, but there is no clear plan for the strategic planning process. This results in the fact that the company does not have a clear strategy for further development. The situation is complicated by the increased uncertainty and variability of the external environment of the enterprise, which makes long-term planning impossible. Strategic planning is the main means of determining and developing the course of development of the enterprise in order to achieve its mission and goals in conditions of uncertainty and increased risk.

Keywords: strategy, mission, enterprise, strategic planning, risk, uncertainty, risk management system.

References

- [1] Kapustnyk S.K. 2016. Strategic, tactical and operational decisions: differences and correlations. Proceedings from Ukrainian scientific-practical conference of young scientists and students Development of the European space through the eyes of youth: economic, social and legal aspects Kharkiv: NTMT, pp. 3445-3450.
- [2] Cherkasova V.A. Batenkova A.A. *The Impact of strategic risks on financial results of the company*. Korporatyvnye Fynansy. – Corporate Finance 2007, Vol. 3, pp. 64-76.
- [3] Risk management Standard. Federation of European Risk Management Associations. Available online: <http://www.ferma.eu/app/uploads/2011/11/a-risk-management-standard-russian-version.pdf>
- [4] Hryshko V.V., Hunchenko M.V. *System analysis of risks in logistics activity of the industrial enterprise*. Naukovyj visnyk Mizhnarodnoho humanitarnoho universytetu. Serii: Ekonomika i menedzhment 2016, Vol. 17, pp. 54-58.
- [5] Smerichevskyy S.F. *Modern approach to managing risks of logistics systems of the engineering enterprises*. Prychornomors'ki ekonomichni studii 2016, Vol. 7, pp. 158-162.
- [6] Hunchenko M.V. *Formuvannia stratehii rozvytku diialnosti pidpriemstva v umovakh ryzyku*. Visnyk Odeskoho natsionalnoho universytetu. Serii: Ekonomika 2018, Vol. 5, pp. 60-65.
- [7] Komelina O., Hrynko O., Khrystenko O. *Stakeholder management in the development of building organizations*. International Journal of Engineering and Technology (UAE) 2018, Vol. 7(3), pp. 191-194.

Determinants of the Selection of Optimization Methods in Planning the Layout of Workstations

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Abstract

Production efficiency is highly dependent on the location of production equipment within the plant. The layout of the machines within the production line takes into account the optimal use of available space, time and cost of material flow, and production flexibility. There are many factors influencing the shape and operation of production lines, such as: number of shifts, batch size and their nature, types of transport and storage. The article presents a review of the existing methods of optimization of the production layout and identification of the determinants of the selection of production system optimization methods. The literature review as the main problems related to the design and operation of production lines indicates: the determination of the number of machines within the lines, the location of intermediate buffers and their size, and the layout of machines and workstations within the plant. Among the determinants of the selection of optimization methods for the deployment of workstations one can distinguish, among others, the type and characteristics of the production process, factors influencing the shape of the production line and the optimization criterion. However, the most important determinant is whether a new layout is designed or an existing one is changed.

Keywords: facility layout, production lines design, optimization method selection, production optimization methods, workplace planning.

References

- [1] Centobelli P., Cerchione R., Murino T., Gallo M. *Layout and material flow optimization in digital factory*. International Journal of Simulation Modelling 2016, Vol. 15(2), pp. 223-235.
- [2] Halicka K. *Innovative Classification of Methods of The Future-Oriented Technology Analysis*. Technological and Economic Development of Economy 2016, Vol. 22(4), pp. 574-597.
- [3] Halicka K. *Technology Selection Using the TOPSIS Method*. Foresight and STI Governance 2020, Vol. 14(1), pp. 85-96.
- [4] Kikolski M., Ko C. H. *Facility layout design—review of current research directions*. Engineering Management in Production and Services 2018, Vol. 10(3), pp. 70-79.
- [5] Matulja T., Hadjina M., Kolić D. *Shipyard Production Processes Re-Design Methodology Based on Expert Approach and Simulation Modeling*. Pomorski Zbornik 2016, Vol. 51(1), pp. 25-41.
- [6] Ojaghi Y., Khademi A., Yusof N.M., Renani N. G., bin Syed Hassan S.A.H. *Production layout optimization for small and medium scale food industry*. Procedia Cirp 2015, Vol. 26, pp. 247-251.
- [7] Yang S.L., Xu Z.G., Wang J.Y. *Modelling and production configuration optimization for an assembly shop*. International Journal of Simulation Modelling 2019, Vol. 18(2), pp. 366-377.
- [8] Zupan H., Herakovic N., Zerovnik J., Berlec T. *Layout optimization of a production cell*. International Journal of Simulation Modelling 2017, Vol. 16(4), pp. 603-616.

Application of Lean Ideas in Architectural Design

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Abstract

Design is the most critical stage in the project lifecycle. Improper design may not only lead to change orders, but also reduce constructability, therefore increasing project duration and costs. This study aims to enhance design correctness by applying lean production and concurrent design concepts through developing a Lean Concurrent Design Model. The concepts of concurrent design, building information models, and system dynamics are first explored. Lean production and concurrent design concepts are then used to develop the Lean Concurrent Design Model, in which Building Information Modeling (BIM) and Three-Dimension (3D) techniques are presented through the Industry Foundation Classes (IFC) protocol that allows for the sharing of design information. Finally, feasibility of the proposed design model is validated using system dynamics. Analysis results show that applying lean production and concurrent engineering in the design phase may reduce design errors and increase design reliability. *Keywords:* design correctness, lean construction, concurrent engineering, system dynamics.

References

- [1] Ali A., Seifoddini H., Lee J. 2010. *Efficient material allocations in high-mix low-Vol. manufacturing*. Journal of Advanced Manufacturing Systems 2010, Vol. 9(2), pp. 101-116.
- [2] Ballard, H. G. The Last Planner System of Production Control. Doctoral Dissertation, School of Civil Engineering, University of Birmingham, Birmingham, UK, 2000.
- [3] Chimay, J. A., Baugh, C., Khalfan, M. M. A. *Organisational structures to support concurrent engineering in construction*. Industrial Management & Data Systems 2002, Vol. 102(5), pp. 260-270.
- [4] Cooke-Davies, T. *The "real" success factors on projects*. International Journal of Project Management 2002, Vol. 20(3), pp. 185-190.
- [5] Ekenberg L., Johannesson P. *A framework for determining design correctness*. Knowledge-Based Systems 2004, Vol. 17, pp. 249-262.
- [6] Hunter S. L. *Lean production design: Parallel pull flow*. International Journal of Industrial Engineering: Theory Applications and Practice 2006, Vol. 13(3), pp. 254-259.
- [7] Ilozor B. D., Kelly D. J. *Building Information Modeling and Integrated Project Delivery in the Commercial Construction Industry: A Literature Review*. Journal of Engineering, Project, and Production Management 2012, Vol. 2(1), pp. 23-36.
- [8] Josephson, P. E., Larsson, B., Li, H. *Illustrative Benchmarking Rework and Rework Costs in Swedish Construction Industry*. Journal of Management in Engineering 2002, Vol. 18(2), pp. 76-83.
- [9] Knotten V., Lædre O., Hansen G. K. *Building design management-key success factors*. Architectural Engineering and Design Management 2017, Vol. 13(6), pp. 479-493.
- [10] Ko C. H., Wang W. C., Kuo J. D. *Improving Formwork Engineering Using the Toyota Way*. Journal of Engineering, Project, and Production Management 2011, Vol. 1(1), pp. 13-27.

Creative Management as a Factor in the Formation of Organizational Culture

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Abstract

This article is aimed at studying modern approaches to the formation and development of creative management as a factor in the formation of organizational culture in the enterprise. It systematizes and generalizes scientific approaches to the interpretation of the concept of modern creative management. The content, principles, goals, tasks of creative management of the enterprise for increase of its own creativity are defined. Internal and external prerequisites for the formation of creative management at the enterprise are established. It was found that creative management involves the transition to a new model of cost management, product quality assurance and certification, taking into account current national and international standards. It also revolves around the transition to an innovative model of enterprise development, the implementation of constant monitoring and evaluation of technical and technological base, to name but a few.

Keywords: enterprise, creative potential, creative management, organizational culture, principles, functions, tasks.

References

- [1] Svydruk I.I., Yu.I. Ossik, Prokopenko O.V. *Creative management: theoretical foundations: monograph*; Drukarnia Cyfrowa, Chorzów, Poland, 2017.
- [2] Kirsanov K. *Creative and heuristic management and inventive creativity*. Naukovedenie 2011, Vol. 4, pp. 21-35.
- [3] Lytvyn I.V. *Osoblyvosti poshuku innovatsiinykh idei u systemi kreatyvnoho menedzhmentu*. Nauk. visnyk NLTU Ukrainy 2011, Vol. 21(7), pp. 360-364.
- [4] Doroshenko O.S. Stanovlennia kreatyvnoho sektoru hlobalnoi ekonomiky: avtoref. dys. na zdobuttia nauk. stupenia kand. kon. Nauk : spets. 08.00.02 – svitove gospodarstvo i mizhnarodni ekonomichni vidnosyny; K. : KNEU im. V. Hetmana, 2014.
- [5] Kalinichenko Yu. B., Smirnova Ya. I. *Kreatyvnist yak osnova menedzhmentu orhanizatsii*. Marketynh i menedzhment innovatsii 2011. Vol. 4(II), pp. 186-191.
- [6] Komelina O.V. Modern principles of formation of innovative and creative model of economic development. Modern innovation and investment mechanisms of national economy development: abstracts of the international scientific-practical Internet conference, October 27, 2016. Part 1. Poltava, 2016. pp.17-20.
- [7] Bozhydarnik T.V. *Kreatyvnyi menedzhment : navch. Posibnyk*; Kherson: OLDI-PLIUS, 2014.
- [8] Vartanova O.V. Kreatyvnyi menedzhment yak pidgruntia rozvytku kreatyvnykh pratsivnykh pidprijemstva Available online: http://stvua.com/?wpfb_dl=18
- [9] Onyshchenko V.O., Redkin O.V., Komelina O.V., Tolkachov D.M. *Upravlinnia Proektamy. Teoriia i praktyka profesiinoho upravlin-nia biznes-proektamy ta prohramamy rozvytku*; Chastyna 2. Orhanizatsiia y upravlinnia protsesamy pidhotovky, rozroblennia ta planuvannia proektiv i prohram; PoltNTU, Poltava, Ukraine 2017.
- [10] Xu F., Rikards T. 2007. *Creative Management: A Predicted Development from Research into Creativity and Management*. Creativity and Innovation Management 2007. Vol. 3. pp. 216-228.
- [11] Torrance E.P. *Guiding Creative Talent*; Englewoodcliffs, Prentice-Hall, New York, USA, 1962.

The Impact of Foresight Maturity on Organisational Ambidexterity

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Abstract

In Western practice, organisational foresight has become an annual ritual for many future-oriented companies. The research field is still immature and dominated by exploratory research, most often based on case studies or expert opinion, used to create arbitrary categories to order empirical observations. As foresight implemented in the enterprise is still a new area of research, the apparent unavailability of empirically validated foresight constructs and measures may not be surprising. Such constructs and measures are arguably key to growth and progress in this area of research. The aim of the article is to present the influence of foresight maturity on organizational ambidexterity understood as the ability of an organisation to simultaneously exploit existing competencies and explore new opportunities. The application of structural modelling (SEM) made it possible to identify the constructs of foresight maturity and organisational ambidexterity as well as the indicators associated with them. The study covered 580 Polish industrial processing companies. The selection of the enterprises was motivated by the fact that they most often compete globally, experience changes of the technological environment and demonstrate a significant innovative potential. The key contribution of the article is the presentation of the empirical relationship between foresight maturity and organisational ambidexterity. It has also been demonstrated that the level of maturity depends on the size of the enterprise, its type, area of activity and the industry represented.

Keywords: foresight, foresight maturity, organizational foresight, SEM modelling, ambidexterity.

References

- [1] Andersen E.S., Jessen S.A. *Project maturity in organisations*. International Journal of Project Management 2003, Vol. 21(6), pp. 457-461.
- [2] Anzules-Falcones W., Diaz-Marquez A.M., Padilla L., Hernan-Hidalgo D., Sanchez-Grisales D. *Foresight for small and medium enterprises in the context of the Circular Economy*. Foresight and STI Governance 2021, Vol. 15(1), pp. 86-96.
- [3] Augier M., Teece D.J. *Dynamic Capabilities and the Role of Managers in Business Strategy and Economic Performance*. Organisation Science 2009, Vol. 20(2), pp. 410-421.
- [4] Edgeman R. *Strategic resistance for sustaining enterprise relevance: A paradigm for sustainable enterprise excellence, resilience and robustness*. International Journal of Productivity and Performance Management 2015, Vol. 64(3), pp. 318-333.
- [5] Højland J., Rohrbeck R. *The role of corporate foresight in exploring new markets – evidence from 3 case studies in the BOP markets*. Technology Analysis & Strategic Management 2018, Vol. 30(6), pp. 734-746.
- [6] Iden J., Methlie, L.B., Christensen G. E. *The nature of strategic foresight research: A systematic literature review*. Technological Forecasting and Social Change 2017, Vol. 116, pp. 87-97.
- [7] Nelson R., Winter S.G., *An evolutionary Theory of Economic Change*; Belknap Press, Cambridge, Massachusetts, USA, 1982.
- [8] Paliokate A., Pacesa N. *The relationship between organizational foresight and organizational ambidexterity*. Technological Forecasting and Social Change 2015, Vol. 101, pp. 165-181.
- [9] Weissenberger-Eibi M.A., Almeida A., Seus F. *A Systems Thinking Approach to Corporate Strategy. Development*. Systems 2019, Vol. 7(1), pp. 1-10.
- [10] Wind J., Mahajan V. *Issues and Opportunities in New Product Development: An Introduction to the Special Issue*. Journal of Marketing Research 1997, Vol. 34(1), pp.1-12.
- [11] Zakra S.A., Sapienza H., Davidsson P, *Entrepreneurship and Dynamic Capabilities: A Review, Model and Research Agenda*. Journal of Management Studies 2006, Vol. 43(4), pp. 917-955.
- [12] Zollo M., Winter S.G. *Deliberate Learning and the Evolution of Dynamic Capabilities*. Organization Science, 2002, Vol. 13(3), pp. 339-351.

The Application of the Modified SERVQUAL Model for the Diagnosis of the Educational Offerings in the Field of Career Guidance Training: Industry 4.0 Challenges

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Abstract

The importance of vocational guidance is growing, and the focus on modern tools enabling the development of competences such as flexibility, the ability to identify trends shaping the labour market and considering alternatives are natural consequences of the detected changes. The aim of the article is to present a comprehensive methodology (based on the SERVQUAL model) and the results of a nationwide survey focused on the disconfirmation between the ideal features of the courses offered and the perception of the courses completed by career guidance practitioners in Poland. The research methods used in the research process are: the literature review, bibliometric analysis and the analysis and logical construction method. To diagnose the educational offerings in the field of career guidance training, the authors applied a modified SERVQUAL model. The results of the analysis carried out allow us to conclude that the themes of the analysis of scientific and technological trends, such as automation, robotization, and digitization, are treated marginally within the framework of the education completed by the respondents. This demonstrates a major challenge for including this curriculum content in the area of vocational guidance. The modified SERVQUAL model developed by the authors of the study for the diagnosis of educational offerings in the field of vocational guidance can be used to evaluate the educational offerings in other countries.

Keywords: SERVQUAL model, educational offering, Industry 4.0, career guidance.

References

- [1] Engelland B.T, Workman L., Singh M. *Ensuring Service Quality for Campus Career Services Centres: A Modified SERVQUAL Scale*. Journal of Marketing Education 2000, Vol. 22 (3), pp. 236-245.
- [2] Gudanowska A. E. Ed., & Kononiuk, A. Ed. *Uwarunkowania ucyfrowienia procesów produkcji i wzrostu kompetencji cyfrowych społeczeństwa*; Oficyna Wydawnicza Politechniki Białostockiej, Białystok, Poland, 2020.
- [3] Pohyae S., Romle A.R., Darus M., Saleh N.H, Saleh S.S., Mohamood S.K.B. *The Relationship Between Service Quality and Student Satisfaction: The Case of International Students in Public University*. World Applied Sciences Journal 2016, Vol. 34 (4), pp. 491-498.
- [4] Seth N., Deshmukh S. G., Vrat. P. Service quality models: a review, International Journal of Quality & Reliability Management 2005, 22(9), 913-949.
- [5] Siderska J. Robotic Process Automation - a driver of digital transformation? Engineering Management in Production and Services 2020, 12(2), 21-31.
- [6] Tóth Z., Surman V. Listening to the voice of students - Development of a service quality measuring and evaluating framework in case of a special course. International Journal of Quality and Service Sciences 2019, 11(4), 455-472.
- [7] Wang Y.L., Tainyi L.U.O.R., Luarn P. Lu H.P. Contribution and Trend to Quality Research-a literature review of SERVQUAL model from 1998 to 2013. Informatica Economica 2015, 19(1), 34-45.
- [8] Wolniak R., Skotnicka-Zasadzień B. Wykorzystanie metody SERVQUAL do badania jakości usług w administracji samorządowej, Gliwice: Wydawnictwo Politechniki Śląskiej, 2009.
- [9] Xue L., Cho Y, He W., Yao L., Zou W. *Construction and application of the student satisfaction evaluation system for the extracurricular education services in colleges*. Computer Applications in Engineering Education, Special Issue 2020, Vol. 29(2), pp. 370-384.

Creation of the Mathematical Model Prototype to Optimize the Planning of Construction Site, Using BIM and Engineering Geological Cross Sections

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Abstract

Modern construction technologies strongly affect the environment. Taking this into consideration, design and building construction should also follow the principle of sustainable development. In this case, design and construction work based on the principle of sustainable development should be aimed at the creation of the safe and healthy living environment, the economic use of natural resources and the stimulation of economic development for creating the welfare of humans and favourable natural conditions. In the article, a mathematical algorithm is proposed as a comprehensive solution for the planning construction site - from calculation of earthworks till automated creation of engineering geological cross sections. The paper integrates mathematical modelling with BIM technology. The application of the building information model is undoubtedly one of the most advanced technologies used in the construction sector, whose advantages have been shown by researchers. At the preliminary stage of construction, the decisions, as well as the material and human resources, schedules and estimates, should be analysed and planned. The paper presents a description of the developed principal mathematical model created by the authors for designing a construction site by using the BIM technologies. The main formulas of a mathematical algorithm aimed at the selection of the objects used on the building site and the need for them are presented. The main principles and methods of selecting the mechanisms used at the construction site are given. To avoid using the irrelevant information in planning the construction site, the technologies of virtual reality are used. Having the important and new information about the construction site, all the obstacles found at the construction site, i.e. the plants, the surrounding constructions and other relevant objects, are known.

Keywords: building technologies, sustainable construction, selection of building equipment, building information modelling, building site planning.

References

- [1] Berner F., Hermes M. Spieth D.: *Interaction between Lean Construction and the working method BIM using the example of application of visualization and modelling of the construction process*, Bauingenieur 2016, Vol. 91, pp. 466-472.
- [2] Briskorn D., Dienstknecht M. *Mixed-integer programming models for tower crane selection and positioning with respect to mutual interference*, European Journal of Operational Research 2019, Vol. 273 (1), pp. 160-174.
- [3] Fadoul A., Tizani W., Koch C. *A BIM-based model for constructability assessment of conceptual design*. Advances In Computational Design 2018, Vol. 3(4), pp. 367-384.
- [4] Gbadamosi A.Q., Mahamadu A.M., Oyedele, L.O., Akinade, O.O., Manu P., Mahdjoubi L., Aigbavboa, C. *Offsite construction: Developing a BIM-Based optimizer for assembly*. Journal of Cleaner Production 2019, Vol. 215, pp. 1180-1190.
- [5] Ilce AC., Ozkaya K. *An integrated intelligent system for construction industry: a case study of raised floor material*. Technological and Economic Development of Economy 2018, Vol. 24(5), pp. 1866-1884.
- [6] Ji Y. S., Leite F. *Automated tower crane planning: leveraging 4-dimensional BIM and rule-based checking*. Automation in Construction 2018, Vol. 93, pp. 78-90.
- [7] Ji Y. S., Sankaran B., Choi J. Y., Leite F. *Integrating BIM and Optimization Techniques for Enhanced Tower Crane Planning*. Computing in Civil Engineering 2017: Information Modelling and Data Analytics. Conference: ASCE International Workshop on Computing in Civil Engineering (IWCCE), 2017; pp. 67-74.
- [8] Jin R. Y., Zhong B., T., Ma L., Hashemi A., Ding L.Y. *Integrating BIM with building performance analysis in project lifecycle*, Automation in Construction 2019, Vol. 106, 102861.

Multi-Criteria Analysis in Technology Selection Problems – Systematic Literature Review Results

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Abstract

Along with the rapid technology development and the growing importance of technology impact on the competitiveness and performance of companies, the selection of the appropriate one that meets all requirements constitutes a challenging strategic decision problem faced by entrepreneurs and institutions. This paper aims to answer the following research questions: What are the main research directions in the application and adaptation of multi-criteria analysis in the field of technology selection? Which multi-criteria analysis (MCA) methods are most often used in the technology assessment process? Which features of the technology are key as criteria in the selection process and whether and how they determine the choice of MCA methods? The research methodology is based on a systematic literature review on the use of multi-criteria analysis in decision-making processes regarding technology selection and technology assessment. Text analysis methods and visualization of their results were also applied. This study contributes to the theory of technology assessment and multicriteria analysis by recognition the state-of-the-art in the existing published works and identification of possible research directions in the future. Furthermore, an in-depth analysis of the chosen articles was carried out to identify the critical features of technology and key criteria in the technology selection process. In addition, an attempt was made to diagnose whether there is a pattern in the use of specific MCA methods in a particular sector, which may constitute a practical implication of this study.

Keywords: technology assessment, technology selection, multi-criteria analysis, multi-criteria decision making, MDCM.

References

- [1] Ansari R., Soltanzadeh J., Tavassoli A. *Technology selection between technology management and decision making: A case study from the Iranian automotive industry*. International Journal of Automotive Technology and Management 2016, Vol. 16(4), pp. 365-388.
- [2] Fang. H. Wang, X., Song, W. *Technology selection for photovoltaic cell from sustainability perspective: An integrated approach*. Renewable Energy 2020, Vol. 153, pp. 1029-1041.
- [3] Habbal A., Goudar S.I., Hassan S., *A context-aware radio access technology selection mechanism in 5G mobile network for smart city applications*. Journal of Network and Computer Applications 2019, Vol. 135, pp. 97-107.
- [4] Halicka K. *Technology Selection Using the TOPSIS Method*. Foresight and STI Governance 2020, Vol. 14(1), pp. 85-96.
- [5] Kafuku, J.M., Saman, M.Z.M., Yusof, S.M, *Application of Fuzzy Logic in Selection of Remanufacturing Technology*. Procedia Manufacturing 2019, Vol. 33, pp. 192-199.
- [6] Opricovic S., Tzeng G.H. *Compromise solution by MCDM methods: A comparative analysis of VIKOR and TOPSIS*. European Journal of Operational Research 2004, Vol. 156(2), pp. 445-455.
- [7] Saen R.F. *A decision model for technology selection in the existence of both cardinal and ordinal data*. Applied Mathematics and Computation 2006, Vol. 181(2), pp. 1600-1608.
- [8] Tzeng G.H., Huang J.J. *Multiple Attribute Decision Making. Methods and Applications*, CRC Press, London, 2011.
- [9] Tzeng, G.H., C.W. Lin, and S. Opricovic. *Multi-criteria analysis of alternative-fuel buses for public transportation*. Energy Policy 2005, Vol. 33, no. 11, pp. 1373-1383.

Green Last-Mile Route Planning for Efficient E-commerce Distribution

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Abstract

The purpose of this study is to design vehicle routes based on both cost minimization and greenhouse gases (GHG) emissions minimization to help companies solve the VRPPD problem via particle swarm optimization (PSO). Effective metaheuristics search technique called particle swarm optimization (PSO) is applied to design the optimal route for these types of problems. Simulated data from Li and Lim (2001) are used to evaluate the PSO performance for solving green vehicle routing problems by pickup and delivery requests (Green VRPPD). The findings suggest that green vehicle routing problems with pickup and delivery requests should be used when distributing products to customers living in a specific area called a cluster. However, the design of vehicle routes by Green VRPPD costs more when it is used to distribute products to customers living randomly in a coverage service area. When logistics providers decide to use Green VRPPD instead of VRPPD, they need to be concerned about possible higher costs if an increase in the number of vehicles is needed. PSO is confirmed to be used for designing solving VRPPD effectively. The results based on the use of two different objective functions with fuel consumption from diesel and liquefied petroleum gas (LPG) are compared. It indicates that solving VRPPD by considering the emissions of direct greenhouse gases as an objective function provides cleaner routes, rather than considering total cost as the objective function for all test cases. However, this requires more total cost than considering the total cost as the objective function. The reason is the Green VRPPD requires a greater number of vehicles and longer traveling distance. Considering the types of fuels used, it is obvious that using LPG is more environmentally friendly than the use of diesel by up to 53.61%.

Keywords: last-mile, routing, green, particle swarm optimization, e-commerce

References

- [1] Bansal, S. and Wadhawan, S. A hybrid of sine cosine and particle swarm optimization (HSPO) for solving heterogeneous fixed fleet vehicle routing problem. *International Journal of Applied Metaheuristic Computing (IJAMC)* 2021, Vol. 12(1), pp. 41-65.
- [2] Bruglieri, M., Mancini, S. and Pisacane, O. The green vehicle routing problem with capacitated alternative fuel stations. *Computers & Operations Research* 2019, Vol. 112, pp. 104759.
- [3] Harbaoui Dridi, I., Ben Alaïa, E., Borne, P. and Bouchriha, H. Optimisation of the multi-depots pick-up and delivery problems with time windows and multi-vehicles using PSO algorithm. *International Journal of Production Research* 2020, Vol. 58(14), pp. 4201-4214.
- [4] Li, H. and Lim, A. A metaheuristic for the pickup and delivery problem with time windows. *International Journal on Artificial Intelligence Tools* 2003, Vol. 12(02), pp. 173-186.
- [5] Sruthi, A., Anbuudayasankar, S.P. and Jeyakumar, G. Energy-efficient green vehicle routing problem. *International Journal of Information Systems and Supply Chain Management (IJISSCM)* 2019, Vol. 12(4), pp. 27-41.
- [6] Yu, Y., Yu, C., Xu, G., Zhong, R.Y. and Huang, G.Q. An operation synchronization model for distribution center in E-commerce logistics service. *Advanced Engineering Informatics* 2020, Vol. 43, pp. 101014.
- [7] Zhang, X., Zhou G., Cao J., Wu A. Evolving strategies of e-commerce and express delivery enterprises with public supervision. *Research in Transportation Economics* 2020, Vol. 80, 100810.

Awareness of the Prevention through Design (PtD) Concept among Design Engineers in the Philippines

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Abstract

Purpose: The concept of "Prevention through Design (PtD)" considers construction safety during the design process. Several countries are currently practicing PtD, including UK, Singapore, Malaysia, Australia, and the USA, which is still not the case in the Philippines. The study presented in this paper aimed to indicate the current level of awareness of the concept of PtD among the structural engineers and purposed to generate a basis of initiatives to introduce or improve the understanding and adoption of PtD in the Philippines. A knowledge, attitude, and practice (KAP) questionnaire was distributed to survey respondents obtained through a snowball sampling method, consisting of structural engineers currently working in the Philippines. Sixty-one (61) structural engineers responded and their answers were analyzed in this study. Results indicated that PtD was relatively a new concept for most structural engineers in the Philippines. Similarly, the designers' knowledge of the concept was still low. However, structural engineers viewed PtD as necessary, and its implementation will be essential in the construction industry. Despite the known concerns in PtD implementations, structural engineers favored the adoption of the concept. The paper also discussed challenges and key drivers for implementing PtD in the Philippines based on the questionnaire results and supporting literature reviews. The findings and methodology presented in this paper could serve as a baseline for a larger sample size covering other design trades such as architectural, electrical, and mechanical design services leading to the broader adoption of PtD in the Philippines. Furthermore, the framework of this study could also be applicable to other countries with similar contexts.

Keywords: construction safety, Prevention through Design, Design for Safety, Philippines, KAP, structural design.

References

- [1] Sousa V., Almeida N. M., Dias L. A. *Risk-based management of occupational safety and health in the construction industry – Part 1: Background knowledge*. Saf. Sci. 2014, Vol. 66, pp. 75-86.
- [2] Behm M. *Linking construction fatalities to the design for construction safety concept*. Saf. Sci. 2005, Vol. 43, no. 8, pp. 589-611.
- [3] Goh Y.M., Chua S. *Knowledge, attitude and practices for design for safety: A study on civil & structural engineers*. Accid. Anal. Prev. 2016, Vol. 93, pp. 260-266.
- [4] Che Ibrahim C.K.I., Belayutham S. *A knowledge, attitude and practices (KAP) study on prevention through design: a dynamic insight into civil and structural engineers in Malaysia*. Archit. Eng. Des. Manag. 2020, Vol. 16, no. 2, pp. 131-149.
- [5] Gambatese J.A., Behm M., Rajendran S. *Design's role in construction accident causality and prevention: Perspectives from an expert panel*. Saf. Sci. 2008, Vol. 46, no. 4, pp. 675-691.
- [6] Fargnoli M., Lombardi M. *Building information modelling (BIM) to enhance occupational safety in construction activities: Research trends emerging from one decade of studies*. Buildings 2020, Vol. 10, no. 6.
- [7] Gambatese J.A., Michael Toole T., Abowitz D.A. *Owner perceptions of barriers to prevention through design diffusion*. J. Constr. Eng. Manag. 2017, Vol. 143, no. 7.

Industry 4.0 – Alternative Approaches to Efficient Implementation in SMEs

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Abstract

Industry I4.0, driven by the need to access real-time insights and information across the manufacturing process, creates a disruptive impact on industries. Large-scale machine-to-machine communication, virtual reality (VR), the Internet of Things (IoT), simulation technologies and network management are integrated for increased automation, machine learning, self-controlled social and technical systems (Smart Factories). The uptake of advanced manufacturing solutions represents a challenge for business and for SMEs in particular. SMEs possess neither the organizational capability nor financial resources to systematically investigate the potential and risks of introducing Industry 4.0. However, the so-called fourth industrial revolution is not only a matter of technology, but also a matter of cooperation between European regions to share knowledge concerning alternative regional and national approaches to successful support of the I4.0 implementation. Therefore, the primary aim of this paper is to analyse practical experience on how European policies related to Structural Funds can unlock the full potential of Industry 4.0 and overcome the fragmentation of Industry 4.0 solutions. Case studies of successful transfer of I4.0 to SMEs in Europe and supporting regional instruments presented in the paper could inspire and enable the potential of digitalization by dealing with main challenges hampering their diffusion into the business ecosystem.

Keywords: Industry 4.0, digital transformation, SMEs.

References

- [1] Alcacer V., Cruz-Machado V. *Scanning the industry 4.0: A literature review on technologies for manufacturing systems*. Engineering Science and Technology, an International Journal 2019, Vol. 22(3), pp. 899-919.
- [2] Atzori L., Iera A., Morabito G. *The internet of Things: A survey*. Computer Networks 2010, Vol. 54(15), pp. 2787-2805.
- [3] Azevedo A., Almeida A.H. *Grasp the Challenge of Digital Transition in SMEs – A Training Course Geared towards Decision-Makers*. Education Sciences 2021, Vpl. 11, p. 151
- [4] Beier G., Ullrich A., Niehoff S., Reißig M., Habich, M. *Industry 4.0: How it is defined from a sociotechnical perspective and how much sustainability it includes – A literature review*. Journal of Cleaner Production 2020, Vol. 259, p. 120856.
- [5] Borowicz, A. *Does the New Industrial Strategy for Europe Follow the Path of the Concept of Industry 4.0?* Studia Europejskie – Studies in European Affairs 2021, Vol. 1/2021, pp. 85-102.
- [6] Galati F., Bigliardi B. *Industry 4.0: Emerging themes and future research avenues using a text mining approach*. Computers in Industry 2019, Vol. 109, pp. 100-113.
- [7] Hervas-Oliver J.-L., Gonzalez-Alcaide G., Rojas-Alvarado R., Monto-Mompo S. *Emerging regional innovation policies for industry 4.0: analyzing the digital innovation hub program in European regions*. Competitiveness Review 2021, Vol. 31(1), pp. 106-129.
- [8] Horváth D., Szabó R.Z. *Driving forces and barriers of Industry 4.0: Do multinational and small and medium-sized companies have equal opportunities?* Technological Forecasting and Social Change 2019, Vol. 146, pp. 119-132.
- [9] Ingaldi M., Ulewicz R. *Problems with the Implementation of Industry 4.0 in Enterprises from the SME Sector*. Sustainability 2020, Vol. 12(1), p. 217.

The Desirable Systemic Uncertainty in Complex IoT Sensor Networks – General Anticipatory Foresight Perspective

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Abstract

A wide methodological spectrum regarding future research is offered by anticipation studies, with a special role of foresight studies. Many studies of this type focus on generating the desired future, taking into account the fact that it is accompanied by uncertainty. The author of this publication postulates to treat uncertainty as an equivalent -- in relation to the future -- research object. This approach allows us to formulate general assumptions for a model of the anticipatory management of systemic uncertainty in IoT networks. The goal of such a model will not be to eliminate or even minimize uncertainty, but to regulate it to a desired level. Such an action can bring much more benefits than trying to zero out uncertainty. On the general side, uncertainty can be studied in 2 ways: 1) as an abstract idea; or 2) as a feature of a particular structure, also with elements of research on its abstract component. In this paper the attention is focused on the second approach. The main research area is the IoT network in its broadest sense, with a particular role of the social construct, in the context of the study of systemic uncertainty in relation to selected anticipatory actions. The overarching goal is to define a desired state, or to determine what such a desired state is, of anticipatory IoT uncertainty.

Keywords: anticipation, system, future, uncertainty; knowledge, foresight, Internet of Things

References

- [1] Beven K. Environmental modelling: an uncertain future?. CRC Press, 2018.
- [2] Cofta P., Karatzas K., Orłowski C.A. Conceptual Model of Measurement Uncertainty in IoT Sensor Networks. *Sensors* 2021, Vol. 21(5), pp. 1-19, 1827.
- [3] Courtney H., Kirkland J., Viguerie P. Strategy under Uncertainty. *Harvard Business Review* 1997, Vol. 75, No. 6, pp. 67-79.
- [4] Furlanetto A., Poli, R. Anticipatory Risk Management. In *Handbook of anticipation: Theoretical and applied aspects of the use of future in decision making*, Poli, R., Ed., Springer, New York, 2019, pp. 1647-1658.
- [5] Millett S.M. Four levels of uncertainty. *Strategy & Leadership* 2002, Vol. 30 No. 2.
- [6] Öner M.A., Beşer S.G., Şenoğlu P. Uncertainty in anticipation: toward conceptual clarity. In *Anticipation. Conceptual, Theoretical And Empirical Issues*; M. Atilla Öner, A. Kemal Tuğcu, (Eds.); Yeditepe Üniversitesi Yayınevi, Baskı, İstanbul, 2019, pp. 65-96.
- [7] Poli R. *Introduction to anticipation studies*, Vol. 1; Springer, Switzerland, 2017.
- [8] Sharma N., Shamkuwar M., Singh I. The history, present and future with IoT. In *Internet of Things and Big Data Analytics for Smart Generation*; Springer, Cham, 2019, pp. 27-51.
- [9] Voros J., Big History and Anticipation. In R. Poli (Ed.), *Handbook of anticipation: Theoretical and applied aspects of the use of future in decision making*, Springer, New York, 2019, pp. 425-464.
- [10] Walker W.E., Harremoës P., Rotmans J., van der Sluijs J.P., van Asselt M.B., Janssen P., Krayen von Krauss M.P. Defining uncertainty: a conceptual basis for uncertainty management in model-based decision support. *Integrated Assessment* 2003, Vol. 4, No. 1, pp. 5-17.

Uncertainty and Foreknowledge of Emerging Technologies in the Context of Fourth Industrial Revolution

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Abstract

One of the key roles in the development of Industry 4.0 systems are played by "emerging technologies" as new tools with promising – but with high level of uncertainty – capabilities. The management of such systems should be based on a comprehensive – future-oriented – research approach. Such activities are enabled by foresight methodology. The main purpose of this publication is an attempt to answer the following research question: "What levels of fore-knowledge and knowledge in the context of development of emerging technologies – in relation to their feature in Industry 4.0 – should be taken into account during analysis of uncertainties in the sense of foresight research?" In detail, the relationship of classes of research foresight methods in their relation to types of future, scopes of uncertainty, cycles of knowledge and original levels of foreknowledge in the field of development of emerging technologies in Industry 4.0 was examined. Emerging technologies combined with the research of foreknowledge and uncertainties, is an interesting research area with many theoretical and practical potential implications. The study uses the results of the analysis and criticism of the literature, mental experiment and the intuitive method as the main research methods. On this basis a conceptual modelling was performed .

Keywords: uncertainty, knowledge, foreknowledge, emerging technologies, futures studies, foresight methods.

References

- [1] Betz G. *Prediction or prophecy?: The boundaries of economic foreknowledge and their socio-political consequences*. Springer Science & Business Media, Deutscher Universitäts-Verlag, Wiesbaden, Germany, 2006.
- [2] Bonaccorsi A., Chiarello F., Fantoni G., Kammering H. *Emerging technologies and industrial leadership. A Wikipedia-based strategic analysis of Industry 4.0*. Expert Systems with Applications 2020, Vol. 160, 113645.
- [3] Halaweh M. *Emerging technology: What is it?* Journal of Technology Management & Innovation 2013, Vol. 8(3), pp. 108-115.
- [4] Miles I. *The development of technology foresight: A review*. Technological Forecasting and Social Change 2010, Vol. 77(9), pp. 1448-1456.
- [5] Packard M.D., Clark B. B. *Mitigating versus Managing Epistemic and Aleatory Uncertainty*. Academy of Management Review 2020, Vol. 45(4), pp. 872-876.
- [6] Padgett A.G. *Divine Foreknowledge and the Arrow of Time: On the Impossibility of Retrocausation*. In God and Time: Essays on the Divine Nature; G. E. Ganssle, D. M. Woodruff Eds.; Publisher: Oxford University Press, Oxford, UK, 2002, pp. 65-74.
- [7] Pidgeon N. *Complexity, uncertainty and future risks*. Journal of Risk Research 2014, Vol. 17(10), pp. 1269-1271.
- [8] Rotolo D., Hicks D., Martin B.R. *What is an emerging technology?* Research policy 2015, Vol. 44(10), pp. 1827-1843.
- [9] Sardar Z., Sweeney J.A. *The three tomorrows of postnormal times*. Futures 2016, Vol. 75, pp. 1-13.
- [10] Saritas O. *Systemic foresight methodology*. In Science, technology and innovation policy for the future; Meissner, D., Gokhberg, L., Sokolov, A. Eds.; Publisher: Springer, Berlin, Heidelberg, Germany, 2013, pp. 83-117.
- [11] Townsend D.M., Hunt R.A., McMullen J.S., Sarasvathy S.D. *Uncertainty, knowledge problems, and entrepreneurial action*. Academy of Management Annals 2018, Vol. 12(2), pp. 659-687.
- [12] Wyckoff J. *On the incompatibility of divine foreknowledge and human freedom*. Sophia 2010, Vol. 49(3), pp. 333-341.

Realizing the objectives of infrastructure master plan: The role of internal operatives

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Abstract

An infrastructure master plan, in a higher education institution, serves as a blueprint for the coordinated and progressive development of the physical infrastructure and services to create a suitable academic environment required for the execution of the core functions of teaching, learning and research. Master plans are usually developed for a long period in the life of the institution, subject to rational and objective modification due to the dynamics that are internal and external to the academic institution. The single case study method of qualitative research was adopted in the exploration of the implementation process of the infrastructure master plan of a higher education institution in Zimbabwe. The findings revealed that internal and external factors were successfully managed through the consultative approach adopted by the institution's University Council / Board and the Building Committee. Other findings include the fact that the institution adopted the mixed methods of infrastructure development, which include new construction, renewal of existing buildings, purchase and renting of suitable properties in order to keep up with the aspirations of the academic plan. Therefore, this research concludes that success in the implementation of infrastructure master plan requires the tenacity and commitment of suitable internal operatives through collaborative monitoring and evaluation of the various projects undertaken by those involved.

Keywords: academic institution, infrastructure, implementation, internal and external factors, master plan.

References

- [1] Abiad A., Almansour A., Furceri D., Granados C.M., Topalova P. World Economic Outlook: Is it time for an infrastructure push? The macroeconomic effects of public investment, IMF Research Department's Economic Modeling and Development Macroeconomics Divisions, 2014, Available online: http://www.eco.uc3m.es/temp/ppt_WEO_Ch3.pdf (accessed on 10 January 2021).
- [2] Hameed R., Nadeem O. *Challenges of Implementing Urban Master Plans: The Lahore Experience*. International Journal of Humanities and Social Sciences, Educational, Economic, Business and Industrial Engineering 2008, Vol. 2, No. 12, pp. 1297-1304.
- [3] Pella M.D.A., Sumarwan U., Daryanto A. *Factors Affecting Poor Strategy Implementation*. Gadjah Mada International Journal of Business 2013, Vol. 15(2), pp. 183-204.
- [4] Alharthy A.H., Rashid H., Khan, F. *Identification of Strategy Implementation Influencing Factors and Their Effects on the Performance* International Journal of Business and Social Science 2017, Vol. 8, pp. 34-44.
- [5] Okumus F. *A framework to implement strategies in organizations*. Journal of Management Decision 2003, Vol. 41(9), pp. 871-882.
- [6] Al-Kandi I., Asutay M., Dixon R. *Factors influencing the strategy implementation process and its outcomes: evidence from Saudi Arabian banks*. Journal of Global Strategic Management 2013, Vol. 7(2), pp. 5-15.
- [7] Walleri D.R., Becker W.E., Linn C. From Academic Vision to Physical Manifestation, 2002, Available online: <https://eric.ed.gov/?id=ED467620> (accessed on 12 April 2020).
- [8] Caruthers J.K., Layzell D.T. *Campus Master Planning and Capital Budgeting*. Roles and Responsibilities of the Chief Financial Officer: New Directions for Higher Education 2003, Vol 107(99), p. 73.
- [9] Lick, D.W., Kaufman R. *Change Creation: The Rest of the Planning Story*. Journal of Planning for Higher Education 2001, Vol. 29(2), pp. 24-36.
- [10] Rudden M.S. *Ten Reasons Why Colleges and Universities Undertake Campus Master Planning (and How to Align Your Campus Planning Effort to Best Address Them)*. Journal of Planning for Higher Education 2008, Vol. 36(4), pp. 33-41.
- [11] Guckert D.J., King J.R., *The High Cost of Building a Better University*. Journal of Planning for Higher Education 2004. Vol. 32(2), pp. 24-29.

Methods for Evaluating and Ensuring the Efficiency of the Energy Saving System in the Enterprise

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Abstract

The article presents the method of the improvement of evaluating the efficiency of the energy saving system in the enterprise. The main factor in the efficiency of the energy saving system of the enterprise is the orderliness of a set of methods that are synchronized with the current objectives of its production. As a result of the scientific works analysis, it is determined that the criterion of innovation and investment activity of the enterprise is used in assessing the system of energy saving efficiency measures in the enterprise. The importance of applying a three-component quality indicator of production energy management is stressed and a system of indicators of the internal component of energy saving of the enterprise is formed. The indicators of stimulants that have a direct impact on strengthening the level of the enterprise energy security and disincentives that have a reverse effect on the security level were identified. A method for assessing the level of energy efficiency supply system management is proposed to identify advanced methods in the management process of system development plans taking into account the directions and real capabilities of the enterprise and reasons for determining high, medium or low level of energy management efficiency.

Keywords: energy saving, system, methodology, indicators, efficiency level, matrix.

References

- [1] Bezv V.V. *Rozvytok mekhanizmu enerhozberezhennia na pidpriemstvakh kharchovoi promyslovosti*. Vcheni zapysky 2011, Vol 13., pp. 169-173.
- [2] Chystov Yu.I. *Sutnist mekhanizmu enerhozberezhennia ta yoho bahatohranna pryroda*. Visnyk Khmelnytskoho natsionalnogo universytetu. Ekonomichni nauky 2010, Vol. 5, pp. 341-344.
- [3] Ishchenko S.V., Malyshev M.V. *Metodychni pidkhody do otsinky efektyvnosti upravlinnia enerhozabezpechenniam pidpriemstva*. Efektyvna ekonomika 2016, Vol. 2.
- [4] Hurniak I.H., Yurynets Z.V. *Osoblyvosti formuvannia stratehii innovatsiinoho rozvytku enerhozberezhennia promyslovykh pidpriemstv*. Efektyvna ekonomika 2015. Vol. 2.
- [5] Hryshko N.Ie. *Upravlinnia ekonomichnoiu bezpekoiu pidpriemstva na zasadakh preventyvnoho rehuliuвання*. Visnyk Kremenchutskoho natsionalnogo universytetu imeni Mykhaila Ostrohradskoho. Seriya Ekonomichni nauky 2014, Vol. 1/2014/(3). pp. 44-51.
- [6] Kyprianou I., Serghides D.K., Varo A., Gouveia J.P., Kopeva D., Murauskaite L. *Energy poverty policies and measures in 5 EU countries: A comparative study*. Energy and Buildings 2019, Vol. 196, pp. 46-60.
- [7] Samborskyi V.O. *Otsinka enerhetychnoi bezpeky pidpriemstva yak skladova yoho stratehii enerhetychnoi bezpeky*. Visnyk NTU «KhPI» 2014. Vol. 34. pp. 166-171.
- [8] Serdiuk T.V. *Orhanizatsiino-ekonomichni mekhanizm enerhozberezhennia v promyslovosti: monohr*; UNIVERSUM, Vinnytsia, Ukraine, 2005.
- [9] Shivakumar A. Dobbins A. Shivakumar A. Fahl U., Singh A. *Drivers of renewable energy deployment in the EU: An analysis of past trends and projections*, Energy Strategy Reviews 2019, Vol. 26, pp. 345-368.
- [10] Vovk Yu. *Orhanizatsiino-ekonomichni mekhanizm upravlinnia ratsionalnym vykorystanniam resursiv*", Sotsialno-ekonomichni problemy i derzhava 2011, Vol. 1(40), pp. 38-56.

Partial Replacement of Cement with Rice Husk Ash in Concrete Production: A Cost Benefit Exploratory Analysis for Low-Income Communities

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Abstract

Cement is an important construction material in the production of concrete; however, it is expensive and unaffordable for many low income and rural communities in developing countries. Rice husk is a by-product from rice mill process, with an approximate ratio of 200 kg rice husks per one tonne of rice produced. The aim of this experimental study was to investigate the integrity of concrete produced in Zambia using Rice Husk Ash (RHA) as partial replacement of cement. The primary goal was to carry out a cost benefit analysis on the use of RHA in concrete. (RHA) was used to partially replace cement with ratios of 10%, 20% and 30 %. The 20% cement replacement mix produced the optimum results of 18 MPa concrete strength at 0.5 water/binder ratio. This translated in cost reduction of concrete by 12.5% which is significant particularly for higher Vol.s of concrete. This concrete produced is suitable for lightly loaded structures such as foundation footings, surface beds and walkways to benefit low-income communities. The study further concluded that the RHA based concrete was more cost-efficient in structures that are of close proximity to areas of rice production due to reduced transportation costs of the RHA.

Keywords: rice husk ash, partial replacement, concrete, cost reduction.

References

- [1] Ahsan M.B., Hossain Z. *Supplemental use of rice husk ash (RHA) as a cementitious material in concrete industry.* Construction and Building Materials 2018, Vol. 178, pp. 1-9.
- [2] Creswell J.W. *Research Design Qualitative, Quantitative and Mixed Methods Approaches*, 3rd ed. Los Angeles: SAGE Publications Inc., 2009.
- [3] Dandautiya R., Singh A.P. *Utilization potential of fly ash and copper tailings in concrete as partial replacement of cement along with life cycle assessment.* Waste Management 2019, Vol. 99, pp. 90-101.
- [4] Fapohunda C., Akinbile B., Shittu, A. *Structure and properties of mortar and concrete with rice husk ash as partial replacement of ordinary Portland cement – A review.* International Journal of Sustainable Built Environment 2017, Vol. 6(2), pp. 675-692.
- [5] Joel M. *A review of partial replacement of cement with some agro wastes.* Nigerian J. Technol. 2010, Vol. 29 (2), pp. 12-20.
- [6] Kundu S., Aggarwal A., Mazumdar S., Dutt K.B. (2016). *Stabilization characteristics of copper mine tailings through its utilization as a partial substitute for cement in concrete: preliminary investigations.* Environmental Earth Sciences 2016, Vol. 75(3), p. 227.
- [7] Novikov A.M., Novikov D.A. *Research methodology: From philosophy of science to research design.* CRC Press, 2019.
- [8] Rajamane N.P., Peter J.A., Ambily P.S. *Prediction of compressive strength of concrete with fly ash as sand replacement material.* Cement and concrete composites 2007, Vol. 29(3), pp. 218-223.

Modelling and Monitoring the State of Transition Towards the Circular Economy in the European Union

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Abstract

The concept of circular economy (CE) has been present in the literature since the 1960s. However, in recent years it has significantly gained prominence both in scholarly and policy circles. Circular economy concept has been introduced into the European Union (EU) policies and strategies. Transformation of the dominant economic model is a long-term process, and the activities leading to the implementation of the circular economy paradigm are gradual. Measuring the progress towards the circular economy model at micro, meso, and macro level is a demanding task, mainly due to the fuzziness, complexity, and multidimensionality. The assessment of the transition towards the CE based on selected sets and subsets of indicators are a subject of numerous publications that include both simple and more sophisticated comparisons, quantitative and qualitative evaluations. One of the widely exploited methods to assess the sustainability, especially of transforming labour, capital, and energy into GDP considering pollutants (mainly greenhouse gas emissions) and renewables is Data Envelopment Analysis (DEA). The article proposes to apply the Rough Set theory introduced by Pawlak (1982), supported with cluster analysis, to reduce the number of indicators from a given set and rules induction to assess the state of transition towards the circular economy in the EU. Rough Set theory is a mathematical approach to vagueness addressing the issues of pattern discovery in data, decision rule generation, and reduction of data. The main contribution of the article is to develop a model to reduce the arbitrariness of the criteria selection in monitoring the state of transition towards the CE.

Keywords: rough set, cluster analysis, circular economy (CE), sustainability, Sustainable Development Indicators (SDI), European Union (EU).

References

- [1] Reike D., Vermeulen W.J.V., Witjes S. *The Circular Economy: New or Refurbished as CE 3.0? – Exploring Controversies in the Conceptualization of the Circular Economy through a Focus on History and Resource Value Retention Options*. Resources, Conservation and Recycling 2018, Vol. 135, pp. 246-264.
- [2] Nazarko, L. *Technology Assessment in Construction Sector as a Strategy towards Sustainability*. Procedia Engineering 2015, Vol. 122, pp. 290-295.
- [3] European Commission (EC) A New Circular Economy Action Plan: For a Cleaner and More Competitive Europe (COM(2020)0098); 2020.
- [4] Saidani M., Yannou B., Leroy Y., Cluzel F., Kendall A. *A Taxonomy of Circular Economy Indicators*. Journal of Cleaner Production 2019, Vol. 207, pp. 542-559.
- [5] Elia V., Gnoni M.G., Tornese F. *Measuring Circular Economy Strategies through Index Methods: A Critical Analysis*. Journal of Cleaner Production 2017, Vol. 142, pp. 2741-2751.
- [6] Chodakowska E., Nazarko J. *Hybrid Rough Set and Data Envelopment Analysis Approach to Technology Prioritisation*. Technological and Economic Development of Economy 2020, Vol. 26, pp. 885-908.
- [7] Pawlak Z. *Rough Sets*. International Journal of Computer and Information Sciences 1982, Vol. 11, pp. 341-356.
- [8] Pawlak Z., Skowron, A. *Rudiments of Rough Sets*. Information Sciences 2007, Vol. 177, pp. 3-27.
- [9] Chodakowska E., Nazarko J. *Assessing the Performance of Sustainable Development Goals of EU Countries: Hard and Soft Data Integration*. Energies 2020, Vol. 13(3439), pp. 1-25.
- [10] Chodakowska E., Nazarko J. *Environmental DEA Method for Assessing Productivity of European Countries*, Technological and Economic Development of Economy 2017, Vol. 23(4), pp. 589-607.

Responsible Innovation in Polish Enterprises

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Abstract

The paper presents the results of research which aimed at studying the problematic of reflexivity and responsibility in production and service enterprises. The study was carried out in 2021 on a sample of 100 medium enterprises (between 50 and 250 employees) operating on the Polish market. The primary data was gathered through interviewing (CATI/CAWI) the top management or owners of the companies. The following research questions are addressed in the paper: 1) How unexpected events in the enterprise's environment affect its competitive position? 2) Do enterprises express the need to acquire competences related to the systematic exploration of multiple socio-technical futures (foresight)? 3) What groups of stakeholders do enterprises feel responsible to when developing new products and services? 4) What grand societal challenges are mostly addressed by newly developed products and services? 5) Is enterprise's future orientation is related with its understanding and practice of responsibility? General findings include the conclusion that companies are aware of the impact of unexpected events on their operations and the long-term viability. They have mixed assessment of the possibility to anticipate such events and they generally don't indicate the need for more foresight competences. In developing new products and services they mostly attempt to address the issues of energy consumption, health and security. They feel responsible mainly to their customers and subcontractors.

Keywords: Responsible Research and Innovation (RRI), responsible innovation, future orientation, foresight, industry, enterprise, Poland.

References

- [1] Nieminen V., Ikonen I. *A future-oriented evaluation and development model for Responsible Research and Innovation*. In: Assessment of Responsible Innovation. Methods and Practices; Yaghmaei E., van de Poel I., Eds.; Routledge: London and New York, 2021, pp. 248-271.
- [2] Ejdys J., Nazarko Ł. *Foresight gospodarczy - instrumentem orientacji na przyszłość*. Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu 2014, Vol. 340, pp. 651-664.
- [3] Glińska U., Kononiuk A., Nazarko Ł. *Przegląd projektów foresightu branżowego w Polsce*. Nauka i Szkolnictwo Wyższe 2008, Vol. 2(32), pp. 66-73.
- [4] Nazarko Ł. *Responsible Research and Innovation in Industry: from Ethical Acceptability to Social Desirability*. In: Corporate Social Responsibility in the Manufacturing and Services Sectors; Golińska P., Sychala M., Eds.; Springer: Berlin and Heidelberg, 2019, pp. 127-138.
- [5] Ejdys J. *Strategic Orientation of Small and Medium Size Enterprises*. Economics and Management 2014, Vol. 19(4), pp. 346-358.
- [6] Halicka K. *Prospektywna analiza technologii – metodologia i procedury badawcze*, Oficyna Wydawnicza Politechniki Białostockiej, Białystok, Poland, 2016.
- [7] Nazarko J., Ejdys J., Halicka K., Nazarko Ł., Kononiuk A., Olszewska A. *Factor Analysis as a Tool Supporting STEEPVL Approach to the Identification of Driving Forces of Technological Innovation*. Procedia Engineering 2017, Vol. 182, pp. 491-496.
- [8] Nazarko J., Ejdys J., Halicka K., Nazarko Ł., Skorek A. *Application of enhanced SWOT analysis in the future-oriented public management of technology*, Procedia Engineering 2017, Vol. 182, pp. 482-490.
- [9] Nazarko J., Ejdys J., Halicka K., Nazarko Ł., Kononiuk A., Olszewska A. *Structural Analysis as an Instrument for Identification of Critical Drivers of Technology Development*. Procedia Engineering 2017, Vol. 182, pp. 504-509.
- [10] van de Poel, I. *RRI measurement and assessment: some pitfalls and a proposed way forward*. In: Assessment of Responsible Innovation. Methods and Practices; Yaghmaei E., van de Poel I., Eds.; Routledge: London and New York, 2021, pp. 339-360.

Delays in the Execution of Construction Projects are Beyond Adequate Funding

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Abstract

Several researchers have identified funding (delayed payments and low cash flow of contractors) as a critical delay factor in the execution of construction projects. However, experiencing delays in projects with adequate funding requires further examination. The case study method of qualitative research was adopted, involving representatives from five universities that benefit from infrastructure funding sponsored by a government agency in Nigeria. The Delphi technique was used for data collection and analysis, complemented with interviews. The findings revealed six factors, namely, faulty contractor selection process, delays by contractors and the failure to complete appropriate phases of project, complexity in project governance system, delays from fund administration policy and the over-centralised process of inspection, monitoring and evaluation. The main contribution of this research is the fact that delays in the execution of sponsored projects emanate from the combined effect of lapses in project management by benefiting institutions and deficiencies in the project governance system of the funding agency. The outcomes of this study will assist the Directors of Physical Facilities in universities to manage their internal operations and provide them with objective information for continuous engagement with the funding agency. Improvements in project cash flow can significantly ameliorate the associated delays in project delivery. Therefore, improvements in the in-house processes of contractor selection and the decentralisation of the project governance structure of the funding agency, can facilitate timely inspection, monitoring and evaluation, which enables the quick release of necessary project funds.

Keywords: adequate funding, construction projects, delays, Delphi technique, funding agency, project governance.

Reference

- [1] Babatunde S. O., Opawole A., Ujadughe I. C. *An appraisal of project procurement methods in the Nigerian construction industry*. Civil Engineering Dimension 2010, Vol. 12(1), pp. 1-7.
- [2] Deep S., Bilal M., Ahmad S. *A study of various factors affecting contractor's performance in lowest bid award construction projects*. International Journal of Civil Engineering and Technology 2017, Vol. 8(2), pp. 28-33.
- [3] Dolo H. *Analysis of pre-qualification criteria in contractor selection and their impacts on project success*. Construction Management and Economics 2009, Vol. 27(12), pp. 1245-126.
- [4] Förster B., Gracht H. V. *Assessing Delphi panel composition for strategic foresight – a comparison of panels based on company-internal and external participants*. Technological Forecasting & Social Change 2014, Vol. 84, pp. 215-229.
- [5] Jafari A. *A contractor pre-qualification model based on the quality function deployment method*. Construction Management and Economics 2013, Vol. 31(7), pp. 746-760.
- [6] Omopariola E.D., Windapo A., Edwards D.J., Thwala W.D. *Contractors' perceptions of the effects of cash flow on construction projects*. Journal of Engineering, Design and Technology 2020, Vol. 18(2), pp. 308-325.
- [7] Yalini R., Alan S. *Study on identification of delay factors in construction project in Tamilnadu*. International Journal of Science and Engineering Research 2015, Vol. 3(5), pp. 3221-3224.
- [8] Zayed T., Liu Y. *Cash flow modelling for construction projects*. Engineering, Construction and Architectural Management 2014, Vol. 21(2), pp. 170-189.

Design and Operation of Low Energy Consumption Passive Human Comfort Solutions

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Abstract

The rapid growth during the last decade has been accompanied by active construction, which in some instances neglected the impact on the environment and human activities. Policies to promote the rational use of electric energy and to preserve natural non-renewable resources are of paramount importance. Low energy design of urban environment and buildings in densely populated areas requires consideration of a wide range of factors, including urban setting, transport planning, energy system design and architectural and engineering details. The focus of the world's attention on environmental issues in recent years has stimulated response in many countries, which have led to a closer examination of energy conservation strategies for conventional fossil fuels. One way of reducing building energy consumption is to design buildings, which are more economical in their use of energy for heating, lighting, cooling, ventilation and hot water supply. However, exploitation of renewable energy in buildings and agricultural greenhouses can, also, significantly contribute towards reducing dependency on fossil fuels. This will also contribute to the amelioration of environmental conditions by replacing conventional fuels with renewable energies that produce no air pollution or greenhouse gases. This study describes various designs of low energy buildings. It also outlines the effect of dense urban building nature on energy consumption, and its contribution to climate change. Energy saving measures in buildings are also presented.

Keywords: renewable technologies, built environment, sustainable development, mitigation measures.

References

- [1] Jeremy L. *The energy crisis, global warming and the role of renewables*. Renewable Energy World 2005; Vol. 8(2), pp. 23-28.
- [2] Omer A., Low energy building materials: an overview. In: Proceedings of the Environment 2010: Situation and Perspectives for the European Union, Porto: Portugal. 6-10 May 2003, pp. 16-21.
- [3] Handbook for the international treaties for the protection of the ozone layer, United Nations Environment Programme, Nairobi, Kenya, 2003, pp. 551-510.
- [4] Viktor D. Ventilation concepts for sustainable buildings, In: Proceedings of the World Renewable Energy Congress VII, Cologne: Germany. 29 June – 5 July 2002.
- [5] Lam J.C. *Shading effects due to nearby buildings and energy implications*. Energy Conservation and Management 2000, Vol. 47(7), pp. 647-659.
- [6] Raja J., Nichol F., McCartney K. Natural ventilated buildings use of controls for changing indoor climate, In: Proceedings of the 5th World Renewable Energy Congress V. Florence: Italy. 20-25 September 1998, pp. 391-394.
- [7] Limb M.J. *Air intake positioning to avoid contamination of ventilation*, AIVC. 1995.
- [8] Miller G., *Resource conservation and management*, Wadsworth Publishers, California: USA, 1990; pp. 51-62.
- [9] Erlich P. *Forward facing up to climate change*. In Global Climate Change and Life on Earth; Wyman R.C. Eds.; Chapman and Hall, London, 1991.
- [10] ASHRAE, *Handbook – Fundamentals (SI)*, American Society of Heating, Refrigerating, and Air Conditioning Engineers Inc., USA. 2005.

Personnel Utilisation in Project Management Office: A Real- World Application

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Abstract

The project management office (PMO) is an organisation structure with the authority to ensure efficient resource utilisation, proper division of work, and interaction among project units. Although, a PMO often operate within an existing structure (e.g. matrix), the complexity associated with contingency features and human dynamics of its design elements can influence efforts to achieve a project objective. In this study, using quantitative methods of operations research, the structure of a PMO was modeled to maximise personnel utilisation function. The work content and numbers of employees at Supervisory (S), Management (M) and Top Management (TM) levels were determined through work sampling methodology. The human utilisation factor of the firm and span of control at S, M and TM levels were (0.9640, 0.8608, 0.8674) and (6,3,3), respectively. The PMO can effectively discharge its duties with 38, 6, 2 and 1 personnel at operation, supervisory, managerial and managing director positions, respectively. This study revealed how operations research paradigm can enhance research opportunities in project-based organisations and organisation design theories. The use of quantitative approach in organisation design can optimise manpower utilisation decisions and associated cost implications in a Project Management Office.

Keywords: project, project management office, organisation structure, personnel, modeling.

References

- [1] Akanbi O.G., Salami S.O., Awodole J.G. *Quantitative Methods in the Design of Organisation: A model and A Real World Application*. TechnickiGlastik 2015, Vol. 9(2), pp. 121-127.
- [2] Babaeianpour M., Zohrevandi S. *Using project management office (PMO) to improve Project Management Abilities*, International Journal of Business and Economics 2014, Vol. 6(1), pp. 53-165.
- [3] Charles-Owaba O.E. *Organisational Design: A Quantitative Approach*. Oporu Books: Ibadan, Nigeria, 2008.
- [4] Odedairo B.O., Raji I.O. *Quantitative Approach to Organisational Design in Project Management Office*, In Book *Advancing Industrial Engineering in Nigeria through Teaching, Research and Innovation: A Festschrift in Honour of Professor O. E Charles-Owaba*; Oluleye, A.E., Oladokun, V.O., Akanbi, O.G.; Eds.; Department of Industrial and Production Engineering, University of Ibadan, Nigeria, 2020; pp.1-17.
- [5] Project Management Institute. *A Guide to The Project Management Body of Knowledge (PMBOK®) 6th ed.*; Project Management Institute, USA 2017.
- [6] Thiry M. *From PMO to PBO: the PMO as a vehicle for organizational change*. Proceedings of PMI Global Congress North America, Atlanta, GA. Newtown Square, PA: Project Management Institute, 2007.
- [7] Turner J. R., Müller R. *On the Nature of the Project as a Temporary Organization*. International Journal of Project Management 2003, Vol. 21(1), pp. 1-8.

The Forecasting Role in the Financial Institutions' Economic Security System

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Abstract

The issue of ensuring economically stable and safe operation of financial institutions has always been relevant. Given the today's realities, this question gains in importance. The paper analyses and advances the theoretical justification for the need to implement institutional forecasting. It describes the concept of economic security in relation to the results of scientific research. The paper provides forecasts and its main functions. The positive effects of the implementation of forecasting methods in the economic security system are determined. In addition, the interdependence between short-term and long-term systems of economic security is characterized. An adequate model for forecasting has been updated, which could be treated as universal. *Keywords:* economic security, threats, forecasting, financial institution.

References

- [1] Dobrovolska O.V. *The current state and problems of development of credit unions in the agricultural sector of Ukraine*. Scientific Bulletin of Kherson State University. Economic Sciences Series 2015, Vol. 11(2), pp. 104-17.
- [2] Gladchuk O.M. *Financial security of the modern insurance market of Ukraine*. Effective Economy 2014, Vol. 4.
- [3] Gorovets N.O. *Problems of development of non-state pension funds in Ukraine*. Economics. Finances. Right 2011, Vol. 6, pp. 22-25.
- [4] Trinko R.I., Zhabynets O.Y. *On the issue of security of insurance companies in Ukraine*. Scientific Bulletin of Lviv State University of Internal Affairs. Economic series 2012, Vol. 2., pp. 165-174.
- [5] Samura Y.O. *Threats to economic security of banking activity and means of its protection*. Economic Journal-XXI. 2015, Vol. 5-6, pp. 86-89.
- [6] Vovchak O.D., Samura Y.O., Sidorenko V.A., Varenik V.A. *Banking security: textbook*. Way, Znannyi 2013, p. 237.
- [7] Vovchenko R.S. *Factors and threats to the financial security of the banking sector of the national economy*. Financial and credit activities: problems of theory and practice 2013, Vol. 1, pp. 75-83.
- [8] Melnik S.I. *Formation of the system of economic security of the bank*. Bulletin of Transport Economics and Industry, 2010, Vol. 29, pp. 149-152.
- [9] Zvarych O.V. *Medium-term forecasting of budget revenues and their relationship with macroeconomic indicators*. Finance of Ukraine 2011, Vol. 8, pp. 59-75.
- [10] Onyshchenko, V.O., Khudolii, Y.S., Chervjak, A.V. *Peculiarities of ensuring economic bank security in terms of financial instability*. Financial and credit activity: problems of theory and practice 2016, Vol.1(20), pp. 4-12.

Comparative Assessment of Deterministic Methodologies for Estimating Excavation Productivity

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Abstract

This paper investigates the prediction capability of deterministic methodologies in estimation construction productivity in earthmoving operations. Published literature includes several estimation methodologies stemming from (a) equipment manufacturers' manuals, (b) editions from German contractors' associations or individual researchers and (c) textbook editions. The purpose of this research is to assess the yielded productivity estimation results under the prism of fourteen estimation methodologies. It is – to the authors' best knowledge – the first research attempt for the comparative evaluation of such a diverse set of estimation methodologies, with the aim of quantifying their effects on the operations analysis in earthmoving works. A uniform mathematical modelling approach is used to formulate the relevant estimation equations and, subsequently, a real-case scenario of an earthmoving project in Greece is used as a benchmark against which the robustness of each methodology is assessed. A sensitivity analysis on main productivity factors concludes the research. The preliminary results indicate that equipment manufacturers' methods are more optimistic and present higher sensitivity to specific productivity factors (e.g. swing angle), whereas the German-oriented approaches are more conservative with less variability due to differing productivity factors. *Keywords:* construction productivity, estimation, excavation, statistical analysis.

References

- [1] Ayele A., Fayek A. *A framework for total productivity measurement of construction projects*. Canadian Journal of Civil Engineering 2019, Vol. 46(3), pp. 195-206.
- [2] Bauer, H. *Bauleistung*. 3rd ed.; Springer, Berlin, 2007.
- [3] BML. *Handbuch BML: Daten für die Berechnung von Baumaschinen-Leistungen*. Zeittechnik Verlag, Neu-Isenburg, 1983.
- [4] Caterpillar. *Caterpillar Performance Handbook*. 46th ed. Caterpillar Inc., Illinois USA, 2016.
- [5] Dixit S., Mandal S.N., Thanikal J.V. and Saurabh K. *Evolution of studies in construction productivity: A systematic review (2006-2017)*. Ain Shams Engineering Journal 2019, 10(3), pp. 555-564.
- [6] Kotte G. *Ermittlung der Nutzforderleistung von Hydraulikbaggern*. TIS Tiefbau Ingenieurbau Strassenbau, Bertelsmann Fachzeitschriften, 1997.
- [7] Panas A., Pantouvakis J.P. *Comparative analysis of operational coefficients' impact on earthmoving operations*. Engineering Construction and Architectural Management 2010, Vol. 17(5), pp. 461-475.
- [8] Panas A., Pantouvakis J.P. *Evaluating research methodology in construction productivity studies*. The Built and Human Environment Review 2010, Vol. 3(1), pp. 63-85.
- [9] Song S., Marks E., Pradhananga N. *Impact variables of dump truck cycle time for heavy excavation construction projects*. KICEM Journal of Construction Engineering and Project Management 2017, Vol. 7(2), pp. 11-18.

Some Aspects of Disciplinary Liability for Corruption Offenses

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Abstract

The article investigates some aspects of disciplinary liability for corruption offenses in Ukraine. The application of disciplinary liability for corruption offenses is analysed to improve the anti-corruption legislation of Ukraine. Fighting corruption is one of the main problems of the country, which should consider certain directions of European integration. Corruption includes a set of various offenses, in particular crimes, administrative and disciplinary offenses, which together pose a threat to national security and, violate fundamental rights and freedoms. The analysis of disciplinary liability for corruption offenses in Ukraine demonstrated that the main problems of liability for corruption offenses are related to the imperfections of courts, delaying the judicial process, and disadvantages of Ukrainian anti-corruption laws. These problems could be solved by establishing tougher measures of liability for corruption and disciplinary liability in the form of dismissal for committing administrative offenses related to corruption. Disciplinary liability in the form of dismissal is a consequence of bringing a person to criminal and administrative liability for corruption offenses. Such responsibility should apply not only to civil servants, but also to local government officials. Relevant changes to the legislation will reduce the number of offenses and in general reduce the level of corruption in Ukraine.

Keywords: disciplinary liability, corruption offenses, legislation of Ukraine.

References

- [1] The Verkhovna Rada of Ukraine (2014) The Law of Ukraine 'On the prevention of corruption'. Available online: <https://zakon.rada.gov.ua/laws/show/1700-18#Text> (accessed April 15, 2021).
- [2] The Verkhovna Rada of the USSR (1984) Code of Ukraine on Administrative Offenses. Available online: <https://zakon.rada.gov.ua/laws/show/80731-10/conv#n1813> (accessed April 15, 2021)
- [3] The Verkhovna Rada of the USSR (1971) Labor Code of Ukraine. Available online: <https://zakon.rada.gov.ua/laws/show/322-08#Text> (accessed April 15, 2021)
- [4] The Verkhovna Rada of Ukraine (2015) The Law of Ukraine 'On Civil Service'. Available online: <https://zakon.rada.gov.ua/laws/show/889-19#Text> (accessed April 15, 2021).

Significant Green Retrofit Technologies: A Perspective of Sustainability Pillars

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Abstract

Green Retrofit (GR) technologies have been introduced as one of the solutions to achieve sustainability in existing buildings. However, the significance of GR technologies is varied with their implications on sustainability pillars: environmental, social, and economic. Hence, this study was carried out to identify significant technologies in terms of each individually as well as all three pillars. A survey among a sample of thirty (30) experts who have involved in green building activities, having sound knowledge about GR technologies offered their views on the relative significance of those technologies using the mean and standard deviation values. According to analyses, most of the significant technologies were in the main category of energy & atmosphere (E&A) and water efficiency (WE) and contributing to sustainability from all perspective. The top four technologies include use of solar energy power generation systems, energy-efficient equipment, biomass boiler, and green roof technology. However, the level of significance of GR technologies varies according to selected sustainability pillar (s). Therefore, the study recommends that the sustainability principles should be one of the criteria along with others in selection of appropriate GR technologies for a given context.

Keywords: Green Retrofit, sustainability, sustainability criteria, technologies.

References

- [1] World Green Building Council. *The Business Case for Green Building: A Review of the Costs and benefits for Developers, Investors and Occupants*, WGBC 2013.
- [2] Liu Z., Liu Y., He B., Xu W., Jin G., Zhang X. *Application and suitability analysis of the key technologies in nearly zero energy buildings in China*. Renewable and Sustainable Energy Reviews 2019, Vol. 101, pp. 329-345.
- [3] Tan Y., Liu G., Zhang Y., Shuai C., Shen G.Q. *Green retrofit of aged residential buildings in Hong Kong: A preliminary study*. Building and Environment 2018, Vol. 143, pp. 89-98.
- [4] Hong Y., Deng W., Ezeh C.I., Peng Z. *Attaining sustainability in built environment: Review of green retrofit measures for existing buildings*, Earth and Environmental Science 2019, Vol. 227(4), pp. 42-51.
- [5] Li J., Ng S.T., Skitmore M. *Review of low-carbon refurbishment solutions for residential buildings with particular reference to multi-story buildings in Hong Kong*. Renewable and Sustainable Energy Reviews 2017, Vol. 73, pp. 393-407.
- [6] Bazar B., Park M., Lee H., Yoon I.S., Cho J. *Determining retrofit technologies for building energy performance*. Journal of Asian Architecture and Building Engineering 2020.
- [7] Chidiac S.E., Catania E.J.C., Morofsky E., Foo S. *Effectiveness of single and multiple energy retrofit measures on the energy consumption of office buildings*. Energy 2011, Vol. 36, pp. 5037-5052.
- [8] Verbeeck G., Hens H., *Energy savings in retrofitted dwellings: economically viable?*. Energy and Buildings 2005, Vol. 37, pp. 747-754.
- [9] Dascalaki E., Santamouris M. *On the potential of retrofitting scenarios for offices*. Building and Environment 2002, Vol. 37(6), pp. 557-567.

Model of Decision-Making Instrument for Alternate Technical Means in the Area of Aerial Work

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Abstract

The paper is a research result of recent publications of the same authors regarding the use of alternate means in aerial work. It presents general assumptions and 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, but its results can be used in a wide range of aerial work. Specific conditions for the chosen area induce the formation of the base of rules and the base of knowledge in applying alternative technical means. It will be essential to prepare the approximate inference standards leaning on insecure or incomplete knowledge. 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. The presented method of using machine learning for decision making in that area gives a possibility of model development and innovation in aerial work.

Keywords: aerial work, service provision effectiveness, process management, air services, air-services, Unmanned Aircraft Services (UAV/RPAS), alternative technical means.

References

- [1] Kaźmierczak J., Piechoczek E. *Model idea of assist comparative estimation selected service processes with utilization of optional technical means*; Publisher: PTZP, Zakopane, Poland, 2016.
- [2] Hanah Corona – *Ofil Systems UV advantage brochure*.
- [3] *Process treatment in management: Manuscript. T. 1.*; SGH Warsaw School of Economics, Warsaw, Poland, 2004.
- [4] Skrzypek E. *Process management in company*; Wolters Kluwer, Warsaw, Poland, 2010.
- [5] Shaoqing R., Kaiming H., Ross G., Jian S. *Faster R-CNN: Towards real-time object detection with region proposal networks*; In Advances in Neural Information Processing Systems; Cortes C, Lawrence ND, Lee DD, Sugiyama M, Garnett R Eds.; Curran Associates, Inc., Vol. 28, 2015, pp. 91-99.
- [6] Lin T., Maire M., Belongie S.J., Bourdev L.D., Girshick R.B., Hays J., Perona P., Ramanan D., Dollár P., Lawrence Zitnick C.L. *Microsoft COCO: Common Objects in Context*. CoRR, abs/1405.0312, 2014.
- [7] Goodfellow I., Bengio Y., Courville A. *Deep Learning*; MIT Press, 2016. <http://www.deeplearningbook.org>.
- [8] Dai J., Li Y., He K., Sun J. *R-FCN: Object detection via region-based fully convolutional networks*. Advances in neural information processing systems 2016, p. 379-387.
- [9] Liu W., Anguelov D., Erhan D., Szegedy C., Reed S., Fu C.-Y., Berg A.C. *SSD: Single shot multibox detector*. In European conference on computer vision, Springer, 2016, pp. 21-37.
- [10] J. R.J., Farhadi A. *YOLOv3: An incremental improvement*. arXiv preprint, 2018. arXiv:1804.02767
- [11] Pił'a J., Kozuba J. *Safety of complex aircraft ergatic systems*. Transport Problems 2019, Vol. 14(2), pp. 101-110.
- [12] Osowski S. *Method and instruments of data exploration* Ed. 1; Publisher BTC, Legionowo, Poland, 2013.

Support for the Development of Technological Innovations at an R&D Organisation

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Abstract

The paper is focused on the problem of supporting the management of the processes of the generation, realisation, and the implementation of technological innovations. It is aimed at presenting an original methodology for supporting the development of technological innovations at an R&D organisation. The development of the methodology is preceded by extensive literature review and case study analyses, and is based on the author's practical experience in managing research project. The methodology assumes the integration of the triad of tools, i.e. future research (foresight), technology assessment, and organisational capabilities assessment. An original matrix approach is adopted where the individual tools in the triad are applied in a way enabling their mutual complementation at successive stages of the innovation process. It is an original contribution to the body of knowledge as an integrated use of the tools in question is still a rare phenomenon and the identified single examples relate mainly to combining only two out of the three considered tools. Furthermore, the tools are not used comprehensively, but only selectively, e.g., at some stages of innovative processes. The usefulness of this methodology has been demonstrated in the course of executing strategic research projects in the field of machine construction and maintenance.

Keywords: R&D organisation, technological innovations, future research, technology assessment, organisational capabilities assessment.

References

- [1] 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, Vol. 71(6), pp. 579-598.
- [2] Keupp M.M., Palmié M., Gassmann O. *The strategic management of innovation: a systematic review and paths for future research*, International Journal of Management Reviews 2012, Vol. 14(4), pp. 367-390.
- [3] Kuhlmann S. *Foresight and Technology Assessment as Complementing Evaluation Tools*. In: RTD Evaluation Toolbox – Assessing the Socio-Economic Impact of RTD-Policies – Strata Project HPV 1 CT 1999 – 00005; Fahrenkrog G., Polt W., Rojo J., Tübke A., Zinöcker K. Eds.; European Commission, Joint Research Centre, Institute for Prospective Technological Studies (IPTS), 2002.
- [4] Loveridge D. *Foresight, Technology Assessment and Evaluation – Synergy or disjunction?* Ideas in Progress. Paper Number 5. ASTPP meeting, Amsterdam, 1996.
- [5] Nerkar A., Paruchuri S. *Evolution of R&D capabilities: The role of knowledge networks within a firm*. Management Science 2005, Vol. 51(5), pp. 771-785.
- [6] Poteralska B. *Decision support system in the area of generating innovative research projects of the future*. Procedia Engineering 2017, Vol. 182, pp. 587-593.
- [7] Porter A.L. *Technology assessment*. Impact Assessment 1995, Vol. 13.
- [8] 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”, 2002.
- [9] Taylor F.W. *The principles of Scientific Management*, Harper & Brothers, New York, USA & London, UK, 2011

Technology Commercialisation Processes at R&D Organisations

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Abstract

The problems related to R&D results commercialisation constitute an area of in-depth analyses due to a significant importance of applying research results in the economy, high level of their complexity and numerous barriers hampering effective application of innovations in enterprises. The remedy for overcoming or limiting the existing barriers are effectively conducted commercialisation processes with the use of dedicated models. Although commercialisation processes models are a subject of theoretical investigations and practical applications, there is a research and empirical gap concerning commercialisation processes models for the use by R&D organisations. The article is aimed at presenting a proposal of such a model, composed of several hybrid submodels, meant for the use at R&D organisations, based on the input criteria (the type of innovation, the production scale) conditioning the choice of the commercialisation path (sale, licence, service, spin off), while taking into account the sets of dedicated marketing tools (ATL, BTL). The model, with a focal point of an R&D result (innovation), comprises the phase from the idea generation (R&D concept) to the phase of its marketisation (launch). The article presents good practices on the use of the developed model while implementing R&D results in the fields of, e.g., materials engineering and optomechatronics.

Keywords: commercialisation, R&D organisation, models of the commercialisation process, marketing tools.

References

- [1] Bernardos Barbolla A.M., Corredera J.R.C. *Critical Factors for Success in University-Industry Research Projects*, Technology Analysis & Strategic Management 2009, Vol. 21(5), pp. 599-616.
- [2] Budi A.A., Aldianto L. *Research and Development – Commercialization Bridge: A Refined Model*. The Asian Journal of Technology Management 2020, Vol. 13(1), pp. 47-62.
- [3] Dehghani T. *Technology commercialization: From generating ideas to creating economic value*. International Journal of Organizational Leadership 2015, Vol. 4., pp. 192-199.
- [4] Gwarda-Gruszczyńska E. *Modele procesu komercjalizacji nowych technologii w przedsiębiorstwach. Uwarunkowania wyboru – kluczowe obszary decyzyjne*. Wydawnictwo Uniwersytetu Łódzkiego, Łódź, Poland, 2013.
- [5] Jung W. *Barriers to technology transfer and their elimination*, Journal of Technology Transfer 1980, Vol. 4(2), pp. 15-25.
- [6] Kirchberger M.A., Pohl L. *Technology commercialization: A literature review of success factors and antecedents across different contexts*. The Journal of Technology Transfer 2016, Vol. 41(5), pp. 1077-1112.
- [7] Maarse J.H., Bogers M., *An integrative model for technology-driven innovation and external technology commercialization*. In: Open Innovation at Firms and Public Administrations: Technologies for Value Creation; de Pablos Heredero C., López D. Eds.; Hershey, PA: IGI Global, 2012.
- [8] Meijer L.L.J., Huijben J.C.C.M., van Boxstael A., Romme A.G.L. *Barriers and drivers for technology commercialization by SMEs in the Dutch sustainable energy sector*, Renewable and Sustainable Energy Reviews 2019, Vol. 112, pp. 114-126.
- [9] Walasik M. *Marketing orientation of scientific-research units as support for the process of commercialization of R&D results*, MINIB 2018, Vol. 30(4), pp. 75-90.

Threats to the Security of Foreign Trade in the Context of the Global Pandemic

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Abstract

The authors address the main risks and threats faced by businesses oriented towards external markets. Since the national economies of most of the world are affected by crises caused by forced quarantine, the identification of threats to business structures is a pressing issue. The research was carried out on the example of the corporation «Kernel Group», which includes JSC «Poltava oil extraction plant – Kernel Group», JSC «Kernel – Trade» and other structures. An analysis of the risks associated with external economic activities in the context of the ongoing global pandemic revealed an increase. In particular, the risk of increasing the economic egoism of highly developed countries is a desire to protect, first and foremost, their own national economies from the negative impact of the pandemic, as well as the risk of recognizing quarantine as a force majeure for business. The further research will focus on the development of methodological tools of risk management for business-oriented foreign economic activities, under conditions of global pandemic and political instability in individual regions of the world using the model «Three Lines of Protection» (3LOD) and DRG (dynamic risk management).

Keywords: economic risks, pandemics, external business, export, risk management.

References

- [1] Official Kernel Group website. Available online: <https://www.kernel.ua>.
- [2] Official site of JSC Poltava oil extraction plant-Kernel Group. Available online: <http://poez-pnt.kernel.ua>.
- [3] Information on the impact of measures to support national economies in the context of the COVID-19 pandemic on the export conditions of Ukrainian products. Available online: URL: <https://lcci.com.ua/wp-content/uploads/2020/04/Informatsiia-shchodo-vplyvu-zakho-divz--pidtrymky-natsionalnykhekonomik-vumovandemikhpani--COVID1919na-umrainovy-eksportu-ukskskoi-produktsii>.
- [4] Law of Ukraine On Introduction of Amendments to Certain Legislative Acts of Ukraine aimed at Prevention of Occurrence and Spread of Coronavirus Disease (COVID-19). Available online: <https://zakon.rada.gov.ua/go/530-20>
- [5] Law of Ukraine On Chambers of Commerce and Industry in Ukraine». Available online: https://kodeksy.com.ua/pro_torgovo-promislovi_palati_v_ukrayini/14-1.htm
- [6] Zoidze D.G., Gubarev A.A. *Evolution of risk management approaches in organizations*. Business Inform 2021, Vol. 4, pp. 276-285.
- [7] Murray M. *Dynamic Risk Governance: Linking Strategy and Risk Management*. Sorporate Sompliance Insights 2021. Available online: <https://www.corporatecomplianceinsights.com> (accessed February 15, 2021).
- [8] Tysiac K. *Three Lines Model for Risk Management gets major update*. Journal of Accountancy 2020.

Assessment of Construction Risks in Projects Funded by External Sources in Jordan During the COVID-19 Pandemic

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Abstract

In general, construction projects suffer different risks during their lifecycles, depending on the project specifications and environment. The COVID-19 pandemic has provided many challenges and difficulties for the construction industry. This study presents an assessment of 47 major risks affecting construction projects funded by external sources. The studied risks were categorized by using PESTLE technique that includes political, economic, social, technological, legal, and environmental risks. A questionnaire survey was conducted on thirty-four construction organizations who implemented or supervised projects funded by external sources. The six risk groups were assessed in terms of the probability of occurrence and the severity on both project cost and project schedule. In conclusion, the results showed that the environmental and legal risks are the most important groups of risks according to the respondents' opinions. The results showed that the most important risk factors are the difficulty of issuing licenses and permits, and the inappropriate definition of scope of work. This study indicates the difficulties and risks faced by construction organizations involved with construction projects funded by external sources during the COVID-19 pandemic. This will help managers and fund providers to make decisions regarding risks during difficult health conditions. Although this study was conducted in Jordan, it can be applied in other countries with similar properties and conditions.

Keywords: construction projects, risk factors, COVID-19 pandemic, crisis, external sources, PESTLE, questionnaire survey.

References

- [1] Abbasi G.Y., Abdel-Jaber M.S., Abu-Khadejeh A. *Risk analysis for the major factors affecting the construction industry in Jordan*. Emirates Journal for Engineering Research 2005, Vol. 10(1), pp.41-47.
- [2] Abdul-Rahman H., Loo S.C. Wang C. *Risk identification and mitigation for architectural, engineering, and construction firms operating in the Gulf region*. Canadian Journal of Civil Engineering 2012, Vol. 39(1), pp. 55-71.
- [3] Akintoye A.S., MacLeod M.J. *Risk analysis and management in construction*. International journal of project management 1997, Vol. 15(1), pp.31-38.
- [4] Al-Amer R.M., Malak M.Z., Aburumman G., Darwish M., Nassar M.S., Darwish M. Randall S. *Prevalence and predictors of depression, anxiety, and stress among Jordanian nurses during the coronavirus disease 2019 pandemic*. International Journal of Mental Health 2021, pp.1-12.
- [5] AlSabah R., Refaat O. *Assessment of construction risks in public projects located in the state of Kuwait*. Journal of Engineering Research 2019, Vol. 7(3).
- [6] Andi, *The importance and allocation of risks in Indonesian construction projects*. Construction Management and Economics 2006, Vol. 24(1), pp.69-80.

Effect of Zirconium Addition on the Wear Resistance of Aluminum Grain Refined by Ti-B: A Three Dimensional Presentation

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Abstract

In this paper a review analysis and the presentation of three-dimensional effect of addition of zirconium, Zr, on the wear resistance of commercial aluminum using a pin-on-disc apparatus at different loads, speeds, and periods and the loss of mass was measured at each condition then taken as a criterion for comparison. Al-Zr master alloy was prepared followed by Al-Zr, Al-Ti-B, and Al-Ti-B-Zr micro alloys preparations. After the casting process that produced cylindrical workpieces that were used in the wear test, a modified and calibrated wear tester machine was used. The obtained results, presented three-dimensionally, indicated that the mass loss is the function of the three parameters: load, speed, and time. The speed was found to be the main affecting factor, where the grain refined alloy is recommended to work under the medium speed and load conditions for prolonged service. The wear resistance of aluminum is appreciably enhanced by the addition of Ti-B as a grain refiner, but is deteriorated by adding Zr. This work is original in that it was conducted on a set of Al micro alloys and the study was performed three-dimensionally i.e taking into account load, speed, and time.

Keywords: aluminum, grain refinement, titanium-boron, zirconium, three dimensional, wear resistance.

References

- [1] William Callister D. *Materials Science and Engineering an Introduction* 7th edition; John Wiley, New Jersey, USA, 2007.
- [2] Jones G.H., Pearson J. Factors Affecting the Grain Refinement of Aluminum Using Titanium and Boron Additives *Met. Trans. B*, 1976, p. 223-234.
- [3] Cibula A. J. *Institute of Metals*, Vol. 80 (1951-1952), p. 1-15.
- [4] Açmaz E. *Experimental analysis and modeling of wear in rocket rail launchers* [Msc thesis]. Çankaya Ankara: Middle East Technical University; 2011
- [5] Abdel-Hamid, A.A. *Effect of other elements on the grain refinement of Al by Ti or Ti and B*. *International Journal of Materials Research* 1989, Vol. 80(8), pp. 566-569.
- [6] Johnson M. Influence of Zr on the Grain Refinement of Al Z. *Metallkd* 1989, Vol. 85, pp. 786-789.
- [7] Jones G.P., Pearson J. *Factors Affecting the Grain Refinement of Aluminum Using Titanium and Boron Additives met. Trans. B* 1976) p. 223-234.
- [8] Abdel Hamid A.A., Zaid A.I.O. *Poisoning .of Grain Refinements Some Aluminum Alloys*. In *Current Advances in Mechanical Design and Production*, 2000, MDP-6, p. 323-331.
- [9] Zaid A.I.O., Abdel-Hamid A.A. *Poisoning of Grain Refinement of Some Aluminum Alloys In Current Advances in Mechanical Design and Production*, 7th, Cairo Intern. The conference, Cairo, 2000, p. 331-338.

Challenges and Barriers to Connect Manufacturing Continuous Improvement Processes to Industry 4.0 Paradigms

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Abstract

The article exposes the difficulties in integrating the vectors 'industry practices 4.0' and 'World-Class Manufacturing' due to the rapid expansion of production systems and the increasingly complex data monitoring. The methodology applied was a study of multiple cases, with the aid of a semi-structured questionnaire. Responses from 16 companies were analyzed. The companies of different expertise, all of large size represented five countries and three continents. The results show when organizations' strategy is linked to industry 4.0 practices and the World-Class Manufacturing method. The outcomes also demonstrate that human resources are essential in this integration. However, the practices of continuous improvement do not keep up with the speed of development that the industry 4.0 model proposes, requiring studies directed to the vectors 'World-Class Manufacturing' and 'industry practices 4.0'. Although if there is a coexistence of improvement and innovation in world-class manufacturers, the literature has not yet provided a complete understanding of how this coexistence can be achieved at the manufacturing level. Like this, the authors of the article present the main actions to overcome these barriers. The conclusions drawn suggest that the barriers found for the increasing progress of these procedures, such as the costs associated with the use of technologies, the lack of knowledge of the methods and tools applied, the lack of trained and qualified human resources and the resistance of people to the use and application of the new practices adopted, has been shown to be robust in the face of the desired progress. *Keywords:* Industry 4.0, World-Class Manufacturing (WCM), continuous improvement, strategy, case studies, human resources.

References

- [1] Dalenogare L.S., Benitz G.N., Fabián A.G., Ayala N.F. *The expected contribution of Industry 4.0 technologies for industrial performance*. Intern. Journal of Production Economics 2018, Vol. 204, pp. 383-394.
- [2] Davies R., Coole T., Smith A. *Review of socio-technical considerations to ensure successful implementation of Industry 4.0*. Procedia Manufacturing 2018, Vol. 11, pp. 1288-1295.
- [3] Dubey R., Gunasekaran A., Childe S.J., Wamba S.F., Papadopoulos T. *The impact of big data on world-class sustainable manufacturing*. International Journal Advanced Technology 2016, Vol. 84, pp. 631-645.
- [4] Fettermann D.C., Cavalcante C.G.S., Almeida T.D., Tortorella G.L. *How does Industry 4.0 contribute to operations management?* Journal of Industrial and Production Engineering 2018, Vol. 35, Vol. 4, pp. 255-268.
- [5] Ghobakhloo M. *The future of manufacturing industry: a strategic roadmap toward Industry 4.0*. Journal of Manufacturing Technology Management 2018, Vol. 29, Vol. 6, pp. 910-936.
- [6] Jabbour A.B.L.S., Jabbour C.J.C., Foropon C., Godinho Filho M. *When titans meet – Can industry 4.0 revolutionise the environmentally-sustainable manufacturing wave? The role of critical success factors*. Technological Forecasting & Social Change 2018, Vol. 132, pp. 18-25.

Ambidextrous Governance Impact on Supply Chain Performance – Buyer and Supplier Perspective

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Abstract

One of the most important issues in today's supply chain management is a choice of governance mechanisms that foster receiving the highest possible supply chain performance. Supply chain governance consisted mainly of two dimensions: contractual and relational. The substitute perspective emphasises that governance mechanisms are substitutes. However, in the dominant perspective governance mechanisms function rather as complements. The interaction of relational and contractual governance is called ambidextrous governance. The problem of how different supply chain governance mechanisms affect supply chain performance it is still not solved. Additionally, the research shows different impact of governance mechanisms on collaboration in supply chain and its influence on performance for buyers and suppliers. Therefore, the purpose of the study is to analyse the ambidextrous governance impact on supply chain performance. Models taking into account buyers and suppliers' perspective were developed. The study is based on Computer Assisted Telephone Interviews among buyers and suppliers representing manufacturing companies. The results prove that supply chain performance is influenced by relational governance in case of buyers and suppliers. Furthermore, the presence of a second-order construct called ambidextrous governance and its effect on supply chain performance for suppliers was proved. However, in case of contractual governance the impact on performance is significant only for suppliers.

Keywords: supply chain, ambidextrous governance, relational governance, contractual governance, supply chain performance, buyers, suppliers, model.

References

- [1] Blome C., Schoenherr T., Kaesser M. *Ambidextrous Governance in Supply Chains: The Impact on Innovation and Cost Performance*. Journal of Supply Chain Management 2013, Vol. 49, No. 4, pp. 59-80.
- [2] Cao Z., Lumineau F. *Revisiting the interplay between contractual and relational governance: a qualitative and meta-analytic investigation*. Journal of Operations Management 2015, Vol. 33-34, pp. 15-42.
- [3] Chi M., Zhao J., George J. F., Li Y., Zhai S. *The influence of inter-firm IT governance strategies on relational performance: The moderation effect of information technology ambidexterity*. International Journal of Information Management 2017, Vol. 37(2), pp. 43-53.
- [4] Dyer J.H., Singh H. *The relational view: cooperative strategy and sources of interorganizational competitive advantage*. The Academy of Management Review 1998, Vol. 23(4), pp. 660-679.
- [5] Raue J.S., Wieland A. *The interplay of different types of governance in horizontal cooperations: A view on logistics service providers*. The International Journal of Logistics Management 2015, Vol. 26(2), pp. 401-423.
- [6] Um K.-H., Oh, J.-Y. *The interplay of governance mechanisms in supply chain collaboration and performance in buyer-supplier dyads: substitutes or complements*. International Journal of Operations & Production Management 2020, Vol. 40(4), pp. 415-438.
- [7] Zhang X., Aramyan L.H. *A conceptual framework for supply chain governance: An application to agri-food chains in China*. China Agricultural Economic Review 2009, Vol. 1(2), pp. 136-154.
- [8] Zhang Q., Jin J.L., Yang D. *How to enhance supplier performance in China: interplay of contracts, relational governance and legal development*. International Journal of Operations & Production Management 2020. Vol. 40(6), pp. 777-808.

Exercising Hybrid Statistical Tools GA-ANN and GA-ANFIS to Optimize Underwater Friction Stir Welding Process Parameters for Tensile Strength Improvement

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Abstract

This work investigates the tensile strength (σ_{UTS}) of tests ASTM D3039 specified parts manufactured using UWFSW by Al 6082-T6 material. Three parameters were varied in the fabrication of test specimens: rotational speed from 1000 to 1800 rpm, traveling speed from 4 to 10 mm/s, and shoulder diameter from 10 to 20 mm. Using a polynomial fitting model of second-order, hybrid optimization methodologies such as artificial neural network- genetic algorithm (ANN-GA), and adaptive neuro fuzzy interface framework – genetic algorithm – (ANFIS-GA) are also used to optimise these process parameters. ANN-GA achieved the highest precision of 98.99 %, resulting in optimum parameters like rotational speed 1800 rpm, travelling speed 4 mm/s, and shoulder diameter 15 mm to produce a maximum tensile strength of 199.0212 MPa. The hybrid models developed could be used to predict and maximise specific process parameters and impacts for a variety of industrial situations.

Keywords: underwater friction stir welding, ANN-GA, ANFIS-GA, RSM-GA, tensile strength.

References

- [1] Halverson B., Hinrichs J. F. *Friction Stir Welding (FSW) of Littoral Combat Ship Deckhouse Structure*. Journal of Ship Production 2007, Vol. 23(3), pp. 161-163.
- [2] Patil H.S., Soman S.N. *Experimental study on the effect of welding speed and tool pin profiles on AA6082-O aluminium friction stir welded butt joints*. International Journal of Engineering, Science and Technology 2010, Vol. 2(5), pp. 268-275.
- [3] Sabry A. *Comparison of Mechanical Characteristics of Conventional and Underwater Friction Stir Welding of AA 6063 Pipe Joints*, International Review of Aerospace Engineering 2020, Vol. 14(1).
- [4] Palanivel R., Mathews P. K., Murugan N. *Optimization of Process Parameters to Maximize Ultimate Tensile Strength and Hardness of Underwater Friction Stir Welded Aluminium Alloys using Fuzzy Logic*. Modern Concepts in Material Science 2020, Vol. 3(1), p. 73-78.
- [5] Mahto R.P., Gupta C., Kinjawadekar M., Meena A., Pal S.K. *Weldability of AA6061-T6 and AISI 304 by underwater friction stir welding*. Journal of Manufacturing Processes 2019, Vol. 38, p. 370-386.
- [6] Bijanrostami K., Barenji R. V., Hashemipour, M. *Effect of Traverse and Rotational Speeds on the Tensile Behavior of the Underwater Dissimilar Friction Stir Welded Aluminum Alloys*. Journal of Materials Engineering and Performance 2017, Vol. 26(2), pp. 909-920.
- [7] Paramaguru D., Pedapati S. R., Awang M. *A Review on Underwater Friction Stir Welding (UFSW)*. In The Advances in Joining Technology Springer, Singapore, 2017, pp. 71-83.
- [8] Sakurada D., Katoh K., Tokisue H. *Underwater friction welding of 6061 aluminum alloy*, Journal of Japan Institute of Light Metals 2002, Vol. 52(1), pp. 2-6.
- [9] Fratini L., Buffa G., Shivpuri R. *In-process heat treatments to improve FS-welded butt joints*, International Journal of Machine Tools and Manufacture 2008, Vol. 10(3), pp. 42-53.

Extended EDAS and VIKOR Method for Fuzzy Multi-Criteria Decision-Making: An Application to Underwater Friction Stir Welding

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Abstract

This work provides a method to help optimize the underwater friction stir welding (UFSW) process of pipes based on the fuzzy multi-criteria decision making (FMCDM) methodology. In the optimization phase ambiguity and vagueness are dealt with using linguistic variables parameterized by triangular fuzzy numbers. In the UFSW an important consideration is the cooling effect during the process on the surrounding water. A study is being conducted to conclude and optimize the effects of the UFSWoP process parameters on the welded joint's mechanical properties. Experiments were performed at three levels of three parameters: tool shoulder diameter tool, tool rotational speed and travel speed. For optimization, the MCDM methods were applied as an approach for selecting the optimal values of the parameters. Using MCDM in optimizing the UFSW process is rare and has a limited number of publications. The MCDM techniques used are the Evaluation Based on Distance from Average Solution (EDAs), VlseKriterijumska Optimizacija I Kaompromisno Resenje (VIKOR), hybrid Fuzzy – EDAS and hybrid Fuzzy -VIKOR to find the optimum process parameters which maximize the values of responses: the UTS and the VHN of the welded joint. Results showed that hybrid Fuzzy-EDAS and Fuzzy-VIKOR theory can solve the limitations of using EDAs and VIKOR when uncertainty problems exist in the data. For the used parameter ranges the optimum values were 20 mm, 1800 RPM and 4 mm / min respectively for shoulder diameter, rotational speed and travel speed.

Keywords: UWFSW, aluminium pipes, EDAS , VIKOR, hybrid Fuzzy -EDAS, hybrid Fuzzy -VIKOR.

References

- [1] El-Kassas A.M. Sabry I. *Optimization of the Underwater Friction Stir Welding of Pipes Using Hybrid RSM-Fuzzy Approach*. International Journal of Applied Engineering Research 2019, Vol. 14(24), pp. 4562-4572.
- [2] Na S.J., Lee H.J. *A study on parameter optimization in the circumferential GTA welding of aluminium pipes using a semi-analytical finite-element method*, Journal of materials processing technology 1996, Vol. 57(1-2), pp. 95-102.
- [3] Jain R., Kumari K., Kesharwani R.K., Kumar S., Pal S.K., Singh S.B., Samantaray A.K., *Friction stir welding: scope and recent development*. In Modern Manufacturing Engineering 2015, pp. 179-229.
- [4] El-Kassas A.M., Sabry I., *Using Multi Criteria Decision Making in Optimizing the Friction Stir Welding Process of Pipes: A Tool Pin Diameter*. International Journal of Applied Engineering Research 2019, Vol. 14(18).
- [5] Upadhyay P., Reynolds A. P. *Effects of thermal boundary conditions in friction stir welded AA7050-T7 sheets*. Mater Sci Eng 2019, Vol. 527, pp. 1537-1543.
- [6] Liu H. J., Zhang H. J., Yu L. *Effect of welding speed on microstructures and mechanical properties of underwater friction stir welded 2219 aluminum alloy*. Materials & Design 2011, Vol. 32(3), pp. 1548-1553.
- [7] Zhang H. J., Liu H. J., Yu L. *Microstructure and mechanical properties as a function of rotation speed in underwater friction stir welded aluminum alloy joints*. Material and Design 2011, Vol. 32, pp. 4402-440.
- [8] D.B. Kishta E.E., *Experimental investigation of underwater friction-stir welding of 5083 marine-grade aluminum alloy*. Proceedings of IMechE Part B: Journal of Engineering Manufacture 2014.
- [9] Prabha K.A., Putha P.K., Prasad B.S. *Effect of Tool Rotational Speed on Mechanical Properties of Aluminium Alloy 5083 Weldments in Friction Stir Welding*. Materials Today: Proceedings 2018, Vol. 5(9), pp.18535-18543.

Significant Factors Affecting the Life Cycle Cost Elements of a Building

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Abstract

Life Cycle Cost (LCC) is a vital decision-making tool for realization of investments. However, it is often challenging to forecast the LCC of a building as it comprises several elements which are influenced by a range of factors. Hence, this study was carried out to identify the significant factors affecting LCC elements of buildings. Twenty-six factors identified through a comprehensive literature review were presented to thirty-four experts in the construction industry through a questionnaire survey to collect their views on the significance of those factors. Weighted mean was calculated for each factor to determine the relative significance and thereby identify the affecting level of each factor for LCC elements of buildings. The six most significant factors include: plan shape of the building, size of the building, number of occupants, quality of materials and equipment used, the function of the building, and technology used. Further, the cost of most elements, such as utility, administration, services maintenance, cleaning, external work, and maintenance management is highly influenced by the function of the building. Hence, the study recommends that having a clear understanding on the factors affecting LCC elements is important to proper LCC planning.

Keywords: building, factors influencing LCC, LCC, LCC elements.

References

- [1] Norris G.A. *Integrating life cycle cost analysis and LCA*. The International Journal of Life Cycle Assessment 2001, Vol. 6, pp. 118-120.
- [2] Fuller S. *Life-Cycle Cost Analysis (LCCA)*; National Institute of Standards and Technology (NIST), 2016.
- [3] Gluch P., Baumann H. *The life cycle costing (LCC) approach: A conceptual discussion of its usefulness for environmental decision-making*. Building and Environment 2004, Vol. 39, no. 5, pp. 571-580.
- [4] Aye L., Bamford N., Charters B., Robinson J. *Environmentally sustainable development: a life-cycle costing approach for a commercial office building in Melbourne, Australia*. Construction Management and Economics 2000, Vol. 18(8), pp. 927-934.
- [5] Henn C.L. *The new economics of life cycle thinking*; Proceedings of the 1993 IEEE International Symposium on Electronics and the Environment, Arlington, VA, USA, 2002.
- [6] Sterner E. *Green procurement of buildings: estimation of life-cycle cost and environmental impact*, Doctoral dissertation, Luleå: Luleå Tekniska Universitet, 2002.
- [7] Islam H., Jollands M., Setunge S. *Life cycle assessment and life cycle cost implication of residential buildings – A review*. Renewable and Sustainable Energy Reviews 2015, Vol. 42, pp. 129-140.
- [8] Shabniya V. *Factors affecting construction cost estimation of building projects*. International Journal of Recent Trends in Engineering and Research 2017, Vol. 3(4), pp. 379-387.
- [9] Meng X., Wang L., Currit N. *Morphology-based building detection from Airborne Lidar Data*, Photogrammetric Engineering & Remote Sensing 2009, Vol. 75(4), pp. 437-442.
- [10] Kamaruzzaman A.S., Sulaiman R., Peng C.Y. *Factors affecting housing maintenance cost in Malaysia*, Journal of Facilities Management 2010, Vol. 8(4), pp. 285-298.
- [11] Kerama N.S. *Factors affecting housing maintenance management cost in Kakamega Municipality*; Unpublished Postgraduate Diploma report in Housing Administration). University of Nairobi, Nairobi, Kenya, 2013.
- [12] Vanichavathana S., *Relationship between building characteristics and rental to support serviced apartment investment*, Pacific Rim Real Estate Society (PRRES) Conference, 2006, pp. 1-18.

Thinking and Shaping Industrie 4.0 Ecosystems for Sustainable and Resilient Futures

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Abstract

How can we think and shape collaborative manufacturing networks in digital ecosystems to support Sustainable Development Goals of the United Nations? Since the introduction of “Industrie 4.0” ten years ago – igniting the vision of a fourth Industrial Revolution – progress has been made in digitally connecting the shopfloor with the business level within smart factories. According to the new 2030 vision for Industrie 4.0, the collaboration between factories and complementary actors in flexible and globally networked value creation systems is at the forefront. An analysis of practice examples in that context revealed three development paths towards a digital, networked and sustainable manufacturing industry of the future. This article describes and analyses the collaborative vision and scenario building processes for Industrie 4.0 based on the concept of a multi-actor, multi-level and multi-sector policy approach. Key findings underpin the relevance of interpersonal relationships and networks based on mutual trust for successfully thinking and shaping futures in a participatory, systemic and integrative way. Based on some practical implications for designing collaborative manufacturing networks in digital ecosystems the article concludes with a call for collective action towards the Sustainable Development Goals to be achieved by the year 2030.

Keywords: Industrie 4.0, Sustainable Development Goals, futures, digital ecosystems, collaboration.

References

- [1] Pfeiffer S. *The Vision of “Industrie 4.0” in the Making – a Case of Future Told, Tamed, and Traded*. Nanoethics 2017, Vol. 11, pp. 107-121.
- [2] Plattform Industrie 4.0. *2030 Vision for Industrie 4.0. Shaping Digital Ecosystems Globally*; Federal Ministry for Economic Affairs and Energy, Berlin, Germany, 2019. Available online: <https://www.plattform-i40.de/PI40/Redaktion/EN/Downloads/Publikation/Vision-2030-for-Industrie-4.0.html> (accessed on 15 April 2021).
- [3] Plattform Industrie 4.0. *Sustainable production: actively shaping the ecological transformation with Industrie 4.0*; Federal Ministry for Economic Affairs and Energy, Berlin, Germany, 2020. Available online: <https://www.plattform-i40.de/PI40/Redaktion/EN/Downloads/Publikation/sustainable-production.html> (accessed on 15 April 2021).
- [4] Sautter B. *Futuring European industry: assessing the ManuFuture road towards EU re-industrialization*. Eur J Futures Res 2016, Vol. 4.
- [5] Clar G., Sautter B. *Thinking & Shaping Futures with Actors of the “Spitzencluster” MicroTEC Südwest. A Participatory Approach to Improving Policy Impact*. In *Technikfolgenabschätzung im politischen System*; Decker M., Bellucci S., Bröchler S., Nentwich M., Rey L, Sotoudeh M., Eds.; Nomos: Baden-Baden, Germany, 2014; pp. 163-170.

Exact Solution of a Variable Temperature Plate in a Porous Medium

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Abstract

This paper studies the heat transfer (free convection) over a variable temperature plate in porous medium. The governing differential equations are non-dimensionalized and solved by the Laplace transform technique. Exact solutions for the non-dimensional variables (velocity and temperature) with variable temperature plate are obtained. The solutions agree with the existing literature. The effects of temperature and velocity variations of the plate are analysed for different Prandtl number, Grashof number and for Newtonian and non-Newtonian fluids.

Keywords: free convection, porous medium, variable temperature, Laplace transform, exact solution.

References

- [1] Udell K.S. *Heat transfer in porous media considering phase change and capillarity – the heat pipe effect*. International Journal of Heat and Mass Transfer 1985, Vol. 28(2), pp. 485-495.
- [2] Pankow J.F., Johnson R.L., Hewetson J.P., Cherry J.A. *An evaluation of contaminant migration patterns at two waste disposal sites on fractured porous media in terms of the equivalent porous medium (EPM) model*. Journal of Contaminant Hydrology 1986, Vol. 1(1-2), pp. 65-76.
- [3] Whitaker S. *Flow in porous media I: A theoretical derivation of Darcy's law*. Transport in Porous Media 1986, Vol. 1(1), pp. 3-25.
- [4] Khaled A.-R.A., Vafai K. *The role of porous media in modeling flow and heat transfer in biological tissues*. International Journal of Heat and Mass Transfer 2003, Vol. 46(26), pp. 4989–5003.
- [5] Becker M., Fend T., Hoffschmidt B., Pitz-Paal R., Reutter O., Stamatov V., ... & Trimis D. *Theoretical and numerical investigation of flow stability in porous materials applied as volumetric solar receivers*. Solar Energy 2006, Vol. 80(10), pp. 1241-1248.
- [6] Wildenschild D., Sheppard A.P. *X-ray imaging and analysis techniques for quantifying pore-scale structure and processes in subsurface porous medium systems*. Advances in Water Resources 2013, Vol. 51, pp. 217-246.
- [7] Sheikholeslami M., Ellahi R., Ashorynejad H.R., Domairry G., Hayat T. *Effects of Heat Transfer in Flow of Nanofluids Over a Permeable Stretching Wall in a Porous Medium*. Journal of Computational and Theoretical Nanoscience 2014, Vol. 11(2), pp. 486-496.
- [8] Venkateswarlu B., Satya Narayana P.V. *Influence of Variable Thermal Conductivity on Mhd Casson Fluid Flow over a Stretching Sheet With Viscous Dissipation, Soret and Dufour Effects*. Frontiers in Heat and Mass Transfer (FHMT) 2016, Vol. 7(16).
- [9] Nazari S., Toghraie D. *Numerical simulation of heat transfer and fluid flow of Water-CuO Nanofluid in a sinusoidal channel with a porous medium*. Physica E: Low-Dimensional Systems and Nanostructures 2017, Vol. 87, pp. 134-140.

Multidimensional Aspects of Risk-Taking in Entrepreneurs: a Global Study

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Abstract

The current study presents in-depth analyses of five distinct risk dimensions concerning age, gender, country of origin and existence of an entrepreneur in the family. A unique aspect of this study was the repeated analyses for the same hypotheses, using data from three independent rounds of data collection. This design made it possible to identify inconsistencies in any data trends. Individuals who had an active enterprise had significantly higher scores for risk-taking propensity and profit-contingent risks than aspiring and non-entrepreneurs' groups across all three rounds of data collection. On the other hand, entrepreneurs did not have significantly different scores for risk aversion than the other two groups. A series of linear regression analyses indicated that younger males from a developing country and existence of an entrepreneur in a family had significantly higher risk-taking propensities. Inconsistencies in results for risk-enjoyment and creative risk dimensions may be better understood through qualitative, longitudinal research.

Keywords: entrepreneur, risk-taking, personality, entrepreneurial personality, social entrepreneur.

References

- [1] Bergmann H., Stephan U. *Moving on from nascent entrepreneurship: measuring cross-national differences in the transition to new business ownership*. Small business economics 2016, Vol. 41(4), pp. 945-959.
- [2] Belás J., Ključnikov A., Vojtovič S., Sobeková-Majková M. *Approach of the SME Entrepreneurs to Financial Risk Management about the Gender and Level of Education*. Economics and Sociology 2015, Vol. 8(4), pp. 32-42.
- [3] Calvo S., Morales A., Wade J. *The use of MOOCs in social enterprise education: an evaluation of a North-South collaborative FutureLearn program*. Journal of Small Business and Entrepreneurship 2018, Vol. 31(3), pp. 201-223.
- [4] Gomezel A.S., Rangus K. *An exploration of an entrepreneur's open innovation mindset in an emerging country*. Management Decision 2018, Vol. 56(9), pp. 1869-1882.
- [5] Lago M., Delgado C., Branco M. *Gender and propensity to risk in advanced countries: Comparison between entrepreneurs and non-entrepreneurs*. PSU Research Review 2018, Vol. 2.
- [6] Liu Y., Almor T. *How culture influences the way entrepreneurs deal with uncertainty in inter-organisational relationships: The case of returnee versus local entrepreneurs in China*. International Business Review 2016, Vol. 25(1), pp. 4-14.
- [7] Majková M., Ključnikov A. *The Specific Character Traits of Young Entrepreneurs in Slovakia*. International Journal of Entrepreneurial Knowledge 2017, Vol. 5.
- [8] Masroor I., Alam M. N. *Does risk tolerance behaviour of entrepreneur affect the growth of entrepreneurial firms through the mediation of effectuation decision-making approach?*. International Journal of Export Marketing 2019, Vol. 3(2), pp. 79-104.
- [9] Sharma S., Sahni S. *The world of male and female entrepreneurs: findings from a global study*. Strategic Change 2020, Vol. 29 (6), pp. 725-736.

Critical Evaluation into the Practical Utility of the Design of Experiments

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Abstract

The research aims to emphasise the relevance of the Design of Experiments (DOE) technique as a reliable method for ensuring efficient use of statistical methods in routine industrial processes. A case study approach with a deductive strategy was used to assess the effectiveness of different DOE methods to achieve the desired objectives. Screening, mid-resolution and high-resolution DOE methods helped identify, characterise, and optimise an experimental variable against the desired output response. A general framework for effective DOE is provided as part of DOE planning, including defining DOE objectives, selection criteria, noise reduction, and application across industries. Overall, various DOE models proved successful in identifying a complicated relationship between experimental variables and output response. However, when ideal DOE models may not be feasible, reducing test run by choosing lower resolution DOE or fewer replicates can still provide important insights into the experimental variables' impact on output responses.

Keywords: Six-Sigma, Design of Experiments, screening, Taguchi screening, full factorial

References

- [1] Antony J., Roy R. K. Improving the process quality using statistical Design of experiments: A case study. *Quality Assurance* 1999, Vol. 6, pp. 87-95.
- [2] Brady J. E., Allen T. T. Six Sigma literature: A review and agenda for future research. *Quality and Reliability Engineering International* 2006, Vol. 22, pp. 335-367.
- [3] Davim, J. P. (Ed.). *Design of Experiments in Production Engineering*. Springer International Publishing 2016.
- [4] Durakovic, B. *Design of Experiments Application, Concepts, Examples: State of the Art*. *Periodicals of Engineering and Natural Sciences* 2017, Vol. 5(3), pp. 421-439.
- [5] Goh T. N. The role of statistical Design of Experiments in Six Sigma: Perspectives of a practitioner. *Quality Engineering* 2002, Vol. 14(4), pp. 659-671.
- [6] Kackar R. N., Shoemaker A. C. Robust De-sign: A cost-effective method for improving manufacturing processes. *AT&T Technical Journal* 2021, Vol. 65, pp. 39-50.
- [7] Okatia V., Behzadmehra A., Farsad S. Analysis of a solar desalinator (humidification–dehumidification cycle) including a compound system consisting of a solar humidifier and subsurface condenser using DoE. *Desalination* 2016, Vol. 397, pp. 9-21.
- [8] Yip H. M., Wang Z., Navarro-Alarcon D., Li P., Cheung T. H., Greiffenhagen Ch., Liu Y. A collaborative robotic uterine positioning system for laparoscopic hysterectomy: Design and experiments. *International Journal of Medical Robotics and Computer Assisted Surgery* 2020, Vol. 16(4), e2103.
- [9] Zheng H., Clausen M. R., Dalsgaard T. K., Mortensen G., Bertram, H. C. Timesaving design of experiment protocol for optimisation of LC-MS data processing in metabolomic approaches. *Analytical Chemistry* 2013, Vol. 85, pp. 7109-7116.

The Adoption of Robotic Process Automation Technology to Ensure Business Processes during the COVID-19 Pandemic

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Abstract

The study provides knowledge on the adoption of the Robotic Process Automation (RPA) technology during the COVID-19 pandemic in 110 Polish service companies. As this research was the first of its kind in Poland, the objectives of the CAWI survey were to identify the technology features of the RPA technology and the related determinants and barriers influencing the adoption of the RPA as well as to determine correlations between them. Moreover, the statistical analyses involved considering whether there were differences in the evaluation of individual RPA technology features, mainly in terms of perceived usefulness, ease of use, security and functionality. The results of the study show that almost 60% of the respondents indicated that robotization tools allowed maintaining continuity of business processes during the pandemic. The highest rated were features related to usefulness of the RPA technology. Furthermore, the analysis pointed to the most frequently indicated barriers to technology implementation that were related to non-optimized, non-standardized and non-digitized processes with a large number of exceptions. The study contributes to scientific knowledge and has practical implications for process automation decision-makers concerned with the adoption of the Robotic Process Automation technology. The obtained results can help them to understand the potential enablers and barriers to the adoption of software robots by enterprises and may be an important determinant for companies' managers in the area of implementation of such solutions.

Keywords: Robotic Process Automation, RPA, vbusiness processes, software robots, business continuity.

References

- [1] Mbunge E., Akinnuwesi B., Fashoto S.G., Metfula A.S., Mashwama, P. *A critical review of emerging technologies for tackling COVID-19 pandemic*. Hum. Behav. Emerg. Technol. 2021, Vol. 3, pp. 25-39.
- [2] Bullock J., Luccioni A., Pham K.H., Sin Nga Lam C., Luengo-Oroz M. *Mapping the Landscape of Artificial Intelligence Applications against COVID-19*. J. Artif. Intell. Res. 2020, Vol. 69, pp. 807-845.
- [3] Agarwal S., Punna N.S., Sonbhadraa S.K., Tanveerb M., Nagabhushana P., Soundra Pandianc K.K.; Saxenad, P. *Unleashing the power of disruptive and emerging technologies amid COVID-19*. 2020, arXiv preprint arXiv:2005.11507.
- [4] Nah F.F.N., Siau K. *Covid-19 pandemic – Role of technology in transforming business to the new normal*. In Lecture Notes in Computer Science; Springer: Cham, Switzerland, 2020; pp. 585-600.
- [5] Wang, X.V., Wang, L. *A literature survey of the robotic technologies during the COVID-19 pandemic*. J. Manuf. Syst. 2021 (in press).
- [6] van der Aalst W.M.P., Bichler M., Heinzl, M. *Robotic Process Automation*. Bus. Inf. Syst. Eng. 2018, Vol. 60, pp. 269-272.
- [7] Siderska, J. *Robotic Process Automation – A Driver of Digital Transformation?* Eng. Manag. Prod. Serv. 2020, Vol. 12, pp. 21-31.
- [8] Ejdys J., Gudanowska A., Halicka K., Kononiuk A., Magruk A., Nazarko J., Nazarko Ł., Szpilko D., Widelska U. *Foresight in Higher Education Institutions: Evidence from Poland*. Foresight STI Gov. 2018, Vol. 13, pp. 77-89.
- [9] Enriquez J.G., Jimenez-Ramirez A., Dominguez-Mayo F.J., Garcia-Garcia J.A. *Robotic Process Automation: A Scientific and Industrial Systematic Mapping Study*. IEEE Access 2020, Vol. 8, pp. 39113-39129.
- [10] Syed R., Suriadi S., Adams M., Bandara W., Leemans S.J., Ouyang C., Ter Hofstede I.A.H., Weerd V.D., Wynn M.T., Reijers H.A. *Robotic process automation: Contemporary themes and challenges*. Comp. Ind. 2020, Vol. 115, p. 103162.
- [11] Ng K.K.H., Chen C.-H., Lee C.K.M., Jiao J., Yang Z.-X. *A systematic literature review on intelligent automation: Aligning concepts from theory, practice, and future perspectives*. Adv. Eng. Inform. 2021, Vol. 47, 101246.
- [12] Gudanowska A., Kononiuk A., Siderska J., Dębkowska K. *Uwarunkowania ucyfrowienia procesów produkcji i wzrostu kompetencji cyfrowych społeczeństwa*; Oficyna Wydawnicza Politechniki Białostockiej: Białystok, Poland, 2020. (In Polish).

What Can We Learn from Critical Incident Technique in Investigating the Factors of Power Dynamics in Dyadic Business-to-Business Relationships?

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Abstract

In business exchanges partners are rarely similar in terms of their resources and competencies, which cause differences in power. The power asymmetry can be defined as the difference between the dependence level of the other relationship party which can increase or decrease over time of the relationship. The power asymmetry is not a static concept as it changes over time, which suggests the logic of dynamic viewpoint on power and power asymmetry. In our study we distinguished two types of factors being externally positioned with regards to the relationship, factors occurred inside or outside the companies which constitute the relationship. It is a need for better understanding of power dynamics factors in business-to-business relationships, which we recognized as a research gap. The aim of the article is to identify and organize the factors which caused the most significant increases and decreases of power in the business-to-business relationships from the weaker suppliers perspective in manufacturing industries context. The applied research method is focused on a qualitative approach, in particular essays writing by 23 suppliers' representatives to analyse the factors of power change. We used Critical Incident Technique to identify situations in which the power increased and decreased in researched relationships the most considerably.

Keywords: power asymmetry, power dynamics, Critical Incident Technique.

References

- [1] Wang C. *The moderating role of power asymmetry on the relationships between alliance and innovative performance in the high-tech industry*. Technological Forecasting & Social Change 2011, Vol. 78(7), pp. 1268-1279.
- [2] Lacoste S., Johnsen E. *Supplier-customer relationships: A case study of power dynamics*. Journal of Purchasing & Supply Management 2015, Vol. 21, pp. 229-240.
- [3] Pérez L., Cambra-Fierro J. *Learning to work in asymmetric relationships: insights from the computer software industry*, Supply Chain Management: An International Journal 2015, Vol. 20(1), pp. 1-10.
- [4] Gremler D.D. *The Critical Incident Technique in Service Research*, Journal of Service Research 2004, Vol. 7, pp. 65-89.
- [5] Flanagan J.C. *The Critical Incident Technique*, Psychological Bulletin 1954, Vol. 51(4), pp. 327-358.

Formulation of Change Management Model for Achieving Business Excellence in Large Organizations

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Abstract

This study aims to investigate how the different leadership levels can apply change management successfully in larger organisations in order to facilitate business excellence. First, change models and leadership theories are analysed under EFQM principles, as it is selected as the framework for excellence. Then, a theoretical change management process is synthesised in alignment with leadership organisational levels. The research process is enriched by 6 semi-structured interviews in two different case studies, while the previous findings are validated through 3 structured interviews in a third case study. The analysis shows that although leaders believe that they identify the need for change, sometimes they do not, or they make sense of it too late. As such, a five-step change process model is created as the conclusion of the theoretical and case studies analyses. The value of this research is the connection between theory and practice as it tries to identify the responsible gaps for wrong or not fully successful organisational change projects. The suggested model simplifies the theory into practical steps while the success factors ensure that the enablers can support change efficiently. Further research based on the adoption of Senge's systems theory for network leadership level is recommended to organisations.

Keywords: business excellence, change management, model, process.

References

- [1] Aquilani B., Silvestri C., Ruggieri A., Gatti C. *A systematic literature review on total quality management critical success factors and the identification of new avenues of research*. The TQM Journal 2017, Vol. 29(1), pp. 184-213.
- [2] Burnes B., Jackson P. *Success and Failure In Organisational Change: An Exploration of the Role of Values*. Journal of Change Management 2011, Vol. 11(2), pp. 133-162.
- [3] Heras-Saizarbitoria I., Marimon F., Casadesús M. *An empirical study of the relationships within the categories of the EFQM model*. Total Quality Management and Business Excellence 2012, Vol. 23(5-6), pp. 523-540.
- [4] Šebestová J., Rylková Ž. *Competencies and innovation within learning organisation*. Economics and management 2011, Vol. 16, pp. 954-960.
- [5] Senge P., Kleiner A., Roberts C., Ross R., Roth G., Smith B., Guman E.C. *The dance of change: The challenges to sustaining momentum in learning organisations*. Performance Improvement 1999, Vol. 38(5), pp. 55-58.
- [6] Styhre A. *Non-linear change in organisations: organisation change management informed by complexity theory*. Leadership and Organisation Development Journal 2002, Vol. 23(6), pp. 343-351.
- [7] Todorović M., Petrović D., Mihić M., Obradović V., Bushuyev S. *Project success analysis framework: A knowledge-based approach in project management*. International Journal of Project Management 2015, Vol. 33(4), pp. 772-783.
- [8] Panas A., Edum-Fotwe F., Pantouvakis J.P. *Investigating the changing role within PM teams in AEC projects*. Proceedings of the 2007 ASCE Construction Research Conference, The Grand Bahamas Island, 6-8 May 2007.
- [9] Panas A., Pantouvakis J.P., Edum-Fotwe F.T. *Potential for using Process Approach to manage construction projects in Greece*. Proceedings of the A.R.CO.M. Conference 2005, London, 7-9 Sept. 2005, pp. 853-863.
- [10] Ralli P., Panas A., Pantouvakis J.P., Karagiannakidis D. *Investigation and Comparative Analysis of Learning Curve Models on Construction Productivity: The Case of Caisson Fabrication Process*. Journal of Engineering, Project, and Production Management 2020, Vol. 10(3), pp. 219-230.

An Integrated Approach for Supply Chain Risk Management

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Abstract

Currently, every company is competing to improve the performance of their supply chain. Therefore it requires risk management in the supply chain to mitigate losses. This study aims to identify risks and develop risk mitigation strategies at PT. SPLP. In this study, every risk in the Supply Chain Operation Reference is identified first so that the causes of each risk can be identified. Furthermore, a mitigation strategy will be formulated based on the best based on the criteria. Based on the study results, it was found that each division has its own risks and it was found that conducting a briefing at the beginning of each shift was believed to be the best mitigation strategy. These results indicate that each company has different risks and the results of different mitigation strategies due to different data processing methods. It takes risk management that is carried out and evaluated regularly at PT. SPLP.

Keywords: supply chain, risk management, house of risk, analytical hierarchy process

References

- [1] Accomasso, L., Cristallini, C., Giachino, C. Risk Assessment and Risk Minimization in Nanomedicine: A Need for Predictive, Alternative, and 3Rs Strategies. *Frontiers in Pharmacology* 2018, Vol. 9, pp. 1-7.
- [2] Baryannis, G., Validi, S., Dani, S., Antoniou, G. Supply Chain Risk Management and Artificial Intelligence: State of the Art and Future Research Directions. *International Journal of Production Research* 2018, pp. 1-24.
- [3] Chaudhuri, A., Boer, H., Taran, Y. Supply chain integration, risk management and manufacturing flexibility. *International Journal of Operation and Production Management* 2018, Vol. 38(3), pp. 690-712.
- [4] Hamid, A., Baba, I., Sani, W. Risk Management Framework in Oil Field Development Project by Enclosing Fishbone Analysis. *International Journal on Advanced Science, Engineering and Information Technology* 2017, Vol. 7(2), pp. 446-452.
- [5] Militaru, G. Agility of the Supply Chain. *FAIMA Business & Management Journal Bucharest* 2019, Vol. 7(4), pp. 3-4.
- [6] Raghunath, K. M. K., & Devi, S. L. T. Supply Chain Risk Management. *International Journal of Information Systems and Supply Chain Management* 2018, Vol. 11(3), pp. 87-104.
- [7] Zhang, T., Zhang, C. Y., Pei, Q. Misconception of Providing Supply Chain Finance: Its Stabilising Role. *International Journal of Production Economics* 2019, Vol. 213, pp. 175-184.

The Prospects for Housing Energy-Efficient Renovation in Ukraine

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Abstract

One of the world's major problems is the issue of energy efficiency and energy saving. The level of energy consumption in Ukraine is three times higher than in EU countries. According to government estimates, the energy consumption in the Ukraine could be reduced by almost half by the introduction of energy efficient technologies in industry and the residential sector. Therefore, the potential for the development of efficient energy use, particularly in the field of real estate exploitation, is very high. Ukraine has been an outdated housing fund with a high degree construction period of 1950s and 1970s. Energy consumption of housing and communal services is 31 %. This requires defining the directions of housing reconstruction on the basis of improving its energy efficiency and energy saving. So, the proposals to increase the energy efficiency level of housing were further developed. Comprehensive research of the volume of the rural building in relation with the energy-saving potential in this sphere was conducted, based on foreign experience and the proposals regarding alternative energy development. Volumes and cost of energy consumption indicators in the city and in the countryside were calculated. The role of energy consumption actors at the state and local levels was justified. Directions for level energy efficiency increase in rural houses were suggested.

Keywords: energy efficiency, energy consumption, rural houses, energy-efficient renovation.

References

- [1] Svystun L., Zavora T., Khudolii Yu. Prospects for the implementation of real estate development in Ukraine based on energy efficiency principles and the problems with raising the finance required. *Acta Innovations* 2018, Vol. 29, pp. 5-15.
- [2] Energy Efficiency Standards in Europe and Germany, ESCO. Energy service, 8, 2013. Available online: <http://www.kz.beeca.net/biblioteka/ee-teplosnabzhenii/publikacii/252>.
- [3] EPBD Directive 2010/31/EU on the energy performance of buildings. Available online: <http://www.rehva.eu/en/epbd>.
- [4] European Commission. Nearly zero-energy buildings. Available online: <https://ec.europa.eu/energy/en/topics/energy-efficiency/buildings/nearly-zero-energy-buildings>.
- [5] Bryhilevych, V. (Eds.). *Thermo modernization of housing stock: organizational, legal, social, financial and technical aspects: practical issue*; 3rd ed. Lviv, Ukraine, 2016.
- [6] Samoilyk Iu. *Rural development as a priority of the socio-economic strategy of the state*. Economy and region. Scientific Bulletin of Poltava National Technical Y. Kondratyuk University 2012, Vol. 4(35), pp 140-145.
- [7] Samoilyk I., Svystun L. Energy audit as one of the promising areas of financial services market development. *Financial Market Development in Ukraine: Threats, Problems and Prospects. Proceedings of the International Scientific and Practical Conference, October 15, 2019 Poltava, 2019*. pp. 215-216.
- [8] State Statistics Committee of Ukraine. (2020). Available online: <http://www.ukrstat.gov.ua/>.
- [9] In Ukraine, about 90% of high-rise buildings require thermo modernisation. Available online: <http://www.nova.poltava.ua/v-ukraïni-blizko-90-bagatopoverxivok-potrebuyut-termomodernizacii/>.
- [10] Cabinet of Ministers of Ukraine. National Energy Efficiency Action Plan for 2020. Available online: <http://sae.gov.ua/sites/default/files/documents/nats-plan-052014.doc>.

Waste Management in the Smart Cities: a Bibliometric Analysis

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Abstract

Cities in the modern world face many challenges. One of these is waste management, which is growing year on year and poses problems in terms of collection, storage, disposal and recycling. In smart cities a number of solutions based on modern technologies are being implemented to support waste management. The aim of this paper is to identify the main directions and research trends in the scientific literature on technologies used in waste management in smart cities. The article includes a bibliometric analysis of publications from 2011-2021, collected from the Web of Science and Scopus databases. The methodology used in the study includes: selecting key words and defining search criteria, creating a unique database of bibliographic records, and then analysing the results and identifying the major research trends. Thanks to the research process carried out, the leading countries, institutions, journals and authors in terms of publication activity were identified, as well as the most frequently occurring terms. The key word analysis identified the main research directions.

Keywords: smart city, technology, waste management, bibliometric analysis

References

- [1] Ahmad, R. W., Salah, K., Jayaraman, R., Yaqoob, I., Omar, M. Blockchain for Waste Management in Smart Cities: A Survey. *IEEE Access* 2021, Vol. 9, pp. 131520-131541.
- [2] Gudanowska, A.E. A map of current research trends within technology management in the light of selected literature. *Management and Production Engineering Review* 2017, Vol. 8(1), pp. 78-88.
- [3] Halicka K. Innovative Classification of Methods of The Future-Oriented Technology Analysis. *Technological and Economic Development of Economy* 2016, Vol. 22(4), pp. 574-597.
- [4] Marques, P., Manfroi, D., Deitos, E., Cegoni, J., Castilhos, R., Rochol, J., Pignaton, E., Kuns, R. An IoT-based smart cities infrastructure architecture applied to a waste management scenario. *Ad Hoc Networks* 2019, Vol. 87, pp. 200-208.
- [5] Rao, S. K., Prasad, R. Impact of 5G Technologies on Smart City Implementation. *Wireless Personal Communications* 2018, Vol. 100(1), pp. 161-176.
- [6] Silva, B. N., Khan, M., Han, K. Towards sustainable smart cities: A review of trends, architectures, components, and open challenges in smart cities. *Sustainable Cities and Society* 2018, Vol. 38, pp. 697-713.
- [7] Zakharova, G. B., Fedorova, A. V. Efficient Waste Management in a Smart City. *5th International Conference Safety Problems of Civil Engineering Critical Infrastructures (SPCECI)* 2020.

European Green Deal – Research Directions. Systematic Literature Review

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Abstract

The aim of the article is to provide a classification of scientific research relating to European Green Deal (EGD) issues, to assess their compatibility with the areas identified in the EGD strategy document and to identify emerging directions of the future research. A systematic literature review based on bibliometric analysis articulated included in Scopus and Web of Science database was conducted for the study. The purpose of a systematic literature review is to identify, integrate and evaluate research on a selected topic on the basis of clearly defined criteria. Research query included: (TITLE-ABS-KEY ("EU" OR europ*) AND TITLE-ABS-KEY ("green deal")) in case of Scopus and TS = ("EU" OR europ*) AND "green deal" in case of Web of Sciences database. For the purpose of the analysis, 641 publication records were qualified. The bibliometric analysis allowed to identified eight thematic clusters and linked them to the eight areas of European Green Deal strategy is based on.

Keywords: European Green Deal, systematic literature review, direction of research, bibliometric analysis

References

- [1] Amoroso S., Aristodemou L., Criscuolo C., Dechezleprete A., Dernis H., Grassano N., Moussiégt L., Napolitano L., Nawa D., Squicciarini M., Tuebke A. World Corporate Top R&D investors: Paving the way for climate neutrality. EUR 30884 EN, Publications Office of the European Union, Luxembourg 2021, JRC126788.
- [2] Brodny J., Tuta, M., Bindzár P. Assessing the level of renewable energy development in the European Union member states. A 10-year perspective. *Energies* 2021, Vol. 14(13).
- [3] Gudanowska A.E. A map of current research trends within technology management in the light of selected literature. *Management and Production Engineering Review* 2017, Vol. 8(1), pp. 78-88.
- [4] Halicka K. Innovative Classification of Methods of The Future-Oriented Technology Analysis. *Technological and Economic Development of Economy* 2016, Vol. 22(4), pp. 574-597.
- [5] Jäger-Waldau A., Kougias I., Taylor N., Thiel C. How photovoltaics can contribute to GHG emission reductions of 55% in the EU by 2030. *Renewable and Sustainable Energy Reviews* 2020, Vol. 126.
- [6] Pe'er G., Bonn A., Bruelheide H., Dieker P., Eisenhauer N., Feindt P. H., Hagedorn G., Hansjürgens B., Herzon I., Lomba Â., Marquard E., Moreira F., Nitsch H., Oppermann R., Perino A., Röder N., Schleyer C., Schindler S., Wolf C., ... Lakner S. Action needed for the EU Common Agricultural Policy to address sustainability challenges. *People and Nature* 2020, Vol. 2(2), pp. 305-316.
- [7] United Nation. Transforming our world: the 2030 Agenda for Sustainable Development. A/RES/70/1, 2015. <https://sustainabledevelopment.un.org/post2015/transformingourworld>
- [8] Zorpas A. A. Strategy development in the framework of waste management. *Science of the Total Environment* 2020, Vol. 716.

Foresight as a Tool for Participatory City Management. Evidence from Poland

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Abstract

All over the world, there has been a growing demand for innovative ways of managing cities, due to the continuing problems in many areas of urban life. Tools that involve multiple stakeholders in working together to create shared benefits are now essential in developing new solutions in cities. One such tool is foresight. The aim of the article is to verify the author's methodology of applying foresight research in creating a vision of city development. The study was conducted as part of the social project "Zambrów Foresight 2040". As a result of the research process, 4 scenarios were developed – visions of the development of the city of Zambrów in the perspective to 2040: the names of scenarios are the following: S1 – Winning Zambrów, S2 – Neglected Zambrów, S3 – Dead Zambrów, S4 – Worried Zambrów. In addition, 14 actions were identified that need to be taken in the perspective until 2040 in each area in order to make the S1 – Winning Zambrów scenario a reality. The results obtained from urban foresight projects can definitely be used as a set of data and proposals for socially acceptable solutions when creating long-term city development strategies and many other documents important for the city's functioning.

Keywords: foresight, city management, participation, vision, Poland.

References

- [1] Paskaleva K., Cooper I., Linde P., Peterson B., Götz C. *Stakeholder Engagement in the Smart City: Making Living Labs Work*. In *Transforming City Governments for Successful Smart Cities*. Public Administration and Information Technology; Rodríguez-Bolívar M., Eds.; Springer International Publishing: Cham, UK, 2015, pp. 115-146.
- [2] Pereira G.V., Cunha M.A., Lampoltshammer T.J., Parycek P., Testa M.G. *Increasing collaboration and participation in smart city governance: A cross-case analysis of smart city initiative*. *Information Technology for Development* 2017, Vol. 23(3), pp. 526-553.
- [3] Dixon T., Montgomery J., Horton-Baker N., Farrelly L., Using L. *Urban foresight techniques in city visioning: Lessons from the Reading 2050 vision*. *Local Economy: The Journal of the Local Economy Policy Unit* 2018, Vol. 33, pp. 777-799.
- [4] Ravetz J., Miles I. D. *Foresight in cities: on the possibility of a „strategic urban intelligence”*. *Foresight* 2016, Vol. 18, pp. 469-490.
- [5] Glińska E. *Foresight jako narzędzie zarządzania miastem*. *Przedsiębiorczość i Zarządzanie* 2013, Vol. 14(13), pp. 79-96.
- [6] Szpilko D. *Foresight as a tool for the planning and implementation of visions for smart city development*. *Energies* 2020, 13(7), 1782.

IoT-Based Smart Cities: a Bibliometric Analysis and Literature Review

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Abstract

Modern cities face many challenges related to globalisation, metropolisation and digitalisation. The smart city concept, which has been gaining popularity in recent years, is considered an answer to their needs. One of the paradigms of modern smart cities is the Internet of Things. This article aims to identify the main research directions and trends in the scientific literature in the field of Internet-of-Things-based smart cities. The author of the paper conducted a bibliometric analysis of publications from 2012-2021, collected from the Web of Science, Scopus and IEEE Xplore databases. The methodology includes: (i) the selection of databases and key words, (ii) defining search criteria, (iii) data export, creation of an aggregate database and record selection, and (iv) the analysis of the results and identification of the major research trends. The study involved 1019 publications. The last stage of the research process identified the leading countries, institutions, journals, and authors in terms of publication activity, as well as the most frequently occurring terms. The key word analysis allowed identifying five main research directions: IoT application domains in smart cities, IoT architecture for smart cities, energy, security and privacy and data. Within each area, the main research themes were identified, and selected publications were reviewed.

Keywords: smart city, Internet of Things, IoT, bibliometric analysis.

References

- [1] Albino V., Berardi U., Dangelico R. *Smart Cities: Definitions, Dimensions, Performance, and Initiatives*. J. Urban Technol. 2015, Vol. 22(1), pp. 1723-1738.
- [2] Atzori L., Iera A., Morabito G. *The Internet of Things: A survey*. Comput. Netw. 2010, Vol. 54(15), pp. 2787-2805.
- [3] Caragliu A., Del Bo C., Nijkamp P. *Smart Cities in Europe*. J. Urban Technol. 2011, Vol. 18(2), pp. 65-82.
- [4] Jin J., Gubbi J., Marusic S., Palaniswami M. *An information framework for creating a smart city through internet of things*. IEEE Internet Things J. 2014, Vol. 1(2), pp. 112-121.
- [5] Mehmood Y., Ahmad F., Yaqoob I., Adnane A., Imran M., Guizani S. *Internet-of-Things-Based Smart Cities: Recent Advances and Challenges*. IEEE Commun. Mag. 2017, Vol. 55(9), pp. 16-24.
- [6] Miorandi D., Sicari S., De Pellegrini F., Chlamtac I. *Internet of things: Vision, applications and research challenges*. Ad Hoc Netw. 2012, Vol. 10(7), pp. 1497-1516.
- [7] Mohanty S. *Everything You Wanted to Know About Smart Cities*. IEEE Consum. Electron. Mag. 2016, Vol. 5(3), pp. 60-70.
- [8] Mora L., Bolici R., Deakin M. *The First Two Decades of Smart-City Research: A Bibliometric Analysis*. J. Urban Technol. 2017, Vol. 24(1), pp. 3-27.
- [9] Rathore M.M., Ahmad A., Paul A., Rho S. *Urban planning and building smart cities based on the Internet of Things using Big Data analytics*. Comput. Netw. 2016, Vol. 101, pp. 63-80.
- [10] Sethi P., Sarangi S.R. *Internet of Things: Architectures, Protocols, and Applications*. J. Electr. Comput. Eng. 2017, pp. 1-25.
- [11] Talari S., Shafie-khah M., Siano P., Loia V., Tommasetti A., Catalão J. *A Review of Smart Cities Based on the Internet of Things Concept*. Energies 2017, Vol. 10(4), p. 421.
- [12] Zanella A., Bui N., Castellani A., Vangelista L., Zorzi M. *Internet of things for smart cities*. IEEE Internet Things J. 2014, Vol. 1(1), pp. 22-32.

Innovative Mobility Solutions in Baltic Sea Region Rural Areas

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Abstract

The research problem discussed in the paper is innovative mobility solutions in rural areas. The aim of the study is to identify the specifics of the different research methodologies and innovative mobility solutions in the Baltic Sea rural regions. The article consists of two parts: theoretical and practical. The first part presents the literature review of the rural areas mobility problems and innovative solutions in this field. The theory is confronted with the results of empirical research. The study was conducted between 2019 and 2021 using different research methodologies. The research was carried out by different institutions like universities and local governments representing 7 countries. Both quantitative and qualitative methodologies were used. The research confirmed the assumed concept and demonstrated an interesting differentiation of the methodologies and relatively many innovative mobility solution proposals in rural regions. The most common and expected solutions by the local citizens are electric bikes and cars as well as bike sharing model. The paper is novel in character mainly because of the presentation of the juxtaposition of different methodological approaches and innovative mobility solutions. The paper fills this gap in both theory and practice.

Keywords: innovations, mobility models, mobility research, rural areas.

References

- [1] Balińska A. *Czynniki rozwoju terenów peryferyjnych Polski Wschodniej*. Journal of Agribusiness and Development 2015, Vol. 2(36), pp. 153-160.
- [2] Jasiński A. H., *Innowacyjność w gospodarce Polski: Modele, bariery, instrumenty wsparcia*, Wydawnictwo Naukowe Wydziału Zarządzania UW, Warszawa 2014.
- [3] Jasiński A.H. *Polityka innowacyjna w procesie transformacji w Polsce. Czy skuteczna?* Optimum 2018, Vol. 3, pp. 221-239.
- [4] Pasieczny J. *Profile gmin w Polsce – zarządzanie rozwojem i zmianami*; Publisher: Wydawnictwo Naukowe Wydziału Zarządzania Uniwersytetu Warszawskiego, Warszawa, Poland, 2008, pp. 24-25.
- [5] Poblete C. *Growth expectations through innovative entrepreneurship. The role of subjective values and duration of entrepreneurial experience*. International Journal of Entrepreneurial Behavior 2018, Vol. 24(1), pp. 191-213.
- [6] Przygoda M. *Atrakcyjność inwestowania w regionach słabo rozwiniętych*; Publisher: Wydawnictwo Naukowe Wydziału Zarządzania Uniwersytetu Warszawskiego, Warszawa, Poland, 2013
- [7] Robert K.W., Parris T.M., Leisetowitz A. *What is sustainable development? Goals, Indicators, Values and Practice*. Environment Science and Policy for Sustainable Development 2005, Vol. 47(3), pp. 8-27.
- [8] Skarzynski P., Gibson R. *Innovation to the Core. A Blueprint for Transforming the Way Your Company Innovates*; Harvard Business Press, Boston, 2008, pp. 98-100.
- [9] Solheim M.C.W. *Foreign Workers and International Partners as Channels to International Markets in Core, Intermediate and Peripheral Regions*. Regional Studies, Regional Science 2016, Vol. 3(1), p. 491-505.
- [10] Szymańska E., Dziedzic E., Panasiuk A., Panfiluk E., Rutkowski A. *Innowacyjność turystyki zdrowotnej*; Publisher: Difin, Warszawa, Poland, 2017.

Barriers related to the implementation of intelligent transport systems in cities – the Polish local government’s perspective

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Abstract

Intelligent transport systems (ITS) are undoubtedly an opportunity for the sustainable development of smart cities today. ITS is based on advanced transport technologies that help minimise the emission of harmful substances to the environment. Smart mobility and ITS are related to the use of ICT. The implementation of technologically advanced ITS is associated with several benefits, barriers and difficulties. However, transport, ITS and smart mobility (as a component of a smart city) are indicated as the most desirable option for sustainable urban transport systems. The article aims to identify barriers related to the implementation of ITS in cities from the point of view of people responsible for the organisation of urban transport representing the local government of selected voivodship cities in Poland. The goal formulated in this way allowed to identify the following research question: what are the problems and barriers of implementing ITS in the city from the local government’s perspective? To achieve the paper’s aim, the author based their analysis on a qualitative technique of collecting empirical data. Ten individual in-depth interviews were conducted with representatives of local governments (vice-mayors and members of urban transport organisers) in voivodship cities, which represented six Polish macro-regions. Research results and findings indicate the main categories and subcategories of barriers related to the ITS implementation. The identified barriers are grouped into the following categories: economic, social, organisational, technological and legal. The contribution is twofold: first, in the presentation of the theoretical and practical barriers to ITS in juxtaposition; and second, in identifying the intelligent transportation impact, which affects the provision of being a smarter city. The findings can positively influence as important factors for local governments to focus on intelligent transport.

Keywords: intelligent transport systems (ITS), smart city, smart mobility

References

- [1] Albino V., Berardi U., Dangelico R.M. *Smart cities: Definitions, dimensions, performance, and initiatives*, Journal of Urban Technology 2015, Vol. 22(1), pp. 3-21.
- [2] Allwinkle S., Cruickshank P. *Creating Smarter Cities: An Overview*, Journal of Urban Technology 2011, Vol. 18(2), pp. 1-16.
- [3] Caragliu A., Del Bo C., Nijkamp P. (2011). *Smart cities in Europe*, Journal of Urban Technology 2011, Vol. 18, pp. 65-82.
- [4] Kirylyuk H., Glińska E., Ryciuk U., Vierikko K., Rollnik-Sadowska E. *Stakeholders engagement for solving mobility problems in touristic remote areas from the Baltic Sea Region*, PLoS ONE 2021, Vol. 16(6), e0253166.
- [5] Mfenjou M.L., Abba Ari A.A., Abdou W., Spies F., Kolyang. *Methodology and trends for an intelligent transport system in developing countries*, Sustainable Computing: Informatics and Systems 2018, Vol. 19, pp. 96-111.
- [6] Szpilko D., Glińska E., Szydło J. *STEPPVL and Structural Analysis as a Tools Supporting Identification of the Driving Forces of City Development*, European Research Studies Journal 2020, Vol. XXIII(3), pp. 340-363.
- [7] Szymańska E., Panfiluk E., Kirylyuk H. *Innovative Solutions for the Development of Sustainable Transport and Improvement of the Tourist Accessibility of Peripheral Areas: The Case of the Białowieża Forest Region*, Sustainability 2021, Vol.13, 2381.
- [8] Tomaszewska E.J., Florea A. (2018). *Urban smart mobility in the scientific literature – bibliometric analysis*, Engineering Management in Production and Services 2018, Vol. 10(2), pp. 41-56.
- [9] Winkowska J., Szpilko D., Pejić S. *Smart city concept in the light of the literature review*, Engineering Management in Production and Services 2019, Vol. 11(2), pp. 70-86.
- [10] Yigitcanlar T., Kamruzzaman Md., Buys L., Ioppolo G., Sabatini-Marques J., Moreira da Costa E., Yun J.H.J. *Understanding ‘smart cities’: Intertwining development drivers with desired outcomes in a multidimensional framework*, Cities 2018, Vol. 81, pp. 145-160.

Determination of Blackspots by Using Accident Equivalent Number and Upper Control Limit on Rural Roads of Thailand

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Abstract

The Department of Rural Roads (DRR) is one of highway authorities in Thailand that is responsible for over 48,000 kilometers of rural roads and highway networks. One of its responsibilities is to provide better road safety management. In road safety procedures, blackspots are usually identified by observing the frequency of accidents that occurred at a particular road section. This research is aimed to develop a model that includes levels of severity of accident in the process of blackspot identification. The classification of severity levels includes deaths, serious injuries, minor injuries, and damaged property only. The Analytic Hierarchy Process (AHP) is employed to derive the weight of each severity level. The identification model is developed using Equivalent Accident Number (EAN) together with Upper Control limit (UCL). The data applied in the model are obtained from road accident investigation of DRR. The five roads, including Nakhon Ratchasima 3052, Chonburi 1032, Nonthaburi 3021, Samutprakarn 2001 and Chiangmai 3029 have been selected based on the top frequency accident recorded in the last three years. Based on the results of blackspots founded in the study, most accidents occurred from frontal and rear ends by road users driving above the speed limit. Recommendations are also discussed.

Keywords: blackspot, equivalent accident number, road safety, rural roads.

References

- [11] Batagarawa, R., Williams, J., Potts, J., Brown, J. *Use of Analytic Hierarchy Process (AHP) as an Instrument to Develop a Solid Waste Management Assessment Tool*. GJAETS 2015, Vol. 4(2), pp. 70-75.
- [12] Chiangmai University. *The Development of Road Safety Audits System for Department of Rural Roads Thailand*. Thailand: Department of Rural Roads 2018.
- [13] Direktorat Jenderal Perhubungan Darat. *Pedoman Operasi Accident Black Spot Investigation Unit/Unit Penelitian Kecelakaan Lalu Lintas (ABIU/UPK)*. Jakarta: Ministry of Transportation Republic of Indonesia 2007.
- [14] Elvik R. *State-of-the-art approaches to road accident black spot management and safety analysis of road networks*. Oslo: The Institute of Transport Economics (TOI), 2007.
- [15] Halim H., Saing Z. *Severity Characteristics and Identification of Traffic Accident Prone Areas in Makassar City*. Journal of Advanced Research in Dynamical and Control Systems 2018, Vol. 10, pp. 2134-2141.
- [16] Kowtanapanich W. *Black Spot Identification Methods in Thailand*. Chulachomklao Royal Military Academy Journal 2007, Vol. 5(1), pp. 126-134.
- [17] Leelakajonjit A., Iamtrakul P. *Appropriated Accident Black Spot Definition for Thai Police*. The National Convention on Civil Engineering, Chiangmai, 2013.
- [18] Leuhery L., Hamkah H. *Determination of Black Site Area Based on Equivalent Accident Number Analysis: Case Study National Roads in Ambon City*. Civil Engineering and Architecture 2020, Vol. 8(5), pp. 1063-1073.
- [19] Office of Road Safety Audits (ORSA). *Road Safety Principal Manual*. Bangkok: Department of Rural Roads, Thailand, 2017.
- [20] Sugiyanto G., Fadli A., Santi M.Y. *Identification of Black Spot and Equivalent Accident Number Using Upper Control Limit Method*. JEAS 2017, Vol. 12, pp. 528-535.
- [21] Susilo B.H., Geovan R. Imanuel, I. *Identifying Black Spots in Southeast Sulawesi Province, Indonesia: A Combination Method of Equivalent Accident Number and Road Safety Survey Value*. APTE 2018.
- [22] Xiaolan, Z., Hong, X., & Huiping, Y. *Determination of the Weight Values of Assessment Indexes of Website Based on AHP – Take the Website of University Library as an Example*. 11th Asia Pacific Transportation and the Environment Conference (APTE 2018) Atlantis Press, 2019, pp. 171-175.

Inventory Management of the Air Conditioner Industry Utilizing the System Dynamics Modelling Approach

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Abstract

Air-conditioner is commonly used in high-temperature countries, including Thailand. Moreover, global warming and Covid-19 pandemic raise demand of high-quality air conditioners in the country. The air conditioning companies then need to properly manage their inventory to ensure the stock availability. This study examines and minimizes the inventory cost of air conditioners in the long-term utilizing the system dynamics (SD) modelling approach. Key factors affecting air conditioners' demand in Thailand are considered in the developed SD model. The results show that the most suitable order quantity that leads to the lowest inventory cost is 4,201 per order. The air conditioning companies may use the developed SD model to test with different demand and select the most suitable order quantity that will bring the lowest inventory cost in the long term.

Keywords: air-conditioner, inventory management, order quantity, system dynamics modelling.

References

- [1] Sheakh T. *A Study of Inventory Management System Case Study*, Journal of Dynamical and Control Systems 2018, pp. 1176-1190.
- [2] Electricity Generating Authority of Thailand. *Maximum power demand and Retrieved from Energy Consumption*, 2020. Available online: <https://www.egat.co.th/en/images/publication/EGAT-Overview-2020/EGAT-Overview-2020.pdf>.
- [3] Larsen J., Larsen K., Delgado M., Herndon W. *Assessing the Effect of Rising*, Rhodium Group, LLC, 2017.
- [4] Suksuntornsiri P., Lekngam S. Limpitipanich P. *Effects of add-on high-efficiency filter on room air conditioning performance in a Thai climate*, Case Studies in Thermal Engineering 2020, Vol. 18, pp. 1-8.
- [5] Research and Market, "Global Air Filters & Filtration Equipment Market 2020-2025 – Surging Demand for HEPA Air Filters Worldwide," 2020. Available online: <https://bit.ly/3wzzYbr>.

Turnover-Mitigating Servant Leadership Influence on Job Performance

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Abstract

Employee job performance is a very important aspect for an organization due to the significant impact on organizational performance, therefore the article aims to identify factors that positively shape job performance. It has been shown that employees' turnover is a mediator in the job performance model based on turnover-mitigating servant leadership. Additionally, the influence of employees' dynamic capabilities has been analysed. The developed moderated mediation model is empirically verified based on the data collected from 263 managers working in profit-oriented organisations in Poland. The results were analysed using Macro for IBM SPSS Statistics. The conducted study revealed the significance of servant leadership in influencing job performance, but also the disruptive relationship between employees' turnover and the impact of employees' dynamic capabilities in reducing employees' turnover. Therefore, this research provides practical implications for managers and for organizations about the need of selecting the right leadership style to improve employee job performance.

Keywords: servant leadership, employee job performance, employee turnover, employees' dynamic capabilities, organizational performance

References

- [1] Avolio B.J., Walumbwa F.O., Weber T.J. Leadership: Current theories, research, and future directions. *Annual Review of Psychology* 2009, Vol. 60, pp. 421-449.
- [2] Bass B. M. The Future of Leadership in Learning Organizations. *Journal of Leadership Studies* 2000, Vol. 7(3), pp. 18-40.
- [3] Bieńkowska A., Tworek K. Job Performance Model Based on Employees' Dynamic Capabilities (EDC). *Sustainability* 2020, Vol. 12(6), 2250.
- [4] Campbell J.P., McCloy R.A., Opple S.H., Sager C.E. A Theory of Performance. In: Schmitt N., Borman W.C. (Eds.), *Personnel Selection in Organizations*, Jossey-Bass Publishers, San Francisco 1993, pp. 35-70.
- [5] Gašková J. Servant leadership and its relation to work performance. *Central European Business Review* 2020, Vol. 9(3), pp. 24-37.
- [6] Jackofsky E.F. Turnover and job performance: An integrated process model. *Academy of Management Review* 1984, Vol. 9(1), pp. 74-83.
- [7] Koszela A. The influence of staff turnover on work motivation and job performance of employees in it sector—the results of empirical research. *Forum Scientiae Oeconomia* 2020, Vol. 8(1), pp. 29-48.
- [8] Meier K.J., Hicklin A. Employee turnover and organizational performance: Testing a hypothesis from classical public administration. *Journal of Public Administration Research and Theory* 2008, Vol. 18(4), pp. 573-590.
- [9] Russell R.F., Gregory Stone A. A review of servant leadership attributes: developing a practical model. *Leadership & Organization Development Journal* 2002, Vol. 23(3), pp. 145-157.

An Innovative Design Approach to Meet the Customer Requirements: A Case Study of Charcoal Briquettes Packaging

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Abstract

It is a known fact that design plays a very important role on effective and efficient marketing and customer satisfaction of any kind of products. New products have to be dramatically designed and manufactured: they are expected to meet the needs and requirements of customers, differ from the competitors, and be friendly with the environment. Thus, it is important to work closely with customers to make sure that the products will fulfil their needs and requirements. This research was to propose an innovative design approach for charcoal briquettes packaging design to meet the customer requirements. It has four phases. First, it was to explore the customer's requirements and translate the customer's requirement to product characteristics. Second, it was to explore the customers' perceptions to product visual form through emotional design approach. Third, it was to create the new product packaging. Customers' requirements and customer perceptions were integrated to create a new charcoal briquettes packaging. Forth, it was to evaluate possible impact on the environment of a new packaging design and process during its life cycle through carbon footprint values. Based on the results found in our study, it appeared that customer requirements play an important role of design and production as well as functional design of briquette packaging. The innovative design approach can be used to guide designer design the charcoal briquettes packaging to meet the requirements and perceptions of customers, illustrate the product identity and be friendly with the environment.

Keywords: customer requirements, emotional design, quality function deployment, brand identity, life cycle assessment.

References

- [1] Chan L. K., Wu M. L. *Quality Function Deployment: A Comprehensive Review of Its Concepts and Methods*. Quality Engineering 2002, Vol. 15, pp. 23-35.
- [2] Choi K., Jun C. *A systematic approach to the Kansei factors of tactile sense regarding the surface roughness*. Applied Ergonomics 2007, Vol. 38, pp. 53-63.
- [3] Cimini A., Moresi M. *Are the present standard methods effectively useful to mitigate the environmental impact of the 99% EU food and drink enterprises?*. Trends in Food Science & Technology 2018, Vol. 77, pp. 42-53.
- [4] He B., Xiao J., Deng Z. *Product design evaluation for product environmental footprint*. Journal of Cleaner Production 2018, Vol. 172, pp. 3066-3080.
- [5] Kapferer J. N. *New strategic brand management: creating and sustaining brand equity long term*; Kogan Page, London, UK, 2008.
- [6] Karjalainen T. M. *It looks like a Toyota: Educational approaches to designing for visual brand recognition*. International Journal of Design 2007, Vol. 1(1), pp. 67-81.
- [7] Kongprasert N., Butdee S. *A methodology for leather goods design through the emotional design approach*. Journal of Industrial and Production Engineering 2017, Vol. 34(3), pp. 170-179.
- [8] Norman D. A. *Emotional Design: Why We Love (or Hate) Everyday Things*; Basic Books, New York, USA, 2004.
- [9] PAS 2050. *Specification for the assessment of the life cycle greenhouse gas emissions of goods and services*. British Standards Institution, UK, 2011.
- [10] Razza B., Paschoarelli L. S. *Affective perception of disposable razors: A Kansei Engineering approach*. Procedia Manufacturing 2015, Vol. 3, pp. 6228-6236.
- [11] Vergara M., Mondragón S., Sancho-Bru J. S. Company, P., Agost, M. J. *Perception of products by progressive multisensory integration: A study on hammers*. Applied Ergonomics 2011, Vol. 42, pp. 652-664.
- [12] Warell A. *Identity references in product design: An approach for inter-relating visual product experience and brand value representation*. Procedia Manufacturing 2015, Vol. 3, pp. 2118-2125.

Factors Determining the Development of Printing Technologies in Poland in Long-Term Perspective

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Abstract

The dynamics of change in the area of innovative technologies, the continuous development of industry, as well as advancing globalization and increasing competition, force to implement and use new technologies or improve existing ones. This article attempts to identify the factors that determine the development of printing technologies in Poland. The research process included the following methods: desk research, STEEPVL, interviews, expert panel, brainstorming, survey research. The evaluation process of factors determining the development of printing technologies in Poland was conducted among printing companies in PKD section C, division 18 printing and reproduction of recorded media, N=370. The surveyed group consisted of technologists and management staff of the following departments: production, technology, and quality control. As a result of the conducted research process, key factors were identified in terms of importance and uncertainty with a perspective of 2030. The conducted research helped to fill the gap manifesting itself in the lack of determination of the influence of factors of the internal and external environment of enterprises that influence the development of the printing industry in Poland in the long-term perspective.

Keywords: STEEPVL, printing technologies, printing industry.

References

- [1] Angerer S. *Inkjet podąża ku przyszłości własnymi ścieżkami* [Eng. *Inkjet takes its own path to the future*], Świat druku, Wydanie Jubileuszowe, Poland, 2018.
- [2] Barabasz W. *Perspektywy rozwoju fleksografii* [Eng. *Perspectives for the development of flexography*], Świat druku, Wydanie Jubileuszowe, Poland, 2018.
- [3] Chen J., Yang W., Tsai P., Wang S., Chen C., Wang I. *A sampling and analytical method for simultaneously assessing multiple organic solvent exposures for plastic material printing industry workers*. Aerosol and Air Quality Research 2013, Vol. 13(5), pp. 1504-1511.
- [4] Diouf M., Kwak C. *Fuzzy AHP, DEA, and Managerial Analysis for Supplier Selection and Development; From the Perspective of Open Innovation*. Sustainability 2018, Vol. 10(10), p. 3779.
- [5] Esa M.M., Rahman N.A.A., Jamaludin M. *Reducing High Setup Time in Assembly Line: A Case Study of Automotive Manufacturing Company in Malaysia*. Procedia Social and Behavioral Science 2015, Vol. 211, pp. 215-220.
- [6] Halicka K. *Prospektywna analiza technologii – metodologia i procedury badawcze*. Oficyna Wydawnicza Politechniki Białostockiej, Białystok, Poland, 2016.
- [7] Magruk A. *Foresight technologiczny a zarządzanie technologią*. Problemy Eksploatacji 2011, Vol. 3, 47-60.
- [8] Moreira A., Silva F.J.G., Correia A.I., Pereira T., Ferreira L. P., De Almeida F. *Cost reduction and quality improvements in the printing industry*. Procedia Manufacturing 2018, Vol. 17, pp. 623-630.
- [9] Nazarko J. *Regionalny foresight gospodarczy. Metodologia i instrumentarium badawcze*; Publisher: ZPWIM, Warszawa, Poland, 2013.
- [10] Polskie Bractwo Kawalerów Gutenberga. *Rynek poligraficzny i opakowań z nadrukiem w Polsce*. Edycja Siódma, Raport KPMG w Polsce, WDIiB UW, 2018. Available online: <http://www.bractwogutenberga.pl/bg/raporty/rynek-poligraficzny-w-p/4089,quotRYNEK-POLIGRAFICZNY-W-POLSCEquot-wersje-elektroniczne-raportu-w-pdf.html> (accessed on 12 May 2021).
- [11] Wang Y., Tian Z., Wu J., Guo X., Shao M. *Dynamic stability of an axially moving paper board with added subsystems*. Journal of Low Frequency Noise Vibration and Active Control 2018, Vol. 37(1), pp. 48-59.
- [12] Winkowska J., Szpilko D., Pejić S. *Smart city concept in the light of the literature review*. Engineering Management in Production and Services 2019, Vol. 11(2), pp. 70-86.
- [13] Winkowski C. *Classification of forecasting methods in production engineering*. Engineering Management in Production and Services 2019, Vol. 11(4), pp. 23-33.

Towards Achieving Engineers' Career Satisfaction in the Australian Public Sector: Integrated Structural Equation Modeling and Bayesian Networks Approach

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Abstract

This paper proposes a novel approach that integrates the capability of empirical validation of structural equation modelling (SEM) and the prediction ability of Bayesian networks (BN). The Hybrid SEM-BN approach was used as a decision support framework to examine the interplay between salient organizational constructs and their ability to influence engineers' career satisfaction in the Australian Public Service (APS). The results emphasize that the ambidextrous culture for innovation was the most important factor that needed to be implemented in their organization. Managerial implications are recommended for senior managers on how they can implement innovation culture to increase workplace innovation, which could, in turn, help reduce the turnover rate of engineers employed in the APS.

Keywords: structural equation modeling, Bayesian networks, career satisfaction, engineer, Australia.

References

- [1] Andersen P. H., Kragh H. *Exploring boundary-spanning practices among creativity managers*. Management Decision 2015; Vol. 53, pp. 786-808.
- [2] Anderson R. D., Mackoy R. D., Thompson V. B., Harrell G. *A Bayesian network estimation of the service-profit chain for transport service satisfaction*. Decision Sciences 2004; Vol. 35, pp. 665-689.
- [3] Anderson R. D., Vastag G. *Causal modeling alternatives in operations research: Overview and application*. European Journal of Operational Research 2004; Vol. 156, pp. 92-109.
- [4] Arbuckle J. *AMOS 22. User's guide*. Chicago, IL: SmallWaters Corporation; 2013.
- [5] Australian Public Service Commission. *State of the Service Report: State of the Service Series 2012-2013*. Canberra, ACT, Australia.
- [6] Barnett B. R., Bradley L. *The impact of organisational support for career development on career satisfaction*. Career Development International 2007; Vol. 12, pp. 617-636.
- [7] Bielefeldt A. R., Canney N. E. *Working engineers' satisfaction with helping people and society through their jobs*. European Journal of Engineering Education 2019; Vol. 44, pp. 939-953.
- [8] Blodgett J. G., Anderson R. D. *A Bayesian network model of the consumer complaint process*. Journal of Service Research 2000; Vol. 2, pp. 321-338.
- [9] Boehmke B. C., Johnson A. W., White E. D., Weir J. D., Gallaghe, M. A. *Tooth-to-tail impact analysis: Combining econometric modeling and Bayesian networks to assess support cost consequences due to changes in force structure*. Journal of Cost Analysis and Parametrics 2016; Vol. 9, pp. 2-31.
- [10] Bollen K. A., Pearl J. *Eight myths about causality and structural equation models*. In Handbook of causal analysis for social research, Springer; 2013, pp. 301-328.

Adaptation of Polish Regions to the Challenges and Opportunities of the Belt and Road Initiative

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Abstract

The Belt and Road Initiative (BRI) is an international project focused on creating a network of infrastructure and strengthening trade links, primarily between China and Europe. Transport of goods within the BRI is carried out through one maritime and six rail economic corridors, one of which (New Eurasian Land Bridge) crosses the territory of Poland. This article covers issues related to the impact of the BRI on the regions of the participating countries and aims to determine the position of Podlaskie voivodeship in comparison to other Polish voivodeships in the BRI. In order to achieve that, a multi-stage study was conducted, including the design of a set of quantitative factors determining the position of voivodeships in the BRI, evaluation of the importance of the factors during the expert study, collection and normalization of quantitative data, and comparative analysis of the factors. Research results show that, given the methodology adopted, the Podlaskie voivodeship is ranked 11th out of 16 Polish voivodeships in terms of its position in the BRI. This article's findings contribute to the discussion on development opportunities in the Podlaskie region in the context of BRI, as well as provide an incentive to conduct comprehensive research on the strategy for the widest possible inclusion of Podlaskie in the BRI's activities and using them as an important stimulus for the region's development.

Keywords: New Silk Road, Belt and Road Initiative (BRI), Podlaskie voivodeship

References

- [1] Bartosiewicz A., Sztelik P. Poland on the New Silk Road. Current state and perspectives. Wydawnictwo Uniwersytetu Łódzkiego, Łódź, Poland, 2020.
- [2] Choroś-Mrozowska D. Global and regional consequences of the Chinese Belt and Road Initiative, „Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu” 2019, Vol. 63(6), pp. 9-21.
- [3] Czerewacz-Filipowicz K. The Eurasian Economic Union as an Element of the Belt and Road Initiative, „Comparative Economic Research. Central and Eastern Europe” 2019, Vol. 22(2), pp. 23-37.
- [4] Garlick J. The Regional Impacts of China's Belt and Road Initiative, „Journal of Current Chinese Affairs” 2020, Vol. 49(1), pp. 3-13.
- [5] Nazarko J., Czerewacz-Filipowicz K., Kuźmicz K. A., Comparative analysis of the Eastern European countries as participants of the new silk road, „Journal of Business Economics and Management” 2017, Vol. 18(6), pp. 1212-1227.
- [6] Nazarko J., Kuźmicz K.A., Czerewacz-Filipowicz K., The New Silk Road – Analysis of the Potential of New Eurasian Transport Corridors, Proceedings of 9th International Scientific Conference „Business and Management 2016”, 12-13 May 2016, Vilnius, Lithuania, VGTU Press.
- [7] Nazarko J., Kuźmicz K.A., Introduction to the STEEPVL analysis of the New Silk Road initiative, „Procedia Engineering” 2017, Vol. 182, pp. 497-503.
- [8] Pechlaner H. (Ed.). China and the New Silk Road. Challenges and Impacts on the Regional and Local Level, Springer International Publishing, Switzerland, 2020.
- [9] The World Bank. Belt and Road Economics. Opportunities and risks of transport corridors, Washington, 2019.
- [10] Urząd Marszałkowski Województwa Podlaskiego, Podlaskie. Naturalna droga rozwoju, Białystok, Poland, 2020.

Factors Influencing the Adoption of Building Information Modelling (BIM) in the South African Construction Built Environment (CBE), from a Quantity Surveying Perspective.

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Abstract

The construction industry has often been described as stagnant and non-innovative, mainly due to the lack of innovation and the use of innovative ways of working to improve the state of the industry. The adoption of Building Information Modelling BIM within the Construction Industry has been relatively slow and in particular in the South African Construction Built Environment (CBE). A quantitative research approach, grounded in a theoretical framework, was used for the study. A descriptive statistics method was used to analyse data collected through a distributed questionnaire used for data collection. The study was limited to the professional consultants within the South African Construction Built Environment (CBE). The study concludes that the South African CBE still operates mainly in silos and without a centralized coordinated incentive. BIM adoption will continue to be implemented in an organic manor. Project teams are mostly project-orientated, seeking solutions for immediate project solutions and adopting the most appropriate technologies for the team's composition.

Keywords: Building Information Modelling (BIM), South African Construction Built Environment (CBE), design silos.

References

- [1] World Economic Forum. 2018. The Fourth Industrial Revolution is about to hit the construction industry. Here's how it can thrive. [online]. 13 June. Available at: <https://www.weforum.org/agenda/2018/06/construction-industry-future-scenarios-labour-technology/> [Accessed 13 January 2021].
- [2] Ostravik F. *Incentives for Innovation in Construction*. In Construction Innovation; Ostravik F., Dainty A., Abbott C. Eds.; Wiley Balckwell, United Kingdom, 2015, pp. 13-28.
- [3] Cao D., Li H., Wang G., Huang, T. *Identifying and contextualising the motivations for BIM implementation in construction projects: An empirical study in China*. International Journal of Project Management 2017, Vol. 35(4), pp. 658-669.
- [4] Allen C., Smallwood J.Emuze, F. *Building Information Modelling: South African architect's and contractor's perceptions and practices*. First UK academic conference on BIM. Nelson Mandela Metropolitan University, 2012, pp. 141-151.
- [5] Naoum, S.G. *Dissertation Research & Writing for Constrcution Students*. Second edition,. Elsevier, UK, 2007. Ltd. 43.

Visual Control Methods Utilization in Modern Management

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Abstract

Visual servo is considered as a methodology to control movements of a system using certain visual information to achieve a task. Visual servoing aims to control a robotics system through an artificial vision in a way as to manipulate an environment, comparable to humans actions. In this paper Image Based Visual Servoing is an artificial neural network. Servoing a robotics arm towards a moving object movement using visual information is a research topic that has been presented and discussed by a number of researchers for the last twenty years. In this sense, the article discusses a mechanism to learn kinematics and feature-based Jacobian relations, that are used for robotics arm visual servo system. In this respect, the concept introduced within this paper was based on an employment and utilization of an artificial neural network system. The ANN was trained to learn a mapping relating the "complicated kinematics" as relating changes in visual loop into arm joint space. Changes in a loop visual Jacobian depend heavily on a robotics arm 3-D posture, in addition, they depend on features associated with an object under visual servo (to be tracked). Results demonstrated that trained neural network can be used to learn such complicated visual relations relating an object movement to an arm joint space movement.

Keywords: neural network, Image-Based Visual Servo systems, "pin-hole" camera, T-S neural network controller, visual feedback", visual servoing, management.

References

- [1] Aleksander I., Morton H. *An Introduction to Neural Computing, Textbook, International Edition*; 2nd Edition, Chapman and Hall, London, UK, 2014.
- [2] Corke P. *Robotics Toolbox for MatLab, For Use with MATLAB, User Guide, Vol. 1.*, 2015.
- [3] Craig J. *Introduction to Robotics: Mechanics and Control, Textbook*; International Edition, Prentice Hall, New Jersey, USA, 2016.
- [4] Croke P. *High-Performance Visual Closed-Loop Robot Control*, Thesis submitted in total fulfillment of the Requirements for the Degree of Doctor of Philosophy, 2014.
- [5] Eleonora A., Gian M., Domenico P. *Epipolar Geometry Toolbox, For Use with MATLAB, User Guide, Vol. 1*, 2014.
- [6] Lapin Ye.V. *Economic potential of industrial enterprises: formation, evaluation, management: dis. Dr. Econ. Science: 08.07.01, Nat. tech. University "Khark. Polytechnic Inst"*, 2006.
- [7] Fedonin O.S., Riepina I.M., Oleksiuk O.I. *Enterprise potential: formation and evaluation: teaching method. way. for independent study of the discipline*; Ministry of Education and Science of Ukraine, Kyiv National Economic University. KNEU, Kyiv, Ukraine, 2005.
- [8] Balatskyi O.F., Lapin Ye.V., Akulenko V.L. *Economic potential of administrative and production systems*; Sumy University Book, Sumy, Ukraine, 2006.

Analysis of Simulation of Different Forms of Production Organization

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Abstract

Globalization has led to a situation where an important feature of enterprises is the ability to react quickly to emerging opportunities. A large variety of products, a progressing fourth industrial revolution, one of the main elements of which is the individualisation of products, forces manufacturers to design agile production processes. Companies need efficient and flexible production systems to meet customer requirements. Currently known systems that meet these requirements are cellular production (CM) and the Japanese variety of cellular production referred to as seru production. Both of these systems are similar to each other and are characterized by their ability to produce small production series of products with a short life-cycle, a large variety of assortment produced. In this publication, the author has calculated and compared the work efficiency index of each variant with the work efficiency index of a traditional assembly line with a serial structure. The results of each variant of converting the assembly line with a serial structure into a cell structure were compared with the results obtained in a traditional assembly line. The juxtaposition of results was made in context of manufactured products, average production time, costs, average employee utilization.

Keywords: cellular manufacturing, cellular production, assembly line, computer simulation.

References

- [1] Isa K., Tsuru T. *Cell production and workplace innovation in Japan: toward a new model for Japanese manufacturing?* Industrial Relations: A Journal of Economy and Society 2002, Vol. 41(4), pp. 548-578.
- [2] Kaku I. *Is seru a sustainable manufacturing system?* Procedia Manufacturing 2017, Vol.8, pp. 723-730.
- [3] Kaku I. *A Novel SF Seru Production Scheme.* Procedia Manufacturing 2019, Vol. 39, pp. 1082-1089.
- [4] Kikolski M. *Sample measurement of the ISO 22400 standard key performance indicators with the use of simulation models.* In 2019 IEEE Technology & Engineering Management Conference (TEMSCON) (pp. 1-5). IEEE.
- [5] Ma Y.W., Che Y. C., Chen J. L. *SDN-enabled network virtualization for industry 4.0 based on IoTs and cloud computing.* In 2017 19th international conference on advanced communication technology (ICACT) 2017, pp. 199-202, IEEE.
- [6] Sun W., Yu Y., Lou Q., Wang J., Guan Y. *Reducing the total tardiness by Seru production: model, exact and cooperative coevolution solutions.* International Journal of Production Research 2020, Vol. 58(21), pp. 6441-6452.
- [7] Yin Y., Stecke K. E., Swink M., Kaku I. *Lessons from seru production on manufacturing competitively in a high cost environment.* Journal of Operations Management 2017, Vol. 49, pp. 67-76.
- [8] Yu Y., Tang J. *Review of seru production.* Frontiers of Engineering Management 2019, Vol. 6(2), pp. 183-192.
- [9] Zwierzyński P., Ahmad H. *Seru production as an alternative to a traditional assembly line.* Engineering Management in Production and Services 2018, Vol. 10(3), pp. 62-69.

Selected Aspects of Inconel Alloy Green EDM Machining Development

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Abstract

Inconel alloys are one of the most difficult to machine materials with conventional machining methods. The alternative which can be used is electrodischarge machining (EDM). EDM process requires dielectric utilization, during the research the eco- friendly approach and gaseous dielectrics were used. The main aim of this research was to determine the influence of EDM milling in carbon dioxide used as dielectric in two configurations – with and without external workpiece cooling with deionized water on the EDM technological parameters (material removal rate, electrode wear) as well as technological surface integrity and surface structure. The EDM machining was conducted on the research test stand equipped with electrodischarge generator. The dry electrodischarge machining of cuboid workpiece with tubular cooper electrode with outer diameter of 1 mm, in the EDM milling kinematics, was carried out in the carbon dioxide as a dielectric supplied to the machining gap through the channel in the working electrode, in two configurations. Described in the paper dependences and differences between two machining variants are believed to be related with the changing of the machining process mechanism (material oxidation occurs) as well as better heat dissipation from the machining area.

Keywords: electrodischarge machining, Inconel alloy, dry EDM.

References

- [1] Żyra A., Bizoń W., Skoczypiec S. *Primary research on dry electrodischarge machining with additional workpiece cooling*. AIP Conf. Proc. 2018, Vol. 2017.
- [2] Żyra A., Skoczypiec S. *Wpływ dielektryka na cechy strukturalne i morfologiczne stali austenitycznej po obróbce elektroerozyjnej*. Mech Miesięcznik Nauk 2016, Vol. 1, pp. 26-28
- [3] Żyra A., Skoczypiec S. *Badania obróbki elektroerozyjnej żarowytrzymałych stopów niklu Inconel 718 oraz Inconel 625*. Stal, Met Nowe Technol 2016, Vol. (3-4), pp. 46-50.
- [4] Skoczypiec S., Ruszaj A. *A sequential electrochemical–electrodischarge process for micropart manufacturing*. Precis Eng 2014, Vol. 38, pp. 680-690.
- [5] Klocke F., Mohammadnejad M., Hess R., Harst S., Klink A. *Phase Field Modeling of the Microstructure Evolution in a Steel Workpiece under High Temperature Gradients*. Procedia CIRP 2018, Vol. 71, pp. 99-104.
- [6] Zhang Y., Liu Y., Shen Y., Ji R., Li Z., Zheng C. *Investigation on the influence of the dielectrics on the material removal characteristics of EDM*. J Mater Process Technol 2014, Vol. 214, pp. 1052-1061.
- [7] Chakraborty S., Dey V., Ghosh SK. *A review on the use of dielectric fluids and their effects in electrical discharge machining characteristics*. Precis Eng 2015, Vol. 40, pp. 1-6.
- [8] Govindan P., Joshi SS. *Experimental characterization of material removal in dry electrical discharge drilling*. Int J Mach Tools Manuf 2010, Vol. 50, pp. 431-443.

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