PORTO, PORTUGAL

JULY 8-11, 2024

IAMOT 2024

33rd IAMOT CONFERENCE

HUMAN-CENTRED TECHNOLOGY MANAGEMENT FOR A SUSTAINABLE FUTURE

BOOK OF ABSTRACTS

Title. Human-Centred Technology Management for a Sustainable Future (33rd IAMOT Conference): Book of Abstracts

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ISBN. 978-972-752-324-5

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A data-driven review of news media on blockchain and Internet of things in agricultural contexts | *Author(s): Júlia Santos Humberto, Jéssica Alves Justo Mendes, Lucas Gabriel Zanon, Mateus Cecilio Gerolamo and Marcelo Seido Nagano*

Abstract: To overcome the challenges faced by modern agriculture, researchers have turned towards technological advancements, such as the Internet of Things (IoT), and blockchain technology (BT). This study aims to evaluate the discourse involving the themes of IoT and BT in agriculture through a comparative analysis between the discourses of academic papers and news articles identified in Web of Science (WoS) and Google News, respectively. A topic modeling approach using latent dirichlet allocation (LDA) was adopted to analyse the data. The results indicate that academic papers and news articles have shared a discourse related to BT in the food supply chain, IoT sensors, and artificial intelligence (AI) technologies being applied in agricultural practices. The differences between the discourses mainly lie in their focus on farmers and the internet, which attracted notice in news articles but did not garner equal attention in academic literature. Based on the findings, recommendations for future research are proposed.

Transversal competencies assessment and pedagogical methods for higher education: a literature review | *Author(s): Elizaveta Osipovskaya, António Coelho and Péter Tasi*

Abstract: The aim of this article is to provide a literature review of the transversal competencies (TCs) of higher education students. The PRISMA statement was used to guide the methodology for the systematic review. The data collection produced 39 articles from the Scopus database in the four years between 2020 and 2023. The analysis focused on the most highly valued TCs, the methods and instruments for its evaluation, and pedagogical approaches utilized for the integration of TCs at universities. One of the main contributions is the identification of the seven most frequently assessed TCs, creation of a classification that is made up of 33 TCs that are grouped into five dimensions. The results show that approaches like Project-Based Learning, Challenge-Based Learning, or a tool ChatGPT foster TCs. The study underscores the need to integrate TCs into curricula, preparing students for multifaceted modern workforce demands.

Artificial intelligence in engineering education: a content analysis | *Author(s): Emilia Ahumada, Macarena Alvarez, Rosley Anholon, Tiago Sigahi, Carolina Rojas-Córdova and Izabela Simon Rampasso*

Abstract: The integration of artificial intelligence (AI) into engineering education is an evolving area that promises to transform teaching and learning. This study examines the literature on the use of AI in engineering education to understand its current state. For this, a systematic literature review was conducted and the selected papers were analysed through an inductive approach of content analysis. It is highlighted that most of the articles presents practical applications of cases, evidencing a scarcity of theoretical studies. This study also evidenced the need for more AI research in engineering education, with a focus on sustainability to promote more comprehensive education.

Enhancing Technological Taxonomies by Large Language Models | *Author(s): Giuliana Barba, Mariangela Lazoi and Marianna Lezzi*

Abstract: The evolution of Large Language Models (e.g. GPT-4) in the modern data-driven business contexts has opened up new perspectives in optimizing operations and managing information. This study introduces the Automated Semantic Taxonomy Enrichment Methodology (ASTEM), a novel framework utilizing GPT-4 to enhance the semantic richness of corporate taxonomies. ASTEM integrates advanced prompt engineering and iterative evaluation to generate

contextually relevant taxonomy definitions. A case study carried out in a large company operating in the aerospace sector provides a practical perspective on the methodology effectiveness, demonstrating its crucial role in filling information gaps and establishing relevant semantic connections. This study demonstrates the potential of leveraging artificial intelligence to automate complex intellectual processes and suggests directions for future research in expanding its application across different industrial domains.

The dynamics of AI Innovation Ecosystems: A Case Study of Greater Manchester | *Author(s): Na Jin and Ian Miles*

Abstract: This research aims to understand an AI innovation ecosystem, focusing on its inception and dynamics, while also enhancing the broader comprehension of innovation ecosystems. It examines the challenges and governance issues faced in developing the AI innovation ecosystem, emphasizing the critical role of regional capabilities, institutional backing, and educational resources in fostering AI advancement. The study identifies key components like actors and institutions, along with their relationships within the ecosystem, and provides specific policy recommendations. The methodology employed is a mixed-methods approach centered on the Greater Manchester region. It explores the interactions among entities such as universities, institutes, funding agencies, financial services, startups, and established businesses. The study's academic significance lies in shedding light on the dynamics of the AI ecosystem from an innovation standpoint. Practically, it aims to provide actionable guidance for AI innovation ecosystem managers, offering a holistic view of the intricacies involved in nurturing AI innovation environments. Some possibilities for advancing the research field are suggested, relating especially to the integration to more mature organizational studies, such as change management."

Decision maker contact prediction model in a business context: a machine learning approach | *Author(s): Margarida P. Dias, Filipe R. Ramos, João J. F. Gomes, Susana C. Almeida and Rita N. Dias*

Abstract: In the business-to-business sector of a telecommunications company, each company/customer has several contacts associated with its portfolio. The challenge is to identify the critical contact. In this context, by combining human skills with the strengths of technology, it is possible to gain insights that support the management process and business efficiency. The main objective of this study is to develop a predictive model that estimates the likelihood that a contact is a customer decision maker. A binary response variable was created and four formulations were tested using commercial outcome data. A machine learning algorithm (Random Forest) with Bayesian hyperparameter optimisation was used to identify the case that gave the best results. The results were validated through telemarketing campaigns. The developed model successfully overcame the challenge of identifying the critical contact. The support provided by the technology thus proved to be an asset for the telecommunications company (guaranteeing efficiency gains and a higher decision rate).

AI trustworthiness under agency theory perspective: a theoretical approach to human-ai relationship | *Author(s): Rosana Vaz Barbosa*

Abstract: Human-AI relationship is going broader and deeper. The autonomy of AI systems ought to be determined by considering the potential risks and consequences of erroneous decisions on both users and society as a whole Bias and other unwanted outcomes can affect AI decisions and cause harm. How trustworthiness of AI characteristics can be used to solve Agency problems? This research aims to establish a comprehensive relationship between the

trustworthiness of AI systems and Agency Theory. To achieve this goal, constructs were delineated from the theory and propositions were developed. Relevant trustworthy AI requirements are Fairness, Accountability, Transparency and Ethics. 5 propositions P1: Trustworthiness is a mechanism that enables principals (humans) to rely on agent (AI) decisions. P2: Transparency as trustworthiness part could minimize the effects of information asymmetry between humans (principal) and Agents (AI). P3: Fairness as trustworthiness part could minimize the effects of bias from agents (AI) moral hazard. P4: Accountability trustworthiness part could improve agents' behavior (AI) in achieving the principal´s (human) objectives. P5: Ethics as requirement for trustworthiness AI could reduce agency problems related to all stakeholders. From a theoretical perspective this research contributes by connecting AI trustworthiness with Agency theory in a Human-AI collaboration scope. By highlighting the existence of the agency of AI, this study contributes to managers because it discusses causes, effects and mitigation possibilities of the risks from AI Agency problems as a tool, a team member, or as a manager as well. Finally, it aims to bring information to final users, and society, about how they can be aware and reduce risks when using AI.

A Framework for Leveraging AI-Powered Social Listening Technologies to enhance Marketing Strategies for Small and Medium E-commerce Businesses in Egypt | *Author(s): Mohammad Ahmmad, ElHassan ElSabry and Tarek Khalil.*

Abstract. This study investigates the adoption of AI-powered social listening (AI-PSL) by Egyptian e-commerce SMEs. Despite recognizing the potential benefits of AI-PSL for marketing strategies, a significant gap exists between perception and implementation. A mixed-methods approach using surveys and interviews explores the barriers hindering SMEs from leveraging AI-PSL, such as limited resources, lack of technological expertise, and technological readiness constraints. Although these challenges exist, SMEs demonstrate enthusiasm for integrating AI to gain a competitive advantage. To bridge the adoption gap and guide SMEs to harness the full potential of AI for growth and competitiveness in the digital era, this research proposes a tailored framework for AI-PSL adoption. This framework focuses on providing guidance on resource allocation, skill development, and strategic planning for effective utilization of AI-PSL tools.

Using explanations to estimate the quality of computer vision models | *Author(s): Filipe Oliveira, Davide Carneiro and João Pereira*

Abstract: Explainable AI (xAI) emerged as one of the ways of addressing the interpretability issues of the so-called black-box models. Most of the xAI artifacts proposed so far were designed, as expected, for human users. In this work, we posit that such artifacts can also be used by computer systems. Specifically, we propose a set of metrics derived from LIME explanations, that can eventually be used to ascertain the quality of each output of an underlying image classification model. We validate these metrics against quantitative human feedback, and identify 4 potentially interesting metrics for this purpose. This research is particularly useful in concept drift scenarios, in which models are deployed into production and there is no new labelled data to continuously evaluate them, becoming impossible to know the current performance of the model.

AI-based Innovation in Precision Agriculture: Studies of Brazilian AgTechs | *Author(s): Belmiro N. Joao*

Abstract: AgTech is companies using technology in agriculture to increase productivity and efficiency. Technologies like machine learning have prominence in Precision Agriculture. This research aimed to identify and analyze where knowledge is created in ML to AgTech. We show three case studies of AgTech that help this transformation and are attracting the growing interest

of venture capital. The research works on the Knowledge Spillover Theory of Entrepreneurship for creating and flowing ML knowledge in Brazilian universities that impact de AgTech's creation. Convolutional Neural Networks and other deep networks are examples of AI-based technologies in PA. Three relevant AgTechs were selected for the researchers to prepare the case studies. AgTechs have an above-average demand for technological expertise, funding, and knowledge. Crop monitoring and irrigation systems control by remote pivot management are examples of solutions with the participation of leading institutions and experts in Brazil's innovation ecosystem, including leading universities.

Deep Learning for Materials' Transportation Cost Prediction in Modular Construction | *Author(s): Maria Teresa Pereira, Maria José Pereira, Eduardo Oliveira and Marisa Guerra Pereira*

Abstract: Modular construction (MC) represents an innovative approach to optimize construction processes while offering significant gains in efficiency and sustainability. A crucial aspect that is often neglected is the transportation cost of the materials used in modular construction projects. Therefore, there is a lack of data regarding this issue, so this study introduces a deep learning-based approach for forecasting the transportation costs of another type of goods, aiming to later optimize logistical planning and budgeting in MC. The increasingly complex nature of the market requires new and innovative business solutions, which is why our cost prediction model aims to bridge the gap in relevant information in the civil construction domain. Evaluating the feasibility of our proposed algorithm, we obtained a MAPE value of 25.8%, which outperforms the LGBM Regressor that generated a MAPE value of 30.5%. These results indicate that the proposed method has the potential to produce superior outcomes when compared to the LGBM Regressor, a very powerful tree-based algorithm. Additionally, it is possible to conclude that the developed tool is capable of providing good results, enabling informed decision-making and resource management in this highly complex and dynamic sector."

Assessing European Union Member States' Implementation of the Artificial Intelligence Act | *Author(s): Helena da Costa; Joana Mendonça*

Abstract: In this research, we study the differences in approaches of European Union (EU) Member States to follow the requirements of the Artificial Intelligence Act (AIA), unveiling considerable disparities in AI policy frameworks across the Union. These discrepancies not only pose challenges to the harmonization enforcement of the AIA and the synchronization of AI governance but also influence market entry conditions for AI sector players in different countries. Our findings highlight the diverse levels of preparedness among Member States, potentially affecting the competitive of AI development and application across the EU. The variability in policy enactment underscores the necessity for tailored strategies to enhance the AI governance capabilities of less prepared Member States, aiming for a balanced and comprehensive AI policy landscape throughout the EU.

Exploring the drivers and barriers of plastic reduction actions under the circular economy: A PEST analysis-based study | *Author(s): Tung-Fei Tsai Lin, Po-Hsuan Chen, Kuan-Ho Chiang, Jhe-Siang Chen, Chung-Yi Chiu, and Ji-Sian Cian*

Abstract: In response to global environmental and climate challenges, the development of a circular economy, particularly in reducing plastic harm, has become a global imperative. This study examines the factors influencing the development of a plastic circular economy in Taiwan, using PEST analysis to identify influences on industry and market performance in plastic reduction from 1991 to 2020. The findings reveal that both restrictive and encouraging political policies

effectively aid in plastic reduction, although the impact of economic growth on reduction efforts is less clear. Socially, female demographics and increased environmental awareness significantly enhance plastic reduction. Technological advancement, despite being relatively lagging in Taiwan, significantly aids in these efforts. This research offers insights for policy and management strategies in transitioning the plastic industry towards a circular economy, providing guidance for government and industrial manufacturers.

Framework for the Business Transformation Towards the Circular Economy: A Systematic Literature Review | *Author(s): Anja Rasor, Lisa Kirchberg, Michel Scholtysik, Christian Koldewey and Roman Dumitrescu*

Abstract: In the face of climate change and growing sustainability awareness, industrial companies are at a pivotal point in transforming from a linear to a circular economy (CE) model. Yet, aligning their business with the principles of the CE is a challenging task. Utilizing a systematic literature review (SLR) and thematic analysis a framework for the business transformation towards the CE has been developed. It considers the dimensions product, business strategy, corporate management, and value chain. The circular business transformation (CBT) framework includes incentives for entering the CE, fields of action, design options, and associated challenges. For researchers, it provides a comprehensive overview and serves as a basis for in-depth studies of each dimension of CBT. Furthermore, it acts as a practical guide that enables industrial companies to strategically navigate through the complexity of the CBT and to effectively design it.

Measuring and Enhancing Circularity of the Healthcare Sector: The Circularity Model of Products & Spare Parts | *Author(s): Soufiane El Bechari, Ghada Bouillass, Bernard Yannou, Michael Saidani, Alexandru Volanschi and Robert Heidsieck*

Abstract: The medical sector is lagging behind in adopting circular economy practices due to its heavily regulated operating environment. A lack of a framework for measuring circularity performance of large-scale medical equipment is one of the main challenges. To address this, a Circularity Model of Products & Spare Parts (CMPP) was developed by integrating three main features: adapted to the healthcare sector, data-driven automated model, and decision-oriented. The CMPP provides a systematic way to measure and track circularity performance of healthcare industries. It can also be adapted to fit other industrial systems and sectors. The research offers valuable insights into the potential of digitalization and data-driven culture in fostering the transition from linear to circular models both from conceptual and operational perspectives.

Revisiting the Technology Dimension of Circular Economy: A Thematic Review on Technological Barriers | *Author(s): Nihan Yıldırım and Tuğrul U. Daim*

Abstract. The urgent need for sustainable development fuels the rise of the circular economy (CE) as a key enabler of the UN's Sustainable Development Goals (SDGs). However, the nexus between the CE and technologies have played the major role in the previous research on the enablers and barriers of CE transition. This systematic literature review (SLR) aims to explore the technological barriers of this process. Employing the PRISMA approach and searching the Scopus database, the thematic review uncovers valuable insights on the technological barriers as technology roadmap components toward circular transition of businesses. By raising an awareness and technological capability gaps of companies regarding CE transition, this study can guide managers, policymakers, and researchers for designing responsive roadmaps and strategies. By unleashing the full potential of CE through technology adoption, the industrial actors can pave the way for a more sustainable future.

Archetypes of Circular Business Models in the Construction Industry: A Systematic Literature Review | *Author(s): Ana Beatriz Sales and Fernando Viana*

Abstract: The Construction Industry assumes a prominent position in waste generation compared to other economic sectors, so, the consideration of studies related to the Circular Economy in this industry presents itself as an important need. Therefore, this research focuses on a systematic literature review on the archetypes of circular business models in the Construction Industry. The objectives of this study are related to classifying archetypes, identifying the main barriers of the Circular Economy, and identifying research gaps, considering the construction industry. This study provided the classification of archetypes in the context of circular business models, so that predominantly those related to technology and organization stand out. The barriers identified were economic, institutional, social, and legal. In relation to the research gap, we identified the knowledge and application of materials and the collaboration of stakeholders as the main ones.

Proposal of evaluation protocol for measuring citizen sensibilization in recycling practices | *Author(s): José Silva, Felipe Rubilar, Pavlo Santander-Tapia, Christopher Caceres, Daniel Gálvez and Lorena Delgado*

Abstract: Recycling is one of several key activities proposed under a circular economy to keep raw materials in use. However, despite the importance of recycling, there are currently low recycling rates for some materials, such as plastic, glass and tires. In this context, citizen education and awareness is essential, so new forms of awareness-raising, such as virtual or immersive experiences, are being explored in order to support the awareness-raising process. It is for this reason that this research proposes, based on a literature review, a conceptual evaluation protocol that allows evaluating the degree of learning/awareness of citizens in relation to recycling, thanks to their interaction with virtual experiences or other traditional learning techniques.

Development of an analysis grid based on the Living Lab concept to assess innovative initiatives in the forestry sector | *Author(s): Adèle Desaint, Silvia Ureta Cifuentes, Angie Bernal Torres, Dennis Rosales, Maxence Arnould, Alexis Steiner and Laure Morel*

Abstract: In a context of climate change, forest management practices acquired to date are being called into question. Consequently, there is a strong need for innovation to adapt forest management practices in order to design the forests of the future. To this end, the Living Lab approach has shown its relevance in recent work with the construction of a methodological reference framework for piloting forest Living Labs. Nevertheless, this framework has shown some limitations, notably in the evaluation of territories upstream of the implementation of the approach. In this paper, we show the first results of the design of an evaluation tool for innovative forestry initiatives based on Living Lab principles. A tool was created with 70 following a literature review and interviews with Living Lab managers. This tool will now be tested in operational projects to analyze its performance.

A Corporate-Startup Co-Creation Program in the Regulated O&G and Energy Ecosystem in Brazil: the case of Petrobras Connections for Innovation | *Author(s): Ricardo Ramos, Eduardo F. G. Santos, Flavio Romano and Viviane M. A Parreiras*

Abstract: Petrobras decided to create its first corporate-startup co-creation program, called Startups Module, to reduce the barriers to entry in the Oil & Gas and Energy (OG&E) sector. It was launched in 2019 together with the open innovation program called Petrobras Connections for Innovation. This paper focuses on describing the Startups Module's business model, including the method for innovation challenges selection, the role of the stakeholders, the process of

technical and business mentoring, the rules of intellectual property, as well as the main impacts on the innovation ecosystem. The program had a wide repercussion in the sector by stimulating partnerships between corporations, startups, and research centers, and contributing to the improvement of the regulatory framework for RD&I in the Brazilian O&GE sector. As part of our findings, we introduced a new framework for co-creation with startups called "Deep Tech Startup Factory" and listed the premises for its application.

The Impact of Collaborative Innovation on SMEs' Sustainable Performance | *Author(s): Jamel Gamra, Elaine Mosconi and Jean Cadieux*

Abstract: This paper investigates the impact of collaborative innovation on the sustainable performance of SMEs. We postulate that collaborative innovation appears to have a positive effect on the overall performance of the company, which is now intimately linked to the sustainable dimension. However, SMEs' commitment to sustainable development remains limited, requiring efficient use of resources. A field survey was conducted among manufacturing SMEs in Canada to answer this question. A balanced view of performance, presented by the Sustainable Balanced Scorecard (SBSC), aligns stakeholder objectives with company goals for multidimensional sustainable performance for a better understanding of the contribution of collaborative innovation.

Exploring Service Innovation for Regional Development from An Ecosystem Perspective: A Case Study of Living Labs | *Author(s): Na Jin, Ian Miles, Feng-Shang Wu and Hsin-Yi Hu*

Abstract: This study explores service innovation for regional development at the macro-level perspective. It critically reviews concepts of service innovation and innovation ecosystems, highlighting the gaps in existing literature from a service ecosystem perspective. Employing qualitative methods, the study conducts in-depth interviews with experts and panel discussions, focusing on living labs involved with government, universities, research institutes, industrial firms and citizens. The study's academic contribution is providing a macro-conceptual framework for a more holistic understanding of service innovation and ecosystems. Practically, it addresses the challenges and barriers faced by the government and industry in promoting service innovation and proposes a framework for policy recommendations. The paper concludes with five key suggestions aimed at government and industry stakeholders to improve the effectiveness of service innovation efforts for regional development and firm's innovation performance.

Directionality and agency capability as sine qua non for the emergence of inclusive innovation systems: A case study | *Author(s): Claudia Marcela Bula Rodriguez, María Luisa Villalba Morales and Walter Lugo Ruiz Castañeda*

Abstract: An inclusive innovation system (IIS) is defined as the agents, relationships, institutions, and infrastructure necessary to create innovations that promote the social and economic well-being of those experiencing exclusion. The literature suggests that all agents in an IIS, especially those with agency capability, should have a social directionality that promotes the community well-being. However, empirical evidence reveals that these agents may behave in ways that affect the development of an inclusive innovation system. This research aims to deepen the understanding of how the directionality of agents with agency capability, and their altruistic or egotistical behaviours, influence the dynamics in an inclusive innovation system. Three cases of excluded communities in Colombia were compared using a qualitative and descriptive approach. The results show that agency capability alone is insufficient to promote inclusive innovation dynamics and ultimately, inclusive innovation systems.

Into the wild - a methodology for participatory prototyping in complex environments | *Author(s): Sara Reichert, Andreas Sumper, Olga Willner, Daniel Wessolek and Thomas Sikora*

Abstract: We propose a methodology for participatory prototyping among people with different non-expert skill sets. Our research focuses on simplifying technology through a frugal approach, co-designing open hardware prototypes, and leveraging the outcomes for further research or product development. Results are tangible objects with basic functionalities. Hardware cost are less than 50 Euro. Furthermore we suggest a perspective to rate the success of prototyping. Our case study employs adapted transdisciplinary design science research in Berlin and Barcelona, both of which exhibit a focus on data-driven innovation policies and participatory smart city strategies."

Interfaces of Digitalization with Labor Productivity in Construction: A Thematic Literature Review by Roadmapping Components | *Author(s): Ceren Sahin and Nihan Yildirim*

Abstract: Digital technologies hold a prominent position in construction industry's agenda by offering avenues for enhancing process and project management. The technologies address substantial shortcomings in productivity, quality, and sustainability performance, which arise from the construction industry's heavy reliance on labor and its tendency to generate significant waste. Digital technologies change construction operations, both in-situ and throughout the whole life-cycle of a construction project. The goal of this study is to investigate the connections between labor productivity and digitalization in the construction industry. This is achieved by a bibliometric analysis utilizing the Scopus database as the primary source of relevant publications. Grounding on a Prisma Flow approach, this study retrieves publication data using Bibliometrix (Biblioshiny) package in R programming language. Findings indicate that there are few studies for the relationship between digitalization and labor productivity in the construction industry.

Technology Roadmapping for Defence: A Systematic Literature Review and Research Gaps | *Author(s): Linda Malinga, Petrus Letaba and Marthinus W. Pretorius*

Abstract: This review explores the extant literature on technology roadmapping in the Defence context. A systematic literature review was used to identify studies from citation databases, and thematic analysis was used to analyse the relevant studies. This review identified key trends, methodologies and research gaps. It sought to contribute to the systematic literature reviews by identifying technology roadmapping studies tailored to the nuances of Defence technology planning.

Differences in Perceptions of Barriers to Digital Transformation Across Industries | *Author(s): Sven Packmohr, Henning Brink and Fynn-Hendrik Pau*

Abstract: Transformations are characterised as considerable changes in processes and structure compared to the current status quo. The recent transformation companies face is Digital Transformation (DT). However, meeting DT’s changes is not simple. Companies face barriers in realising the promise of DT. We further examine the barriers on an industry level to conclude differences and general patterns. Our analysis draws on data from 46 semi-structured interviews and 1,436 statements from 525 survey participants within 15 industries to generate frequencies of seven barrier dimensions containing 29 characteristics. Major differences between industries exist in the frequencies of missing error culture, bureaucracy, or isolated systems. The barrier of missing organizational knowledge seems stable across different industries. Our research contributes to an enhanced understanding of the root causes of barriers to DT. Analyzing their differences according to industries helps to find common ground and thus leads to higher generalization.

Technological Synergy in Industry 4.0: Unravelling the Temporal Innovation Dynamics | *Author(s): Arman Yalvac Aksoy and Catherine Beaudry*

Abstract: In the era of Industry 4.0, the adoption of cutting-edge technologies has transformed traditional value chains. As the global community progresses towards enhanced digitalization and with the emergence of Industry 5.0, reflecting on the lessons learned from integrating these technologies becomes crucial. This reflection is key to understanding their impact on innovation and steering our approach in embracing current and future technological trends. Through a meticulous analysis of Canadian industries, the study scrutinizes the influence of various industry 4.0 technologies on fostering product, process, organizational, and marketing innovations through time. The findings reveal intricate, technology-specific patterns of innovation, significantly shaped by the temporal dimensions of technology adoption and the extent of integration within firms' operations. Results of this study can help policy makers and managers better understand the technology adoption and innovation dynamics and draft their roadmap for adoption and innovation accordingly.

Leadership main styles in the context of digital transformation | *Author(s): Maytê Pietrobelli de Souza, Joseane Pontes, Elaine Mosconi and Fernanda Tavares Treinta*

Abstract: Digital Transformation in the industrial sector, known as Industry 4.0 and Industry 5.0, has risen in an expressive way in organizations. At the same time, the role of a leader has become strategic to guide organizations through the complexity of organizational changes. However, few research studies have analyzed leadership from a holistic view of Digital Transformation. This paper aims to investigate the most relevant leadership characteristics in this context. Based on a literature review, leader attributes were mapped using a Digital Transformation framework proposing as outputs of the efforts and changes to becoming a more: sensing, smart, sustainable, and social organization. The main contribution of this paper is the survey of the main leadership styles to support Digital Transformation. The findings also have a managerial contribution as a tool to understand the leader’s profile required to guide an organization through its digital maturity in the Digital Transformation journey.

The Applicability of the Government As A Platform (GaaP) Concept for Digitally Transforming the Government of Egypt | *Author(s): Mariam Fayez and Mohamed Awny*

Abstract. This research explores the potential of a shared platform government approach called "Government as a Platform (GaaP)". It presents recommendations for Egypt and other nations seeking a digital government based on the model components and relevant supporting ecosystem. It examines the experiences of three countries, Estonia, India, and the United Kingdom, that have adopted the platform model, focusing on significant projects and approaches that have contributed to the platform of their governments. The research examines and analyses of the local experts' views on Egypt's digital transformation program. The findings suggest that Egypt needs to develop a conducive governance and legislative environment suitable for a platform government, optimize public data for better service delivery, and appoint a national chief information officer to oversee the model implementation. The research concludes that Egypt is developing its unique model for digital government, emphasizing inclusivity, speed of implementation, and opportunities to optimize the wealth of public data.

Circular economy technology management practices in agri-value chains using the NRBV | *Author(s): Nonceba Ntoyanto-Tyatyantsi and Anthea Amadi-Echendu*

Abstract: Food waste and spoilage are major problems in agricultural value chains. The increasing population growth necessitates higher food production which negatively impacts the environment

that the agricultural sector needs to be cognisant of. To manage carbon emissions, reduce waste and pollution, and improve efficiencies at contained costs, technology management practices and technologies such as sensors, AI, big data, blockchain, robotics and drones are used to promote sustainability and record real- time information for better decision-making. This paper used a desktop literature review to interpretatively investigate technology management practices in agro-processing through the circular economy to ensure sustainable agri-value chains while improving efficiencies in the agricultural processes in a cost-effective manner. The NRBV lens was used to review the ecological, economic and environmental resources. The paper concludes that an agri-value chain and not only organisational approach will result in wider and more sustainable benefits through technology management practices.

Collaborative platforms as stakeholder governance modes in circular economy ecosystems | *Author(s): Claire K. Wan*

Abstract: The potential for innovation and value creation through the collaboration of stakeholders in the ecosystem goes beyond the closed-loop value retention models often emphasized in the circular economy (CE). We argue that how to design and implement an effective stakeholder governance mode that can adapt to changes and drive transformations in the CE ecosystem is central for firms to achieve the sustainability goal that simultaneously incorporate the economic, environmental, and social aspects. Drawing on Ostrom's design principles for stakeholder governance and strategy concepts of platform ecosystems, this study uses the abductive method to identify three archetypes of collaborative platform governance modes. The findings advance the ecosystem strategy and stakeholder governance research on the mechanisms of encourage stakeholder participation, collaboration and joint value creation in CE ecosystems.

A human-robot interaction platform in the context of remanufacturing: A case-study | *Author(s): Swaminath Venkateswaran, Amar Makhloufi, Yanis Diallo, B´er´enice Thomine, Louis Plantey and Athana Kumarakulasingam*

Abstract: One of the steps involved in remanufacturing is disassembly. This article presents a human-robot interaction (HRI) platform using a collaborative robot (cobot) for the disassembly of a condensate pump post-usage. The disassembly sequence for the pump is outlined and the tasks that could be automated are identified. A HRI platform using a UR5e universal robot is proposed as a solution to carry out the disassembly sequence. Based on the cobot architecture, the unscrewing operation is automated using the cobot and the rest of the tasks are carried out by the operator. This approach not only introduces an initial disassembly sequence of the pump using a cobot but also contributes to the automation of strenuous tasks.

The Impact of Digital Transformation on Environmental Sustainability and Internationalization Strategy | *Author(s): Joana Silva, Jorge Oliveira, Ana Borges and Telma Mendes*

Abstract: This research intended to understand the knowledge of Portuguese companies on the impact of digital transformation (DT) on environmental sustainability and internationalization strategy. To meet this purpose, we developed a questionnaire that targeted Portuguese firms based in the north of Portugal and classified by the Portuguese Classification of Economic Activities (CAE in Portugal) from 10 to 32 and with an open email. A Factor Analysis was employed to assess the multi-item questionnaire's construct validity, adequacy, consistency, and reliability. The hypotheses were assessed through the Structural Equation Model (SEM) with a diagonally weighted least squares (DWLS) estimator. Findings reveal that participants comprehend that DT, environmental sustainability, and internationalization have favourable impacts on firms,

corroborating the information discussed in the literature. Additionally, results revealed that DT has positive and significant direct effects on enterprise performance, environmental sustainability, and internationalization. However, that impact is bigger on enterprise performance, followed by internationalization strategy and environmental sustainability.

The digitalization of corporate sustainability reporting: Opportunities and challenges | *Author(s): Cristiana Molho, Sónia Monteiro and Pedro Montez*

Abstract: In a context where more and more companies recognize the need to develop sustainability reports, the digital transformation of processes is becoming increasingly important. To understand the most recent developments in the area, this study presents a literature review on the digitalization of corporate sustainability reporting, including a reflection on the corresponding opportunities and challenges. Topics discussed include the importance of certain technologies, such as big data, blockchain and artificial intelligence, to improve the optimization and quality of sustainability accounting. However, the successful implementation of these technologies largely depends on how companies align their strategies, business models and resource management.

Consumers' attitude toward energy-related digital solutions in Europe | *Author(s): Patrícia Abreu, Sara Neves and José Coelho Rodrigues*

Abstract: Digital transformation has been taking place for several decades in different sectors of activity and is contributing significantly to mitigating the environmental impacts of those sectors. Various digital solutions are related to energy consumption and production, which is crucial to ensure continuous decarbonisation. Most of them are targeted to be used by general consumers. Therefore, it is essential to consider consumers' attitudes towards those solutions and their adoption behaviour to ensure a broad diffusion of them. This study uses the Technology Acceptance Model to understand the adoption of energy-related digital solutions in Europe. We conclude that the perceived usefulness of the solutions is more relevant in attitude formation than the perceived ease of use. Moreover, attitude highly influences adoption behaviour, as reported in the literature. Finally, these relations seem to be highly influenced by the belief that, by adopting digital solutions, consumers contribute to a better balance between energy supply and demand.

Critical Success Factors in the Management of Sustainable Projects in the Defense Industry in the Context of Industry 4.0 | *Author(s): Juliano Sampaio Conegundes de Souza, Mauro Luiz Martens, Cristina Dai Prá Martens, Cleber Grafietti, Marcio Cardoso Machado and Cleber Gaspar Correa Duarte*

Abstract. This research aims to identify the critical factors in project management that influence the success of defense industry projects, from the perspective of sustainability and Industry 4.0. To this end, a systematic review of the literature was carried out by searching for articles published in the Scopus and Web of Science databases, between 2013 and 2023. Inclusion and exclusion criteria were defined, which resulted in 21 articles. As results, 55 critical success factors were listed, divided into three categories. This study intends to serve as a basis for researchers looking for references, concepts, gaps and research trends on the topic, as well as identifying critical success factors in project management in the Defense area.

Toward a User-Centric Broadband Equity: A Comparative Analysis of Mobile Broadband Network Performance Using Crowdsourcing and Drive-Through Tests | *Author(s): Amr Hashem, ElHassan ElSabry, Tarek Khalil*

Abstract: Achieving digital equity requires reliable insights into the distribution and quality of broadband access. While crowdsourced network testing (CNT) offers a vast dataset of user-generated insights into network performance, its reliability for policy and research is often questioned. This study contributes to the discourse by empirically comparing traditional drive-through test results from Egypt's telecom regulator (NTRA) with crowdsourced data (Ookla) for the 2020-2021 period. The findings reveal a strong correlation, suggesting that CNT is a viable tool for gaining a user-centric, granular understanding of mobile broadband performance in developing nations. This has implications for academics, policymakers, NGOs, and entrepreneurs focused on addressing the digital divide.

Innovation Adoption in the Agri-food System: the influence of perceived innovation characteristics with Alternative Proteins | *Author(s): Marcela Ribeiro, Eduardo Vasconcellos and Andréa Mineiro*

Abstract. The innovation adoption can be influenced by different perceived innovation characteristics, which vary from sector to sector. The agri-food system is an extremely important sector that has undergone several transformations due to its responsibility to feed a rapidly growing population while facing climate change and resource scarcity. This challenge presents the sector with the possibility of various innovations. However, for the innovation adoption to occur efficiently, it is necessary to identify the perceived innovation characteristics that may influence innovation adoption, which is the objective of this study. For this purpose, semi-structured interviews were conducted with managers involved in the innovation adoption in the agri-food system. It was possible to verify that the following perceived innovation characteristics influence the innovation adoption in the agri-food system: Compatibility and Market Demand, Relative or Economic Advantage, Complexity, Testability, Visibility and Uncertainty.

Technological route for decarbonizing steel processes: A case study in the Brazilian steel industry | *Author(s): Leopoldo Marcelino Silva, Fabio Neves Puglieri, Fernanda Tavares Treinta and Joseane Pontes*

Abstract: The pursuit of sustainability and decarbonization of production processes is a strategy and a reality for many large companies. This article aims to identify technological solutions for decarbonizing the industrial processes of a major Brazilian steel company, with a focus on energy technologies and Industry 4.0. To achieve this goal, a systematic review and case study were conducted to identify applicable technologies for the analyzed context. The identified technologies include connecting the electricity grid to the Brazilian free energy market, which enables the acquisition of energy from renewable sources; utilizing green hydrogen and nitrogen technology from PSA technology to replace the gas energy matrix; and using biogas for combustion processes to replace natural gas. Despite the high level of complexity and investment involved, it is technically possible to neutralize Scope 1 and 2 $C02$ emissions. About Industry 4.0 technologies, it can be observed that they are applicable to a wide range of energy technologies, facilitating real-time operation, the virtualization of processes and equipment, decentralization, and optimized decision-making.

Assessment of the Impact of the Deployment of Manual Accreditation Application Systems by Sector Education and Training Authorities Government Agency on Skills Development Providers | *Author(s): Nita Sukdeo, Olasumbo Makinde and Nomthandazo Nkosi*

Abstract: Systematic assessment and continuous improvement of the accreditation application systems used for the endorsement of Skills Development Providers (SDPs) in South Africa is vital towards ensuring sustainable skills development programme in the country. SDPs experience myriads of challenges during their accreditation journey with the Sector Education and Training Authorities (SETAs) government agency. In view of this, this paper systematically analyses the impact of the usage of manual accreditation application system and recommend solutions tailored towards mitigating the impact of manual accreditation applications that result in long waiting periods for South African SDPs. This paper discusses growing concerns on SDPs' inability to deliver skills development training in periods while awaiting their accreditation application status. Part of the approach discussed in this paper is the recommendation to use an automated accreditation application system, considering all quality aspects involved in the evaluations.

The relevance of soft skills to Industry 4.0 | *Author(s): Claudia Tania Picinin, Gustavo Tadra Waldm, Guilherme Alves Simões, Maurício Fernandez Rolim da Silva, Bruno Pedroso and Guilherme Moreira Caetano Pinto*

Abstract: The literature understands each process of major technological transformation as an industrial revolution. The world is currently moving into the 4th Industrial Revolution, in this line of reasoning, there is a significant impact on the nature of the work carried out in this sector, either from the employee's point of view, or from the employer's point of view, through the human resources sector. These impacts will lead to changes in the requirements to fill professional positions in Industry 4.0. The aim of this study is to identify the main Soft Skills needed to make up the profile of this professional through a bibliometric analysis using a database of 100 previously chosen articles. This collection, processing and analysis should help in understanding the requirements for Industry 4.0 workers. At the end of the paper, the reader should find competencies that, by similarity, will make up the most relevant groups of Soft Skills in this area, as well as their description and definition.

Enhancing learning engagement through creative design: a case on Chemical engineering training | *Author(s): Olivier Potier, Manon Enjolras and Mauricio Camargo*

Abstract: This research aims to contribute to the innovative capabilities of future engineers required to face current societal challenges. Hence, engineering students should not only be able to create advanced and sustainable technologies, but also anticipate the future needs of humanity and feel the future changes and challenges of societal development This paper proposes experience feedback, on an innovative learning integrating C-K theory-based creative design in a traditional chemical engineering training, after several years application period. The lecture deals with physical separation unit operations (filtration, fluidization, membrane processes, decantation and porous media applications). A Challenge Based Learning (CBL) module-based learning has been developed and applied with cohorts of students for a decade. The proposed module integrating theoretical scientific learning and a set of workshops challenge projects. The proposed approach is described and finding and evidences formalized. Concluding remarks and perspectives are then highlighted.

Education for sustainable development: practices in Higher Education Institutions in the Campos Gerais region | *Author(s): Andreia Antunes da Luz, João Luiz Kovaleski and Adriano M. Soares*

Abstract: The objective of this article was to learn about good practices in education for Sustainable Development. The methodology was structured into basic, descriptive and qualitative. A bibliographical research was carried out, consisting of periodical articles available on the Internet. To collect data, information was sought on websites in six (06) Higher Education Institutions in the Campos Gerais region, using the structure-based research proposed [6], [7], which were adapted for this research. Higher Education Institutions began to incorporate environmental education and Education for Sustainable Development. The results showed that there are interconnections between commitment, implementation and good practices in consumer education and environmental education. This research makes it known that, in general, the implementation of Education for Sustainable Development in Higher Education has not been holistically integrated and the results indicate that there is a potential structure.

Key factors for the implementation of technologies supporting Talent Management | *Author(s): Helena Ferreira, Henrique São Mamede and Arnaldo Santos*

Abstract: Although implementing technologies is a continuous practice observed in organizations, many need help to achieve successful implementations and recognize its impact on their operations and outcomes. Therefore, this review paper aims to present the critical success factors that organizations consider when implementing technology in the Talent Management field. A comprehensive understanding of the technological implementation phenomenon requires adopting a strategic perspective. Consequently, this literature review centres on three clusters: challenges organizations are addressing (Challenges), the technological capabilities and the implementation/adoption process (Technology), and the expected impact (Impact). Findings indicate that a central area of research is the integration of technology in recruitment and, particularly, in the context of Small and Medium Enterprises. Digital Transformation, the Industrial Revolution, and a more diverse workforce are challenges that organizations face. Organizations aim to streamline Human Resources Management (HRM) practices, prioritizing data-driven decisions.

Teaching Learning Factories 5.0: Shaping Training, Skilling and Reskilling for the future | *Author(s): Alexios Papacharalampopoulos, Panagiotis Stavropoulos, Unai Ziarsolo and Olga Maria Karagianni*

Abstract: Industry 5.0, being an ensemble of three strategy pillars, is an emerging concept, aiming at facilitating industry and businesses through the various crises come across. To this end, training needs to integrate these three pillars at a fast pace. Herein, with the objective of facilitating jobs transitions and companies being more susceptible to such interventions, the framework of Teaching & Learning Factories 5.0 is regarded, in light of specific future case studies. The framework consists of a specific template and it is open to future transformations so that it meets customized challenges. Special topics, such as evaluation issues pertaining to the framework are discussed.

Management of Teacher Education: a proposal to increase pedagogical mobilization through co-tutoring | *Author(s): Nuno Francisco and Pedro Pereira*

Abstract: Teacher education stands as a paramount educational concern in Portugal. In response to the critical shortage of teachers in schools, this research project advocates for a distinctive approach that seeks to strike a balance between scientific and pedagogical components.

Collaboration among teachers, spanning disciplinary groups and different generations, is proposed to achieve an educational equilibrium in the learning and teaching process. This collaborative action reinforces the professional pedagogical component with social and personal values. Teacher education, it posits, should adopt a humanistic approach, with intergenerational collaboration, aiming for comprehensive and reciprocal pedagogical development between tutors and co-tutors.

Technology-driven measures for Human centricity in the manufacturing sector | *Author(s): Sara Masiero, Jovista Qosaj, Andrea Bettoni and Bartlomiej Gladysz*

Abstract: Industry 5.0 diverges from its predecessor, Industry 4.0, by prioritising human-centric innovation. Beyond driving efficiency, it utilises technological advancements to elevate quality of life, fostering social responsibility and sustainability. A gap persists in refining methodologies for enterprises to transition toward social sustainability. This article addresses the challenge through a bibliometric network analysis of literature on human-centricity topics, aiming to identify and understand the emerging themes for manufacturing transformation facilitated by Industry 4.0 tools. The paper clarifies fundamental human needs and interests of workers and provides technology-driven measures for human-centeredness in manufacturing. The study develops a model to support CEOs and managers in promoting industrial transition while improving social well-being, including emotional and sensorial dimensions.

Introducing a Human-centered Development Approach towards Convivial Artificial Intelligence | *Author(s): Markus Dusdal and Christoph Haag*

Abstract: The aim of the submitted extended abstract is to present an Artificial Intelligence (AI) process model that is referred to as “convivial AI”. The presented process model is essentially based on the remarks of Ivan Illich and the concept of “Tools for Conviviality” and is intended to promote the creation of AI solutions that place a high priority on user-centered AI implementation, human-machine-interaction and reducing AI complexity.

Human Centeredness in Technological Transformation for the Future of Work | *Author(s): Gita Surie*

Abstract: This paper examines the question (1) How can digital technological disruption be managed to achieve a successful transition to a human-centered and sustainable future of work? The paper links research on AI and digital technologies and their impact on work and employment with concepts from the literature on National Innovation Systems (NISs) and Industrial Ecosystems (IDs), together with research on sustainability. It develops a framework that highlights how to leverage the benefits of AI while mitigating the negative consequences for human labor by providing scenarios to determine possible solutions. Finally, the paper suggests three ways to upgrade NISs and IEs to enable a successful transition to a sustainable future of work.

Understanding the human factor in sustainable quality of life at work from the perspective of teleworkers and the challenges of the Digital Age | *Author(s): Lorena Bastos, Marlene Amorim and Mário Rodrigues*

Abstract: Currently, digitalization technology is used in many work contexts. The characteristics of workplaces are changing as digital environments become fundamental to employees' health and well-being. We must therefore understand the factors that affect individuals' quality of work to improve their skills, productivity, and professional and personal satisfaction. The document is based on a systematic review of the literature on the quality and sustainability of work related to

human factors in teleworking contexts. The Scopus database was used to carry out a critical and exploratory analysis of the concepts covered, using the terms "digital work" and "well-being". Between 2018 and 2023, 23 publications were identified. The research used VOSviewer software to develop the bibliometric analysis of the data. The study improves understanding of the relevance of the topic explored, given the limited number of papers published on the subject, and can serve as a basis for future research.

Human-centered technologies in resource-constraint settings. Insights from a Frugal Innovation perspective | *Author(s): Maria Pineda Escobar*

Abstract: This exploratory paper provides an initial overview of frugal innovation (FI) in social entrepreneurship and calls for a greater consideration of the local contextual conditions in the analysis and implementation of FI. To do so, three FI cases from social enterprises in Colombia are presented. It contends that an adequate consideration of local conditions is fundamental in FI, to provide a human-centered technological solution that is more responsive and appropriate for its intended users and their lived reality. The stories of the three social ventures show how the innovators kept the local needs in mind and adjusted their technologies in a way that responded to the local circumstances. The cases illustrate how human-centered technologies in resource-constraint settings can benefit un(der)served users, if they are developed to solve a specific problem and are tailored to the challenges of that particular environment.

The human side of digitalization: Evidence from the B2B sales profession | *Author(s): Ajax Persaud and Alexandria Hewko*

Abstract: There are many models that have been used to study technology adoption intention and use in various contexts. Most of these models focus on technology attributes and contextual factors. Recent reviews of the adoption literature indicate that few models incorporate the characteristics of individuals even though the disposition of individuals may shape adoption decisions. We propose that well-being, an individual characteristic, should be included in adoption models. Our finding is based on dynamics observed through a qualitative study of salespeople who are required to adopt advanced digital technologies in their sales roles. Digital technologies have transformed the sales role raising questions about job security, digital technology self-efficacy, job satisfaction, and so on. This has created considerable anxiety and stress that have affected the well-being of salespeople. We posit that understanding how well-being influence technology use decisions is an important theoretical contribution to technology adoption research.

Maintenance Human Factors in the South African Mining Industry | *Author(s): Tlatso Mayeza and Rina Peach*

Abstract: The majority of research on maintenance human factors was done in the aviation and energy industries. Studies done in the mining industry have focused more on operational human factors than maintenance-related human factors. This study aimed to determine the significant maintenance human factors that affect the quality of maintenance done in the mining industry and recommend actions to mitigate these factors. A conceptual model was developed for this study based on the key points from the literature review and propositions made. Two questionnaires were developed to survey management and skilled employees working in South Africa's mining industry. The maintenance human factors, Shortage of Labour, Lack of Resources, Time/Pressure to Complete Work, High Workload, Not Following Procedure, and Poor Supervision were identified to significantly impact the quality of maintenance in the South African mining industry.

Human-Centred Decision Support System for Improved Picking-by-Line Warehouse Operations | *Author(s): Romão Filipe Santos, Pedro Pinho Senna, Frederico Guilherme M. Borges, Catarina Marques and Ana Silva*

Abstract: Warehouses and distribution centres play a key role in any Supply Chain, particularly in the retail sector, where a network of stores needs to be replenished in a highly dynamic and increasingly uncertain context. In this regard, companies need to improve their intralogistics systems daily to ensure long-term competitiveness and sustainable growth. This is especially true in picking-by-line systems where many time-consuming and manual tasks are usually involved. This study introduces a new decision support tool based on simulation methods to aid the decision-making process in a picking-by-Line system to improve the overall picking operations efficiency, using a human-centric perspective. A Discrete-Event-Simulation model is proposed to assess a set of parameters under several scenarios, driving a more informed decision-making process towards more cost-effective strategies. The proposed approach was validated through empirical case study showing its effectiveness in assisting operational planning decisions related to capacity and resource allocation. The system demonstrates promising versatility for application across varied warehouse environments.

Simulation of Productive Processes in Living Labs: A Support Tool for Decision-Making from an Ergonomic Perspective | *Author(s): Xiomara Pardo Bascuñán, Daniel Gálvez, Christopher Cáceres, Lorena Delgado and Pavlo Santander*

Abstract: The ergonomics of workers in production processes has a direct impact on the efficiency and effectiveness of the process. For this reason, various authors have been interested in evaluating multiple physiological factors with the aim of determining actions that generate greater stress in employees in order to prevent accidents and improve production processes. However, evaluating ergonomics in the workplace is not a simple task. This article proposes the use of Living Lab-type laboratories to carry out simulations of production processes and to measure the level of stress and ergonomics of workers while performing their tasks. The goal is to generate a simulation and evaluation protocol that allows for both quantitative and qualitative assessment of worker ergonomics when carrying out an activity, ultimately providing information for process improvement.

Creating human capital for the Fourth Industrial Revolution epoch and beyond: perspectives for manufacturing companies | *Author(s): Steven Zulu, Elma Van der Lingen and Marthinus Pretorius*

Abstract: The advent of the Fourth Industrial Revolution phenomenon has triggered changes in various organizational systems. It has created new forms of interactions and linkages amongst various value chains and systems, while core businesses remain the same. Radical technological innovations concomitant with Fourth Industrial Revolution technological innovations, have become an unmistakable challenge for organisations as it renders existing human capital capabilities limitation and misaligned usefulness. This research paper complements the existing literature of technology and innovation by proposing an approach for the human capital creation and development for Fourth Industrial Revolution technological innovations."

Comparative analysis of the readiness for Industry 4.0 of two multinationals in Brazil | *Author(s): Luis Mauricio Resende, Angelica Bortoluzzi Pereira and Camila Mika*

Abstract: Given the rapid evolution of the industry and the increasing demands for adaptation and digitalization, it becomes imperative for companies to be prepared for these changes by integrating various technologies and driving changes across different areas of the organization.

Understanding the level of readiness is crucial for making informed decisions and ensuring a successful transition to the new industrial paradigm. To this end, this study aimed to analyze how two multinational industries prioritize factors for Industry 4.0 readiness in their strategic planning. To reach this goal, the level of their readiness for Industry 4.0 was measured. The research revealed that large corporations predominantly achieved readiness levels of 4 and 5 on a scale of 1 to 5 concerning the size of the companies. This underscores the importance of a corporate culture that values innovation, employee training, and a robust strategy for embracing the challenges and opportunities presented by Industry 4.0.

Utilizing Fourth Industrial Revolution Technologies to Attain Quality Benchmarks in Manufacturing | *Author(s): Busisiwe Sithole, Nita Sukdeo and Sambil Charles Mukwakungu*

Abstract: In this paper, we delve into the transformative effects of the Fourth Industrial Revolution (4IR) technologies within the steel sector by closely examining two pioneering companies in South Africa. Through a blend of quantitative and qualitative methods, insights were garnered from 31 industry experts, shedding light on the adoption and impact of IoT, robotics, AI, big data analytics, and cloud computing on manufacturing practices. Our investigation not only maps out the landscape of 4IR technologies but also uncovers a genuine eagerness among the sector to embrace these advancements, underpinning a readiness to leap into the future of industrial innovation. We critically evaluate the advantages and hurdles of integrating these technologies, with a focus on their role in streamlining operations, reducing costs, bolstering competitiveness, and enhancing customer satisfaction. However, the study's scope, limited by its focus on a small sample within a specific locale, calls for a broader inquiry to fully grasp the potential and challenges of 4IR technologies across the manufacturing spectrum. This research paves the way for further exploration, emphasizing the necessity for more extensive, varied, and sector-focused studies. Our findings serve as a cornerstone for ongoing dialogue on the evolution of manufacturing technologies, offering a roadmap for future research and practical application in the quest for manufacturing excellence.

Integrating 4IR Technologies in Steel Manufacturing: A Fusion of Quality Tools and Applications | *Author(s): Mmanoko Rammai, Nita Sukdeo and Sambil Charles Mukwakungu*

Abstract: Quality tools and advanced manufacturing techniques are the focus of this paper on 4IR in steel manufacturing. This study evaluates the effects of the fourth industrial revolution on steel manufacturing. A close-ended questionnaire was distributed to steel manufacturing and quality tool professionals, yielding a 68% response rate. The findings show a positive view of 4IR and quality tools, a significant economic impact, and implementation challenges, particularly in worker training. The study found that while these technologies are generally well-received, they also present challenges and opportunities for improvement. Advanced training, digitalization, automation, and quality tools are recommended. Longitudinal, global comparative, and employment and cost analysis studies are recommended.

Manufacturing Process Level KPIs: Integration and Limitations in Industry 5.0 | *Author(s): Panagiotis Stavropoulos, Alexios Papacharalampopoulos, Olga Maria Karagianni and Doris Schartinger*

Abstract: KPIs have been a long standing tool for optimization in manufacturing. Throughout the years, many of them have been suggested, implicating different strategies and attributes. As such, productivity and time, cost, quality, even flexibility have been considered as different valorisation target fields for KPIs. With the upcoming Industry 5.0 being embedded in the companies' ecosystem, new KPIs need to be considered. This work is a numerical study, taking into account

different families of KPIs and their impact on decision making, mainly at processes level. The three Industry 5.0 pillars, as well as productivity are taken into consideration, as well as the smooth and seamless transition from one KPIs system to a new one.

Stimulating Innovation: The Role of Intellectual Property Rights Incentives in Global Virtual Teams | *Author(s): Zandra Balbinot and Rosane Marques*

Abstract: Global Virtual Teams (GVTs) have become increasingly prevalent, driven by globalization and technological advancements. This study investigated the impact of Intellectual Property Rights (IPR) as an incentive to foster trust among members of GVTs and examined how companies manage GVTs to balance the protection of IPR with the ongoing development of innovative products and processes. To explore these research questions, we employed a qualitative research approach, utilizing semi-structured interviews with six participants from four multinational corporations. These participants were members of GVTs working on research and development (R&D) projects. The results showed that industrial companies were particularly concerned about IPR protection in relation to their competitors. Software companies, on the other hand, were less concerned about internal IPR protocols. Software companies, however, did reward employees for patents they were involved in. There were also no concerns about IPR protection among employees working in different countries and on different development projects. On the contrary, this rotation was considered as key to foster innovation. To minimize the possibility of ideas leaking, software companies often adopt a modular product design strategy, which involves dividing the final product into smaller, independent components, which might be the reason IPR was seen at a different perspective.

Applying the Scale Up and Stakeholder Methodologies to Design an Innovation Hub for the O&G and Energy Ecosystem in Brazil | *Author(s): Ricardo Ramos, Ricardo Marquini, Melissa Fernandez, Patricia Grabowsky, Rodrigo Lemos, Guilherme Pinto, Jorge , C. T. A. Junior and Ivan Cruz*

Abstract: This paper presents the methodology applied in the design of an Innovation Hub focused on the challenges of the Oil and Gas (O&G) and Energy ecosystem in Brazil. The process was comprised of a pioneer joint effort of 12 corporations (O&G and Energy companies, Suppliers, Big Techs) and two industry associations. The methodology covered the problem definition, the benchmarking of co-creation programs and innovation hubs, the ideation to diagnose pains and propose solution strategies for the innovation ecosystem, and the application of the “Scale Up Ecosystem” and “Stakeholder Model” frameworks in an integrated manner for modelling the innovation ecosystem and the innovation hub. Our findings include a new conceptual model for the innovation ecosystem in the O&GE sector and a schematic representation of an innovation hub. That schematic was adopted as a reference to the creation and launch of the iUP – IBP Innovation Hub and its initiatives.

Integration of the organisational capability, service innovation capability and technological capability upgrading: A systematic literature review | *Author(s): Lucas J. Shabangu and Petrus Letaba*

Abstract: In some instances, the service firms are experiencing the difficulties in supplying their customers with the new and better services due to their deteriorating service capabilities over time. To address this challenge, this paper investigates the state-of-the-art development of the service innovation capability frameworks, especially those that integrate the organisational capabilities theory, service innovation capability and technological capability upgrading concept. Through the use of the systematic literature review, it is found that most theoretical models

integrate the organisational capabilities theory and technological capability upgrading concept; and the least number of theoretical models were found to have the integration of service innovation capability and the technological capability upgrading concept. However, this systematic literature review did not find any framework that integrates the organisational capabilities theory, service innovation capability concept and technological capability upgrading concept. Therefore, this is a gap found on this study.

Strategy formulation and execution in highly complex and dynamic environments: a system dynamics model | *Author(s): Martin Schleith, Leon Pretorius and Herman Steyn*

Abstract: Driven by external shocks, such as the Corona Crisis or the Ukraine War, and an ever rapidly changing market environment, businesses must cope with more and more frequent challenges to defend their market share. Disruptive technologies and legal provisions have the potential to threaten the business of entire industries. Thus, to create sustainable success, it is mandatory for companies to develop the ability to continuously create competitive advantages in even shorter cycles. The purpose of this paper is to initially calibrate and design a System Dynamics (SD) model derived from the findings of a first test of an Initial Conceptual Model. Some case results from data collected at a large automotive supplier in Germany are also discussed.

Assessing contexts of inventions: An explorative study in South Korea | *Author(s): Marc Weller and Ludwig Martin*

Abstract: This study focuses on the context of technological invention in South Korea (SK), aiming specifically to reveal the processes that lead up to an invention and the factors that influence the probability of inventing. The study achieves that by exploring the various theories, concepts, and ideas that researchers have proposed for different countries and samples which might relate to SK and reveal contextual factors that may be prominent there; insights into the literature only revealed that there are information gaps and limited research concerning SK itself which led to the purpose of this study which is the collection of data regarding technological invention through interviews with Korean inventors. The empirical findings add to existing literature and models. They show that many of the results reported in the literature focusing on other countries can be related to SK, indicating commonalities in the inventive phenomenon that have the potential to support future applied research into it."

Responding to weak signals: a key driver of business performance advantage? | *Author(s): Tingxuan Liu and HuiFeng Chen*

Abstract: The role of weak signals in maintaining a firm's competitive advantage is widely recognized, but existing research is unclear about the relationship between a firm's investment regarding weak signals and its business performance. To bridge this research gap, we constructed a model of a firm's weak signal investment strategy, business strategy, and firm performance based on data from Chinese listed manufacturing firms and patent data. Our study shows that the number and structure of weak signal investments have a significant and positive impact on firms' performance, but the effects of weak signals are heterogeneous among firms with different business strategies. This study enriches the literature on topics related to the impact consequences and attribute dimensions of weak signals and contributes to helping managers properly recognize and effectively invest in the direction of innovation indicated by weak signals.

Entrepreneurial intention and entrepreneurial behaviour of research scientists: An extended conceptual framework | *Author(s): Sonia Mathopo, Leon Pretorius and Jan Harm Pretorius*

Abstract: Research commercialisation of innovative, new scientific and technology knowledge originating from universities and public research organisations depends on the transfer of the entrepreneurial intention of research scientists into actual entrepreneurial behaviour. There is a low rate of research commercialisation through the creation of technology-based firms in South Africa. The scientific research output generated from government funded research and development institutions is not always commercialised through the creation of technology-based firms. Hence, there remains a literature gap in understanding the factors that influences the relationship between entrepreneurial intention and entrepreneurial behaviour of research scientist. This study is based on a literature review to develop the conceptual framework and identify factors that influence the implementation of entrepreneurial behaviour of research scientists to participate in research commercialisation through the creation of technology-based firms. A conceptual framework based on the theory of planned behaviour, the Rubicon model of behaviour phases and behaviour regulation theory is developed. The framework is based on extending the study described by Roos and Botha on closing the gap between entrepreneurial intention and entrepreneurial behaviour. It was found that entrepreneurial education, commercialisation resources, and scientists' entrepreneurial characteristics are critical factors that influence the translation of entrepreneurial intentions of research scientists into entrepreneurial behaviour, such as the creation of technology-based firms. The behavioural and post-behavioural phases in the Rubicon model of behaviour phases and the plan generation, decision-making, execution, and monitoring steps can assist the research scientist in implementing entrepreneurial behaviour. This literature study contributes to the field of technology-based entrepreneurship by identifying critical factors required for closing the literature gap on the relationship between entrepreneurial intention and entrepreneurial behaviour of research scientists.

A Study of Perspectives on the Exploration and Exploitation Framework: Focusing on Gradual Change from Exploration to Exploitation and the Role of the Organizational Front Line | *Author(s): Kiyohiro Yamazaki*

Abstract: This paper aims to derive a new dynamic model of exploration and exploitation for product line development by reviewing previous studies on exploration and exploitation. The usefulness of the exploration and exploitation framework presented by March (1991) has been recognized by many scholars. However, the researcher’s perspective is generally static, and the analysis subjects are short-term. Thus, there is a strong tendency to have a fragmented view of the temporary states of the exploration and exploitation done by organizations. However, there is a trade-off between exploration and exploitation; the balance in an organization may change over time with changes in the business environment or strategies. Therefore, this paper first organizes the premises and understandings related to the exploration and exploitation of researchers by reviewing previous research on the topic. It then outlines three balanced organizational approaches to the trade-off between exploration and exploitation: sequential, structural, and contextual approaches. A dynamic model is presented that illustrates the changes in exploration and exploitation by organizations engaged in product development by focusing on the gradual changes within exploration and exploitation, the role of an organization’s frontline, and its changes. This dynamic model allows us to grasp the gradual changes and recurrences of exploration and exploitation and to consider relevant organizational responses from a dynamic perspective, which are insufficiently discussed in previous research. The previous researches, which have been more static in their discussion, have narrower temporal perspectives of analysis

and tend to capture individual product developments, thereby assuming the coexistence of existing exploitation and exploitation product developments. Therefore, exploitative product development was assumed to coexist with a single case of explorative product development. In contrast, in order to understand the product line development, in which firms engage through a long-term perspective, this model considers the development process in which multiple product lines using explorative product development overlap temporally.

An analysis of serendipity in NPD: six cases | *Author(s): Paul Trott, Paul Ellwood and David Baxter*

Abstract: Serendipity is widely recognised as an important feature of innovation management practice, and yet it is not yet the subject of systematic study. We analyse six cases of serendipity in innovation and identify activities which increase the likelihood of serendipity. We develop a model of serendipity in NPD. We suggest process, environment, and people as three important organizational elements of managing for serendipity during new product development. We contribute to innovation theory and show serendipity as an organisational capability in the NPD process.

Employee rewards and creativity versus organizational innovations | *Author(s): Ivan Oelofse*

Abstract: To spark creativity in a workplace, it is important to create an environment where the employees know their input is valued, and where they are free to share their ideas. To improve our understanding of the driving forces behind organisational innovations a study was performed to analyse if there are any correlations between the constructs of employee rewards, employee creativity, and organisational innovations in the managed care sector of South Africa. An online survey questionnaire was distributed covering each latent construct. Results indicated strong correlations between both constructs however due to limitations only a statistically significant correlation between Employee Creativity and Organiational Innovations could be established. The results correlate and contribute well with previous studies conducted in non-healthcare sectors.

Entrepreneurial Creativity and Motivation: an exception to Maslow's hierarchy of needs | *Author(s): Sunja Dewet and Elma Van der Lingen*

Abstract: Entrepreneurial creativity and the motivation to become an entrepreneur are fundamental to the success of any entrepreneurial endeavour. It is therefore impossible to separate the act of creativity from the entrepreneur. This article focuses on better understanding entrepreneurial creativity through a qualitative comparative analysis of entrepreneurs in South Africa and Norway. The data from case study research conducted on both entrepreneurs in South Africa and Norway was used in combination with published data to better understand entrepreneurial creativity. This article strives to convey an interpretation and understanding that focuses on the prevalence of entrepreneurial creativity in both a developing country (South Africa) and a developed country (Norway). Based on the results from the case study research, entrepreneurial motivation and entrepreneurial creativity prevalence are found to be intricately connected. The motivation and drive behind entrepreneurial creativity in these two settings were found to be as vastly different as the environment in which their creativity presented itself. It was found that Norwegian entrepreneurial creativity could be more associated with the concept of self-actualisation while South African entrepreneurial creativity was more associated with the drive to fulfil their basic needs.

The ideal team network and leadership for facilitating knowledge transfer and promoting innovative behaviour | *Author(s): Lerato Khabo and Kai-Ying Chan*

Abstract: In the rapidly changing landscape of contemporary business, fostering innovation is of utmost importance for organizations seeking to maintain their competitive edge. Effective leadership stands as a corner stone in fostering creativity and driving innovation within teams and across organizational networks. This study explores the interplay of leadership styles and team network structures in promoting innovation and effective knowledge transfer within organizations. A comprehensive survey was conducted, garnering 86 valid responses. Results emphasize the crucial role of transformational leadership in encouraging individual team innovation, mitigating knowledge transfer barriers and enhancing trust and shared values in teams. Interestingly, a positive relationship was observed between knowledge transfer barriers and individual innovative behaviour. Consequently, the study supports strategies that encourage transformational leadership and optimized network structures, promoting knowledge sharing, and innovation. Furthermore, it paves the way for investigating the intriguing dynamics between knowledge transfer barriers and innovation, contributing to organizational growth and competitiveness.

Immutability through change: how organizational memory guides a European car brand's electric future | *Author(s): Yu-Shen Shen and Yen-Chen Ho*

Abstract: This study explores how organizational memory shapes a European car brand's response to the transition of the car industry towards electric vehicles (EVs). Organizational scholars thought organizational memory could be instrumental when organizations adapt to changes. Presentations of organizational memory could carry symbolic meanings; thus, memory can bring resilience, enabling members to maintain identity and stability in turbulent environments. We analyze the press releases of a European car brand between 2000 and 2024 using text analysis and topic modeling. References to the brand's founding year and core value increased significantly after 2013, suggesting a deliberate evocation of organizational memory to reinforce identity. This research highlights the strategic use of organizational memory to foster a sense of continuity. The finding of this research provides valuable insights into how organizations leverage their past to navigate present challenges and future uncertainties.

Transforming Intelligent Packaging for Sustainability | *Author(s): Sukky Jassi*

Abstract: The increasing use of smart technology has not translated to greater take-up in all industries. Smart and intelligent packaging technology has been available for many years and its capabilities are continuously developing at rapid pace. Despite growth in the market, there is still limited application of it in the food industry. This paper explores acceptance and resistance to four specific intelligent packaging (IP) technologies (QR Codes, AR, sensors and smart indicators) in the food industry, and how they can be transformed into human-centric and accessible formats that support global sustainability.

Determinants of Artificial Intelligent adoption in Emerging Economies: Evidence from the Information Technology Industry in Morocco | *Author(s): Khalid Allam and Siham Lalaoui*

Abstract: Artificial Intelligence (AI) is rapidly transforming various sectors in the economy, including the Information Technology (IT) industry. In Morocco, there is a lack of research regarding the state of adoption of AI in the IT sector. Therefore, this qualitative study aimed to examine the factors that drive the intention of Moroccan IT companies to integrate AI applications.Semi-structured interviews with eight IT executives from the Rabat-Casablanca region were conducted. The Technology, organizational, environment theoretical model was used as a framework of the study. Findings showed that participants perceive AI as a complex

technology with many potential benefits to the IT sector but can have privacy issues for organizations. Access to financial resources, lack of AI skilled workforce and pressure from competition were identified as important organizational determinants of AI adoption. Environmental factors include technological infrastructure and regulatory support through an AI national strategy. These findings highlight the importance of a public-private partnership to support the adoption of AI in the IT sector and its diffusion to other industries in Morocco.

Climate change and circular economy | *Author(s): Kamila Frizzo, Clandia Maffini Gomes, Jordana Marques Kneipp, Carlos Rohrig da Costa and Roberto Schoproni Bichueti*

Abstract: Climate change resulting from the externalities generated by the linearity of the production and consumption economic model causes various risks to society and organizations. However, the challenges associated with these changes may bring opportunities, driving actions and new businesses and contributing to sustainable development. Therefore, this study aimed to analyse the relationship between the strategic management of climate change within the circular business model, the reputation of industrial companies and public policies. The first phase of the research, characterized as qualitative, was carried out from a multiple case study with three Brazilian companies. The results of this phase allowed concluding that the investigated companies have strategic management of climate change, evidencing a relationship between the mitigation and adaptation practices and three other factors: transition to a circular business model, corporate reputation, and public policies. Thus, based on the results of the qualitative stage, it was possible to confirm the assumption that strategic management of climate change is associated with the circular business model, corporate reputation, and involvement in public policies in the Brazilian organizational context. The second stage of the study, characterized as quantitative, comprised a survey research with Brazilian industrial companies. The results of this second phase made it possible to observe that strategic management of climate change embedded in the circular business model is related to reputation and public policies, as positive associations were found between the dimensions of dependent and independent variables. It was also possible to notice distinctions between the adoption of climate change strategic management, the circular business model innovation degree, the corporate reputation degree, and the engagement public policies degree, given the significant distinctions found in the mean difference test.

Redesign of circular products: an analysis of the Footwear industry | *Author(s): Gustavo Dalmarco, Federico Stacchetti, Ana Ines and Ricardo Zimmermann*

Abstract: The concept of circular economy aims to extend the end-of-life of products by reducing or reusing products and materials, being Design a central part of a successful circular product. In line with the 6Rs strategy for circularity, Redesign (applied by eco-design practices) allows the creation of products that can be easily repaired, upgraded, or disassembled, extending their life, and fomenting a circular economy. For that reason, the aim of this research is to analyse the role of Redesign in the circularity of products. Exploratory qualitative research was conducted, with five in-depth interviews with founders and R&D managers of prominent footwear organizations. Results demonstrate that most interviewed companies, which were born circular, considered Redesign practices from the definition of the product concept. In conclusion, looking at Redesign strategies holistically and through its specific sub-relationships have a major impact on the company's circularity practises.

Technology Management and Innovation in Open-Pit Peruvian Mining: Case Studies | *Author(s): Yannick Carrasco*

Abstract: Mining is one of the main sectors of Peruvian industry; its considerable contribution to GDP, and its exploration and integration projects with other sectors; determine their attraction. The purpose of this work is to employ the benchmark of innovation and technology management in open-pit mining companies in Peru. The methodology of the investigation is descriptive and qualitative, based on a Case Study of five companies in the open-pit mining sector.

Assessing Data Analytics Readiness in the Egyptian Market | Author(s): Ziad Diab

Abstract: This study assesses the Data Analytics Readiness in the Egyptian market using the acatech Industrie 4.0 Maturity Index. 100 responses collected from different domains and industries to understand the data analytics readiness of the Egyptian market on four different pillars: Resources, Information Systems, Culture and organizational. Results indicate mixed readiness, showcasing strengths in Information Systems and infrastructure, coupled with challenges in talent availability and cultural adaptation. The study underscores the importance of aligning organizational strategies, fostering a data-driven culture, and addressing key challenges to unlock the full potential of data analytics in the Egyptian business landscape.

Industry 4.0 Technologies Revolutionising Footwear: Paving the Path to Circularity through Innovative Services | *Author(s): Leonor Monteiro, Ana Correia Simões, António Baptista and Rui Rebelo*

Abstract: The footwear industry, a sub-sector of textile industrial sector, faces increased pressures towards higher levels of sustainability and circularity along all the value chain. Along the last decades, shoe products have become more complex products, integrating a greater number of components, materials diversity and often long supply-chains related to cost reduction and production or sourcing delocalization strategies. Full value-chain digitalization, as a cornerstone of Industry 4.0 paradigm, plays a key role for leveraging more sustainable and circular products, namely by traceability operationalization and forthcoming instruments such as Digital Product Passport. This research studied, via a state-of-art framing of the challenges followed by qualitative approach, how Industry 4.0 technologies can support the development of new services that contribute to sustainable and circular practices in footwear companies. An interview-based survey was conducted to 6 footwear companies, to map the adoption level of Industry 4.0 technologies and cross-linking to circular services business models.

Empirical Study on Data-based Tailoring in Project Management | *Author(s): Anna Schidek, Claudia Doering and Holger Timinger*

Abstract: Project management incorporates a wide range of different tools for the initiation and processing of different projects. A suitable project management approach is essential for business and knowledge management and is therefore often tailored to the requirements of the individual project and its environment. In research and practice multiple approaches for tailoring exist. This paper presents a in-depth survey and its results concerning the tailoring of project management methodologies on the basis of data. Evaluation of a cross-university certification system in project management Author(s): Holger Timinger Abstract: In this paper, a certification system for students in project management is evaluated through a comprehensive study based on an online survey. First, the derivation, structure, and organization of the cross-university certification system for modern project management are briefly outlined. In the main part of the paper, the design of the evaluation study and the results are presented: All successful participants since 2019 were invited

to participate in the survey. The survey revealed a high level of satisfaction with the certification system. Many participants are already in their professional life and can assess the relevance of the certificates for their career. Most participants found the content and qualification level appropriate and helpful. Potential employers appreciate the cross-university collaboration in defining and documenting a common understanding of modern project management.

Evaluation of a cross-university certification system in project management | *Author(s): Holger Timinger, Anna Schidek, Matthias Vieth and Harald Wehnes*

Abstract. This paper presents the evaluation of a cross-university certification system for students in project management. For this purpose, the certification system is briefly described and the evaluation by means of an online survey is explained. The results show that most of the participants of the certification were satisfied with the organization and the structure, the level of difficulty and the contents of the certification. The survey also showed that companies value the certificate when certificate holders apply for jobs. From the results, opportunities for improvement can be derived, such as increasing awareness and providing more information upfront, which can be implemented in the future.

A Study on the Contribution of Project Leaders to the Evaluation Results of National R&D Projects in Japan | *Author(s): Takeshi Maeno and Ayano Kobayashi*

Abstract: The New Energy and Industrial Technology Development Organization (NEDO), one of Japan's largest public R&D management organizations, plans, designs and manages many national R&D projects (NEDO projects) under the two basic missions of ""addressing energy and global environmental problems"" and ""enhancing industrial technology"". NEDO covers a wide range of technological fields, including photovoltaics, storage batteries, hydrogen, robotics, artificial intelligence, electronics, and materials. A typical NEDO project has a project duration of approximately 5 years, a total budget of approximately 3 billion yen (approximately 20 million US dollars) and approximately 7 participating companies. NEDO projects are characterized by the participation of various players from industry, academia and government, and the promotion of these projects through cooperation and competition. NEDO has strengthened management by establishing project teams that include project managers within NEDO and appointing external experts as project leaders (PLs) to lead R&D. In some cases, PLs are not appointed. In this study, we focus on the relationship between evaluation results of NEDO projects and the presence or absence of PLs. Specifically, we conducted numerical and textual analysis of evaluation results for 417 NEDO projects that were evaluated terminally over the 21-year period from 2002 to 2022, categorizing them into those with and without PLs. In addition, we interviewed PLs and other relevant parties for the 8 projects that were evaluated terminally in 2022. These results are discussed.

The Adaptation of the Agile Stage-Gate Model (ASGM) for Application in the Development of Timber Building Design | *Author(s): Chandini Singh and Schalk Grobbelaar*

Abstract: There is an overall shortage of innovation within the construction sector, which limits the exploitation of sustainable buildings, such as with mass timber. The research presented in this paper is the first step toward developing an idea-to-launch model based on the Agile-Stage-Gate (ASG) to assist with the diffusion of this technology. Concepts considered included pre-fabricated timber, diffusion of innovation, traditional Stage-Gate (SG) and ASG models. Agile Scrum was proposed to be implemented in Stages 3 and 4, with additional changes made in the post-launch review stage. The potential limitations and benefits of applying this model to the timber industry

were also discussed. In follow-up research, the proposed model may be refined according to inputs from industry experts.

The role of quality management practices in optimising project execution | *Author(s): Tshomarelo Moche, Andre Vermeulen and Jan Harm C. Pretorius*

Abstract: Several studies have been conducted on how quality management can influence project success. Limited studies have focused on how quality management practices influence specific project management phases. This study aimed to evaluate the role of quality management practices on project execution. The study adopted a quantitative methodology and used data from n=49 projects conducted and completed by a South African multinational company in the manufacturing automation industry over a period of five years. The study revealed that quality management practices significantly influenced project execution duration and project execution costs. The implication of this study is that project managers can enhance quality execution through embedding quality management practices in their respective project management systems. It should be noted that this study focused on two of the three triple project management constraints, duration, and cost/budget, and excluded project scope due to limited data within the organisation studied. Future studies can enhance the findings of the current study by including this variable. Nonetheless, this study provides a foundation for evaluating the influence of quality management practices on project execution. Future studies may also need to evaluate how quality management practices influence other phases of project management.

Combining Quality and Agile: A Contribution to Hybrid Models in Regulated Environments | *Author(s): Heruã Luis Soares da Silva, Daniel C. Amaral and Isabela Neto Piccirillo*

Abstract: Innovation within regulated sectors demands compliance, traceability, and validation, making it conducive to plan-driven project management approaches. However, the increasing level of innovation often makes traditional methods incompatible. Hybrid models have emerged as promising solutions to balance this trade-off. One such practice involves integrating quality management practitioners to validate deliverables produced by agile teams. This study examines the efficacy of this approach within the product development context of an automotive company operating under regulatory constraints. The findings demonstrate positive impacts on delivery planning, monitoring and control, assessment, and knowledge management. Positive contributions include critical analysis of compliance requirements, continuous improvement of deliverables and documentation, and the team's proficiency in regulatory mandates. However, dependence on quality specialists can pose a barrier and potentially lead to negative impacts.

The Project Methodology as a decisive element in the evaluation of the Life Cycle Assessment of Wind Rotor- Blades | *Author(s): Felipe Yamazaki, Albina Gonçalves Filipi, Silvia Pierre Irazusta and Francisco del Moral Hernandez*

Abstract: Brazil has 1039 wind energy production parks, comprising more than 11,000 wind turbines are in operation. It can be stated that there are more than 33,000 wind blades in use. This work aimed to analyze how the Design Methodology based on Scientific Methodology (DMSM) method can contribute to studies of the Life Cycle Assessment (LCA) of Wind Rotor-blades (WRB). Scientific methods are considered for Wind Blades: in the manufacturing, distribution, operation, maintenance and disposal phases. A bibliometric study was carried out, selecting the areas of Production Engineering and Power Generation, in the period from 2013 to 2023, The survey method was applied. 30 specialists answered the interviews. In the questionnaire carried out remotely, 56.5% of respondents agreed that it is possible to apply the

DMSM and its growth was detected in research applied to the life cycle of wind blades. DMSM and LCA can be well used in the Feasibility Study stage for 34.8% and 30.4% understand that the DMSM can be useful in identifying problems in the process of using wind blades.

Holistic application of overall equipment effectiveness and its utilization as a management tool: a production packaging study | *Author(s): Andre Vermeulen, Jan Harm C. Pretorius and Sefularo Masipa*

Abstract: Overall Equipment Effectiveness is the foremost production performance indicator to track performance and reduce production losses. The research aimed to explore the effect of Overall Equipment Effectiveness on equipment's. Focusing on internal versus external factors. The study was conducted through open-ended interview and web- based questionnaire survey. Research results highlight the importance of measuring packaging production performance and computing costs due to poor performance. Research findings showed that 40% losses attributed to external factors and revealed that the monetary value attributed to production inefficiencies which contribute to losses into financial value.

Influence of shared mental models of R&D teams in transitioning through the technological valley of death of innovation | *Author(s): Jim Giraldo-Builes and Walter Ruiz-Castañeda*

Abstract: The technological valley of death is the gap between technological and product development and the actual realization of innovation. While the lack of financing has been the traditional explanation for this phenomenon, newer perspectives have emerged to better explain its occurrence. One alternative explanation for individual behavior lies in mental models. These are the set of expectations, knowledge, beliefs, and experiences, among other factors, that govern our actions. This proposal seeks to explain how the mental models of the members of the development teams influence the transition from the technological valley of death to innovation. It is proposed to use agent-based modeling to achieve the desired outcome. The modeling will utilize the routines of teams and complex adaptive systems to obtain emergent behavior in the form of mental models that either facilitate or hinder the transition through the valley of death. This will be used to develop theory that complements the existing explanations of the phenomenon.

What enables spin-off emergence after the closure of anchor firms? | *Author(s): Michi Fukushima, Noriko Taji and Shingo Igarashi*

Abstract: Anchor firms are large, R&D-oriented firms that significantly impact the local economy. This study examines the conditions and mechanisms for the emergence and growth of spin-offs in a region following the closure or downsizing of an anchor firm. The literature on the loss of existing anchor firms and the emergence of spin-offs has only presented individual cases. Researchers have yet to attempt to find common mechanisms. This study extracts the following conditional factors from previous multiple case studies and investigates their relationships: anchor firm factor, spin-off factor, regional factor, and spin-off network factor. Using this framework, we studied past cases of spin-off creation, especially those related to Alps Electrics. This study contributes by specifying the factors facilitating spin-offs' emergence and survival after an anchor firm's closure or downsizing.

Standard adoption of ISO 56000 | *Author(s): Geerten van de Kaa and Alice de Casan***ove**

Abstract: Recently, a norm has been developed that describes how companies can standardize their innovation management practices. The question is, however, whether this standard will be widely applied in the business world. That question is addressed in this paper. Based on the literature, the paper examines the factors that contribute to the adoption of innovation management standards by companies. Experts who have to decide to adopt the standard compare the factors. We add to the standardization and innovation management literature by focusing on an underexposed theme: the adoption of standards. In addition, we add to the literature by describing the innovation management standard in detail.

Optimizing Smartphone's Back Panel Material Selection: A Comprehensive Analysis Using House of Quality (HOQ) | *Author(s): Ali Al Mamun, Subrata Talapatra, Md. Omar Faruk and H M Belal*

Abstract: This study aims to analyse the characteristics of the back material used in Organization Z's smartphones compared to those of other market competitors, following customer requirements. It also seeks to identify the most suitable material to increase customer satisfaction. Using the main tool of Quality Function Deployment (QFD), the House of Quality (HOQ), absolute and relative weight values were identified. These values were based on customer requirements, which were obtained from a customer survey, and on technical descriptors. These values guided the selection of an optimal material. Among the materials studied, alkali-aluminosilicate sheet glass emerged as the most suitable, exhibiting the highest absolute and relative weights. This chosen material, alkali-aluminosilicate sheet glass, was expected to meet customer demands most effectively. Overall, the study yielded valuable insights for decision-making and improving customer satisfaction in Organization Z's smartphone offerings.

Enhancing Strategic Roadmapping: Addressing Improvement Areas for Effective Product Planning of Software Intense Products | *Author(s): Şenay Demirel and Alper Camcı*

Abstract: In the ever-evolving landscape of technology, companies face the daunting task of navigating through uncertainty to make informed decisions in product management. This dynamic environment, marked by robust competition and rapid technological progress, presents unprecedented challenges characterized by Volatility, Uncertainty, Complexity, Ambiguity (VUCA) or Brittle, Anxious, Nonlinear, Incomprehensible (BANI) attributes. Traditional product roadmapping approaches often fall short in addressing these challenges, necessitating the development of more adaptive, strategic, and data-driven methods. This paper explores the identification of improvement areas within roadmap planning, emphasizing the need for iterative and cyclical approaches, integration with product lifecycle management, distinguishing between feature-based and goal-oriented roadmaps, and effective roadmapping through continuous review and data-based mechanisms. By aligning with the principles of VUCA and BANI, organizations can enhance their roadmapping processes to be more resilient, strategic, and responsive in today's rapidly changing market environments.

Responsible research and innovation (RRI) assessment: the path to a tool | *Author(s): Cristina Machado Guimarães, Vasco Amorim and Fernando Almeida*

Abstract: This article describes the construction path of a Responsible Research and Innovation (RRI) tool, starting with a systematic literature review of all responsible innovation tools to extract the essential dimensions and exclude overlapping. Those dimensions were presented in a series of workshops within a Research and Innovation Action European Project where 35 Innovation Actions (IA) were developed. Focus-group methodology was followed, including the IA's leaders,

to generate discussion around the sixteen dimensions and the meanings of the different grades of the Likert scale of an assessment tool to be applied to innovation processes and results.

Smart Cities as Innovation Ecosystems: Role and Contribution of Citizen Engagement, and a Conceptual Framework | *Author(s): Regina Negri Pagani, Jaqueline Fonseca Rodrigues, David Nunes Resende, Gilberto Zammar and João Luiz Kovaleski*

Abstract: Smart cities are urban areas that use advanced technology solutions to improve services and life of residents. Due to their characteristics, smart cities are conceptualized by literature as fertile innovation ecosystems. The extant literature on this theme claim citizens participation is relevant in the innovation and decision-making process. Despite this claimed relevance, there is not a consensus regarding the effectiveness of this participation. The purpose of this paper is to examine the literature on this regard and to propose a conceptual framework of smart city as an innovation ecosystem suggesting a flux for the role of citizens as active participants in the decisions and innovation process of a city as innovation ecosystems. In order to achieve this purpose a literature review using Methodi Ordinatio 2.0 is carried out. The robust portfolio provided the foundation for the framework. Results describe the steps to be followed in order to plan the citizens' engagement.

Exploring Sustainable Urban Planning: A Global Analysis with a Focus on Brazil | *Author(s): Aline Monteiro Campos, Veridiana Souza da Silva Alves, Vivian Karina Bianchini, Carlos do Amaral Razzino, Paulo Renato Pakes and Barbara Stolte Bezerra*

Abstract: Rapid global urbanization is driving the planning of sustainable cities, where more than half of the world's population already resides in urban areas, with projections indicating that two-thirds will be living in these areas by 2050. This interdisciplinary study adheres to the principles of the circular economy, industrial symbiosis, and urban metabolism. A systematic literature review reveals a growing concern with sustainable practices in urban areas, highlighting their importance for collaboration and the matching of waste and resources. However, there is a significant gap in case studies or analyses in Brazil. Given the numerous technology parks within Brazilian territory, industrial symbiosis emerges as a key strategy to integrate industries into the urban environment, promoting waste reduction and fostering economic circularity, both globally and locally.

An Exploratory Study of the Value Co-Creation Mechanisms of Social Enterprises: A Service-Dominant Logic Perspective | *Author(s): Chia-Chang Tsai*

Abstract: This study explores the importance of value cocreation mechanisms in social enterprises and the key factors influencing their sustainability. The author selected Duofu Care & Service, the first Taiwanese social enterprise to be listed on the Taiwanese overthe-counter stock market, as the subject of a case study. This study analyzes how interaction mechanisms, value propositions, support systems, operant resources, and value-in-use interact in the cocreation of value between producers and consumers of a service. Social enterprises often implicitly adopt value cocreation theory in service-dominant logic to adjust their strategies, proposing appropriate value propositions to attract consumer engagement, using support systems to facilitate value cocreation, and developing mechanisms for interaction between cocreation participants. By providing a fresh perspective beyond social impact theories to evaluate social enterprises, this study highlights the crucial role of value cocreation mechanisms in social enterprises, clarifying the distinct components that constitute these mechanisms. Therefore, this study fills a gap in the literature regarding the value cocreation mechanisms that contribute to evaluating the social impact of social enterprises.

Using of Social Return on Investment index-SROI as tool of responsible research and innovation. Colombian University Case | *Author(s): Diego Andrés Vélez Rivera, Yeny Paola Duque Castaño, María Luisa Villalba Morales, Catherine Torres Arboleda, Ana María Gil Henao, María Isabel Arango Valencia and Diego Andrés Aguirre Cardona*

Abstract: Universities currently face the imperative of showcasing their social and environmental practices and research to the community. Hence, this case study aims to assess the social and environmental impacts arising from organic waste composting practices within the university, employing the SROI methodology. This research adopts a mixed-method approach, utilizing proxy variables and both primary and secondary sources. Through these inputs, a characterization of the involved stakeholders was conducted, alongside mapping the project's inputs and outputs. The findings underscore the positive impacts of composting on waste reduction, the effective implementation of Industry 4.0 technology (IoT), and the significance of the SROI indicator in quantifying the value generated concerning university investment. Such endeavors are integral to investigative processes aligned with the principles of responsible research and innovation (RRI).

Mapping Technology Solutions with Social Impact in the European Union | *Author(s): Maria Eugénia Leitão, Ana Carvalho and Miguel Amaral*

Abstract: While persisting social and environmental problems are amplified by new risks, traditional solutions show evidence of failure in responding to society's growing and diverse needs. Recognizing the importance of social and technological innovation, policymakers and international organizations have encouraged the use of technology for social good and legitimated hybrid socio-technological solutions. However, there is a knowledge gap regarding how Technology Solutions with Social Impact (TSSI) intermediate the resolution of a social need by developing and implementing technology-based solutions. Consequently, using the multiple-case research method for theory building, this research maps which TSSI are currently being developed and implemented in the 27 countries of the European Union and what social and environmental issues these TSSI address. Key findings, future research avenues and implications for theory and practice are presented and discussed.

Building Stakeholder Engagement and Social Capital in a Social Entrepreneurship Ecosystem | *Author(s): Keysa Mascena, Daiane Neutzling, Thomaz Novais Rocha and José Milton Sousa-Filho*

Abstract: This paper aims to analyze how stakeholder engagement and social capital are built in a social entrepreneurship ecosystem. The empirical research was developed in the northeast region of Brazil as part of a national program to develop a connected network of regional social entrepreneurship ecosystems throughout the country. Basic qualitative research was carried out with 30 participants. We propose a stakeholder engagement strategy model for social enterprise based on empirical evidence, social enterprise literature, and stakeholder theory. The findings show that the development of affirmative actions for developing the ecosystem is relevant, reiterating the pragmatic and strategic perspectives of engagement. The value creation occurs through short-term relationships with high reciprocity. Strategies for engaging stakeholders are proposed, providing social enterprise development and, consequently, expanding the possibilities for socio-environmental impact. Strengthening this ecosystem is relevant to the context of social vulnerabilities in emerging markets.

Sustainability-oriented innovation in the cocoa industry: a case study in Brazil | *Author(s): Fernanda Santana da Silva Ferreira, Erica Trica Fedato, Mayara de Oliveira Neco and Fernanda Salvador Alves*

Abstract: Abstract. Sustainability is a challenge for contemporary society and a potential source of innovation for organizations. This qualitative case study analyzed, through secondary data, what innovations (product, process, organizational, marketing) are developed by Dengo Chocolates (an industry in the Brazilian cocoa sector) in pursuit of the sustainability tripod. The results indicate that the company develops the four types of innovation, with an emphasis on product innovation. The environmental dimension of sustainability is more affected by its innovations, to the detriment of the economic dimension. Future studies can investigate the economic sustainability of companies with a socio-environmental purpose. Furthermore, it is suggested that additional studies be carried out on SOI in small and medium-sized Brazilian companies, considering that these constitute the majority of commercial enterprises in the country.

Sustainable infrastructure engineering planning: A socio and techno-economic perspective | *Author(s): Jan Harm C. Pretorius, Leon Pretorius and Thando Montso*

Abstract: The economic growth as well as sustainable development of industries and entire country are determined to a great extent by the transport infrastructure development. The organisations that manufacture and develop critical infrastructure such as transport and/or energy must be efficiently managed, as they are key role players in the economic development of a country. To improve economic growth, sustainable efforts to innovate and develop engineering infrastructure can be made through various planning processes that consider the state of social well-being. There has been a widespread of system pressing issues, which resulted from the rolling power blackouts to congested transport systems in South Africa. The negative impact has resulted in economic decline. This paper aims to explore the planning concept of national well-being and determine technical factors that will improve the energy engineering management system with a strong focus on maximizing the interdependency of well-being strategies to improve freight rail business success.

Predicting risks and its relation to sustainable development goals: An analysis from public procurement | *Author(s): Susana Valencia, Miguel David Rojas Lopez and Silvana Ruiz-Moreno*

Abstract: Public procurement, represented by the acquisition of goods and services, represents close to 12% of GDP worldwide by 2021. According to World Bank data, stopping wasteful public procurement could free up at least USD 1 trillion a year to put economies on the path to green, resilient and inclusive development. This reality makes necessary to incorporate technological measures to mitigate the risk associated with this lack of management and to guarantee that resources are executed in projects with a focus on reducing social gaps and promote Sustainable Development Goals (SDG). This research focuses on identifying the risks associated with public procurement and the technologies that support the forecasting, management and mitigation of these risks, and its impact on the social gaps reduction with a focus on the SDG.

Proposal for a management indicator of the Capability of Organizations for the development of Sustainable Innovations | *Author(s): Tahia Ureta, Sabrina Higuera, Daniel Galvez, Pavlo Santander, Lorena Delgado and Betzabe Lopez*

Abstract: Innovation allows organizations to generate new solutions that add value, provide competitive advantages and enable economic growth. However, the current challenges embodied

in the 17 Sustainable Development Goals, such as climate change, poverty, health, hunger, education, among others, force innovation to consider not only economic factors, but also social and environmental factors. This is how the concept of sustainable innovation arises, which seeks to integrate three factors: economic, social and environmental. This article proposes a model for managing the capability of organizations to develop and implement sustainable innovations that have this triple impact. Based on a model of best practices evaluated from maturity grids, the potential of organizations to carry out sustainable innovation is diagnosed. The objective is that this diagnosis serves as a starting point to propose improvement strategies in this aspect.

Unveiling Barriers and Overcoming Strategies to Sustainable Supply Chain Management: A Literature Review | *Author(s): Hugo Gonçalves, Vanessa S. M. Magalhães, Luís M. D. F. Ferreira and Amílcar Arantes*

Abstract: Organizations strive to implement sustainable supply chain management (SSCM) practices and technologies to improve their economic, social, and environmental impacts. However, implementing SSCM is challenging. Therefore, it becomes crucial to understand how organizations may overcome these challenges and enable successful implementation and adoption of SSCM. This study reviewed literature to identify the barriers hindering SSCM implementation and their subsequent overcoming strategies. Overall, 80 barriers, divided into nine categories, were encountered. These comprise technological, economic and financial, supplier-related, information-related, market and networking, human resources, social and cultural, regulatory and institutional, and organizational barriers. Moreover, 40 strategies that can help overcome these barriers were reported and resumed in this study.

Analysis of technological routes in the plastics supply chain from renewable and non-renewable sources in Brazil | *Author(s): Vivian Karina Bianchini, Carlos do Amaral Razzino, Paulo Renato Pakes, Glauco Fabrício Bianchini, Alceu Gomes Alves Filho and Ana Lúcia Vitale Torkomian*

Abstract: Brazil stands out in the development of polymers made from renewable sources, known as biopolymers. This research aims to discuss that new forms of relationships exist in the plastic supply chain. In the quest for sustainable products, a new configuration of relationships has emerged between secondary plastic processing companies and the raw material source, now also originating from the sugarcane and alcohol sector, in addition to the traditional petrochemical sector. This new configuration brings about changes in the production strategies of these different plastic supply chains. A multicase study was conducted with semi-structured interviews, direct observation, and analysis of secondary data sources. The aim was to examine the practices adopted by companies, identifying relevant themes, both theoretically and practically, for the continued production of knowledge in a research line on production strategy and sustainable supply chain management.

Current context of reverse logistics for plastic packaging in companies in Brazil | *Author(s): Amanda Silveira Couto, Vívian Karina Bianchini, Carlos do Amaral Razzino, Paulo Renato Pakes, Veridiana Souza da Silva Alves and Regiane Máximo Siqueira*

Abstract: The study, centred on three companies in São Paulo, underscores diverse approaches to sustainability. The first company integrates sustainable practices into its strategies, placing a strong emphasis on consumer awareness. The second, a small-sized enterprise, considers a reverse logistics system impractical due to low demand and a lack of consumer awareness. The third displays minimal sustainable practices, indicating a broader trend of underdeveloped reverse logistics in small and medium-sized companies in the region. Despite the potential for repurposing

post-consumer products and lessening environmental impact, challenges include insufficient awareness and the implementation cost of reverse logistics systems. The study advocates for additional research in emerging countries to pinpoint financially viable solutions, public policies, and sustainable supply chain practices, stressing the imperative for an efficient nationwide reverse logistics system, particularly in plastic packaging.

Conceptualization and Challenges of Social Accounting in Global Supply Chains | *Author(s): Alberto de la Calle, José Luis Retolaza, Ricardo Aguado and Michele Schiavon*

Abstract: In the context of globalized value chains, the importance of social accounting has surged as a means to assess and manage the social and environmental impacts of business activities. This article explores the significance of social accounting within this context, beginning with the implications of globalization on business practices. It then discusses the role of the Sustainable Development Goals (SDGs) as a framework for addressing social and environmental challenges within these chains. The objective of this article is to identify key reasons why companies and their supply chains should adopt social accounting practices. Through literature analysis and conceptual exploration, this study identifies strategic advantages, including enhanced transparency, stakeholder engagement, and alignment with broader organizational goals, highlighting the imperative for businesses to integrate social accounting into their operations in an increasingly interconnected global landscape.

Re-planning e-commerce logistics considering the synergies between last-mile delivery technologies | *Author(s): Vasco Silva and Tânia Fontes*

Abstract: E-commerce popularity has increased the challenges of parcel deliveries, highlighting the urgency in addressing the sustainability of the last-mile, which is considered the most ineffective part of the supply chain and a source of environmental and social issues. Although different alternative last-mile technologies have already been proposed, they all imply complex trade-offs. This study explores how synergies between delivery technologies could improve last-mile logistics. It evaluates the trade-offs between electric vans, cargo bikes, and parcel lockers, and takes into account factors such as package size, consumer requirement, and urban context. The adoption of a combined delivery strategy suggests environmental and social benefits like the mitigation of congestion and emissions while ensuring advantages for companies due to streamlined operations and offering consumers a broader range of choices.

Technological innovation for resilience and sustainability: insights from the energy-intensive ecosystem | *Author(s): Frida Betto, Rosanna Fornasiero, Nils Saorski, Markus Witthaut and Andrea Zangiacomi*

Abstract: This study investigates how technological innovation can foster both supply chain sustainability and transformative resilience, focusing on the European energy-intensive ecosystem. Through multiple case study analysis, the research identifies key technology-driven actions implemented at different levels by a set of steel and metal companies to enhance their sustainability and resilience, such as heat recovery systems and waste recycling initiatives. Collaboration emerges as a fundamental enabler across all levels of the supply chain, highlighting the importance of cross-sector cooperation. The findings highlight the interconnectedness of technological innovation, collaboration, and learning as key enabling capabilities in driving the supply chain transformation.

Beyond the economic horizon: (re)examining the impacts of open innovation in an emerging country | *Author(s): Luiz Guilherme Antunes, Bruno Rondani, Rafael Rocha Levy, Carla Depieri Colonna and Rodolfo Ribeiro da Silva*

Abstract. The article aimed to analyse the types of impact of Open Innovation practices in an emerging country, exploring open innovation beyond economic benefits, focusing on its environmental and social impacts, and addressing global challenges. We used a qualitative methodology to analyse 348 cases of open innovation in Brazil, revealing that, besides economic benefits such as financial growth and operational efficiencies, OI promotes sustainable practices, social inclusion, and diversity and addresses global challenges through digital transformation and integration of ESG principles. This study broadens the understanding of OI's impacts, proposing a new category focused on global challenges and emphasising the importance of aligning open innovation practices with contemporary needs. The results underscore the relevance of OI for sustainable development and offer practical insights for decision-makers in managerial, social, and economic spheres, highlighting the need for a more elaborate decision-making approach that considers cultural and environmental returns in addition to economic ones.

Cooperation between firms in global value chains and firm performance | *Author(s): Marta Bisztray and Balázs Muraközy*

Abstract: Knowledge flows between countries and firms are important in economic growth and technology upgrading, to which Global Value Chains (GVCs) are key contributors. In this paper, we investigate directly rarely observable links between globally integrated firms and their suppliers, and their cooperative activities at a large scale. Linking multiple datasets at the firm- and firm-pair level from Hungary, we document that i) suppliers with GVC-connected, productive or relational buyers are more likely to cooperate with their buyers, ii) cooperating firms and firms with productive buyers are more likely to make innovations both in general and specifically with environmental benefits.

Exploring hidden costs behind open innovation: The impact of R&D collaboration on inventor mobility | *Author(s): Shuxuan Li*

Abstract. This study aims to clarify the impact of R&D collaborations on the mobility of inventors employed by R&D-intensive Japanese listed companies. To examine inventor mobility and patenting activities, this study constructed an original dataset using patent data from the IIP patent database, spanning 2005 to 2019. The dataset includes 3,637 exit inventors and 53,674 non-exit inventors. The analysis reveals that engagement in R&D collaborations is associated with increased inventor mobility; higher levels of engagement further enhance the likelihood. Contrary to expectations, the diversity of R&D collaborators does not significantly influence the mobility of inventors involved in R&D collaborations. Additionally, the results indicate inventors with a broad knowledge base are less likely to move than those specializing in specific technological domains.

Organizational learning from the perspective of green innovation: the case of evolution of a Brazilian Energytech | *Author(s): Vanessa Blas Garcia, Cristina Martens and Mauro Martens*

Abstract: Decarbonization challenges are related to environmental sustainability, energy supply security, economic stability and social aspects. For a decarbonized energy sector, new investments are needed in organizations that help drive the shift from CO2-intensive to sustainable technologies. Decarbonization is an important step towards the practical implementation of the transition to clean energy and the tool for monitoring, controlling and practical implementation of economic decarbonization programs is high technology in the energy

sector – EnergyTech (1). Energytech is the term used for organizations that use innovative technologies, including robots and blockchain, to balance energy markets and ensure responsible environmental management (3), whose strategy is linked to the development of clean energy that achieves the objective of sustainable development 7 (SDG 7), “clean and affordable energy” (4). One of the responses to these sustainability trends is the concept of green innovation, which involves all aspects of knowledge, technology, products, procedures and systems under the umbrella of sustainable development. Therefore, transforming these ideas into a competitive advantage has become essential and can be feasible through synergy between green innovation

strategies (5). The objective of this article is to present the case study of a Brazilian EnergyTech that has been adopting organizational learning to drive green innovation as a competitive advantage. As a result, in addition to integrating green ideas throughout the entire life cycle of their products, new business units were created focused on the entire value chain of clean renewable energy, contributing to the non-depletion of natural resources and preservation of future generations, as well as availability of energy and increased energy for the population

Sustainable supply chains for electric vehicle battery recycling: A literature review | *Author(s): Felipe López, Pavlo Santander, Daniel Gálvez and Lorena Delgado*

Abstract: The global environmental concern over issues like climate change has prompted increased regulations worldwide. The automotive industry, a major contributor to greenhouse gas emissions, has pushed countries to explore electromobility as a pivotal element in achieving climate goals. However, while electric vehicles are seen as an attractive solution, there is a need for research on sustainable end-of-life recovery systems, particularly for electric vehicle batteries. This study conducts a systematic literature review to thoroughly examine the current knowledge on sustainable aspects within supply chains related to the recycling of electric vehicle batteries. Main findings are presented in terms of sustainability dimensions considered, scale of intervention and contexts of application.

Blockchain - Powered Governance: Driving Sustainability in Agri-Food Supply Chains | *Author(s): Majlinda Zhegu and Carene Tchuinou Tchouwo*

Abstract: This article systematically reviews the literature on managing sustainable agri-food supply chains through blockchain technology. To this end, we consulted several academic databases (Scopus, Web of Science, ABI Inform, Google Scholar, Agricola, CabAbstracts, and Hal Sciences). The results demonstrate a consensus in the research indicating that blockchain could contribute to the transition towards more sustainable agri-food supply chains. On the other hand, the adoption and implementation of such technology face several challenges, particularly related to its complexity, high cost, lack of regulation, and data security. Specifically, the intricate ways in which blockchain technology reshapes governance structures and practices within supply chains, as well as the interaction between the technology and current sustainability standards remain important issues to explore in future research.

Developing strategies for sustainable and resilient supply chains | *Author(s): Ricardo Zimmermann, Pedro Senna, Paulo Pereira, Rosanna Fornasiero, Andrea Zangiacomi and Frida Betto*

Abstract: Although recent studies have recognised that sustainability and resilience should be considered part of the same efforts in the context of a transformative perspective, research combining both constructs is still scarce. This study adopts a comprehensive perspective that acknowledges that maintaining business continuity (through persisting, adapting or transforming), to reduce long-term risks is a common aspect of sustainability and resilience. It aims to identify

strategies to be applied by companies and SCs in order to increase their social, environmental and economic sustainability, as well as their ability to be ready, respond and recover from unexpected events. Considering that the actions and strategies to deal with sustainability and resilience can be different and eventually paradoxical, this work applies the organizational ambidexterity approach as a theoretical background.

Technology Roadmap as a Synergic Approach in Nuclear Technology Transfer for the Treatment and Reuse of Industrial Effluents | *Author(s): Daniela Lima Cerqueira Archila and Tereza Raquel Taulois Campos*

Abstract: Organizations have been increasingly dealing with scenarios of great competitiveness and uncertainty to guide their planning, but also composed of many investment opportunities. Strategic, organizational and technological prospective methodologies support decision-making in this complex context in which organizations operate and technologies are developed, assisting them with current actions and future objectives. Technology roadmapping is a tool to connect technologies, products, services and markets throughout the technology lifecycle. The purpose of this paper is to demonstrate a technology roadmapping through a case study on the development of a nuclear technology that addresses the circular economy and a successful innovation, focusing on mapping essential competencies (knowledge, skills and attitudes) and resources (finance, partnership and infrastructure); and recognizing the challenges and opportunities inherent to a diverse and balanced team building and stakeholders' engagement in partnerships with a public research organization. The relevance of this paper can be highlighted from the perspective of a R&D project centered on the deployment of new nuclear technology fostering the development of key personnel, creating value and aligning with global tendencies on science, technology, innovation and sustainability.

Sustainable manufacturing and circular economy in SMEs: A systematic literature review in the context of Industry 4.0 | *Author(s): Cleber Gaspar Correa Duarte, Mauro Luiz Martens, Juliano Sampaio Conegundes de Souza, Cristina Dai Prá Martens, Márcio Cardoso Machado and Cleber Grafietti*

Abstract: The article aims to demonstrate the current stage of scientific knowledge published on the intersection of manufacturing, circular economy and sustainability in the context of industry 4.0 by adopting bibliometric analysis and systematic literature review supported by the PRISMA methodology (Prefer Reporting Items for Systematic Reviews and Meta-Analyses). The survey results reveal interesting insights into the implementation of Industry 4.0 concepts and technologies in sustainable manufacturing, also highlighting the significant challenges with senior management across organizational structures, as well as the inherent economic challenges. Furthermore, they highlight the importance of underlying digital technologies and principles that enable companies to enhance collaboration between different functional areas and integrate more effectively with their stakeholders, both internal and external. They also point out that the adoption of sustainable manufacturing with net zero emissions is recognized as dependent on a set of common practices, among which the culture of sustainability stands out.

Insights from Maritime Port Decarbonization Barriers: A Systematic Literature Review | *Author(s): André Fadiga, Joana O. Andrade, João F. Bigotte and Luís Miguel D. F. Ferreira*

Abstract: Analyzing business responses, particularly in the maritime context, has become increasingly urgent with the escalation of climate change impacts. This study employs a Systematic Literature Review based on thirty-three publications to investigate the barriers hindering maritime port decarbonization. The analysis led to the identification of twenty-five

barriers. The four most cited barriers are high costs, low technology availability and readiness, complexity of the industry, and global policy gaps and instability. This study highlights the interrelationships of the barriers and emphasizes the need for a multifaceted approach to address the complexity of port decarbonization. It is proposed that future research explores the interdependency between the challenges of decarbonizing maritime ports, which must be examined to achieve sustainable operations across the maritime transport sector.

Comprehensive Analysis of External Costs Throughout the Lifecycle of an Onshore Wind Farm: A Framework for Sustainable Energy Decision-Making | *Author(s): Hanif Auwall Ibrahim and George Alex Thopil*

Abstract: Onshore wind power has immense potential to accelerate South Africa's energy transition to a sustainable power supply mix, effectively addressing the rising demand for electricity and mitigating the adverse impacts of fossil fuels. However, the effects on human health, crops, biodiversity, and materials caused by the technology remain largely unexplored in the existing literature. This study addresses this gap by examining both the greenhouse gas (GHG) and non-GHG emissions, as well as the external costs associated with onshore wind power in South Africa. Specifically, with a focus on the 138 MW Jeffreys Bay Wind Farm, throughout its lifecycle from material extraction/manufacturing (M), transportation (T), operation and maintenance (O&M), to decommissioning and disposal (D). Results show that GHG impact accounts for 26.062 gCO2 eq/kWh and human health is the most significant non-GHG impact at 0.638 g/kWh. The external cost of the wind farm ranges from 5.946 to 9.876 ZAc/kWh with climate change and human health accounting for 89% of the median externalities combined. Thus, external cost is vital in determining the economic viability and sustainability of onshore wind power.

Toward A Sustainable Business Ecosystem from the perspective of dynamic capabilities | *Author(s): Feng-Shang Wu, Ian Miles, Na Jin and Pin-Wen Wang*

Abstract: This study examines the evolution of a leading firm's business ecosystem from a dynamic capabilities perspective, emphasizing how businesses adapt to ecosystem changes by managing internal and external resources. It highlights the two-way relationship between business ecosystems and dynamic capabilities. Utilizing a qualitative research of the Gogoro case, the study investigates the interplay of the firm's strategy, capabilities, and business ecosystem. Eight propositions are developed, covering various aspects from micro to macro levels, including the firm's role, capabilities, relationships, evolutionary path, ecosystem participation, competitiveness, and policy influence. Gogoro exemplifies how traditional manufacturers can innovate towards sustainability in their business ecosystems. The study advocates for further research into the adaptation strategies of different ecosystem members, aiming to generalize insights across diverse enterprises for a broader understanding of business ecosystems.

Are we ready to change? A Self-assessment Tool to Measure Industry 4.0 Readiness for Medellin Apparel MSMEs | *Author(s): Juan José Múnera-Sierra, Jim Giraldo-Builes and Silvana Ruiz-Moreno*

Abstract: The need to adopt technological tools that improve the process management and focus on assertive decision making is a reality that manifests itself not only in large enterprises, but also in Micro, Small and Medium-sized Enterprises (MSMEs). However, successful adoption requires not only the correct identification of digitisation needs, but also a diagnosis of current capabilities to acquire and implement technologies that will allow them to address internal deficiencies. This

diagnosis is not always made consciously, which can lead to technology projects failing even after considerable resources have been invested. This study aims to propose a self-assessment tool to measure the readiness of SMEs to adopt Industry 4.0 tools. The main expected impact of this tool is to mitigate the low success of technology projects in these companies, and to enhance their growth by focusing their resources on improvement projects that fit their operational realities.

The issue of carbon emissions to sustainability in the metal industry- Taking the small and medium enterprise in Taiwan as examples | *Author(s): Yichen Lin, W.G. Will Zhao, Kai-Ning Shen and Tzu-Wen Yuan*

Abstract: This study addresses the pressing issue of carbon emissions in the metal industry, focusing on small and medium enterprises (SMEs) in Taiwan. Utilizing a case study approach, the research involves a detailed examination of five selected companies, employing the "emission factor method" to quantify their carbon emissions. The findings reveal a higher proportion of indirect energy emissions (Category 2) compared to direct emissions (Category 1), indicating that the primary carbon footprint in these SMEs stems from electricity consumption. The study highlights the importance of targeted carbon reduction strategies and raises awareness about the environmental impact of the metal industry. Thus research contributes to the ongoing discussion on effective carbon management practices for SMEs in the metal industry, underscoring the need for sustainable operational adjustments.

Application Modernization in Logistics Service Providers: Case Studies | *Author(s): Cleber Grafietti and Mauro Vivaldini*

Abstract: The objective of this research was to evaluate which technologies are being planned or implemented with a view to modernizing applications to meet the growing need for logistical immediacy by logistics service providers serving the city of São Paulo in Brazil. A qualitative approach was used with a multiple case study on operators selected for convenience. Research has indicated that initial actions are being taken to implement disruptive technologies, indicating that the use of cloud computing becomes important in this scenario that is still very much rooted in the use of internal technology infrastructure (on-promise) or data centers. The contributions will be important as these are two topics that are still incipient, logistical immediacy and the modernization of applications, contributing to new theoretical knowledge and to organizations that need to take actions involving these topics.

Organizational learning from the perspective of green innovation: the case of evolution of a Brazilian Energytech | *Author(s): Vanessa Blas Garcia, Cristina Martens and Mauro Martens*

Abstract: Decarbonization challenges are related to environmental sustainability, energy supply security, economic stability and social aspects. For a decarbonized energy sector, new investments are needed in organizations that help drive the shift from CO2-intensive to sustainable technologies. Decarbonization is an important step towards the practical implementation of the transition to clean energy and the tool for monitoring, controlling and practical implementation of economic decarbonization programs is high technology in the energy sector – EnergyTech. Energytech is the term used for organizations that use innovative technologies, including robots and blockchain, to balance energy markets and ensure responsible environmental management, whose strategy is linked to the development of clean energy that achieves the objective of sustainable development 7 (SDG 7), “clean and affordable energy”. One of the responses to these sustainability trends is the concept of green innovation, which involves all aspects of knowledge, technology, products, procedures and systems under the umbrella of

sustainable development. Therefore, transforming these ideas into a competitive advantage has become essential and can be feasible through synergy between green innovation strategies (5). The objective of this article is to present the case study of a Brazilian EnergyTech that has been adopting organizational learning to drive green innovation as a competitive advantage. As a result, in addition to integrating green ideas throughout the entire life cycle of their products, new business units were created focused on the entire value chain of clean renewable energy, contributing to the non-depletion of natural resources and preservation of future generations, as well as availability of energy and increased energy for the population.

Business Model Innovation in the big-data era from the perspective of Knowledge-based dynamic capabilities: case study of a fintech | *Author(s): Salvador Tapia*

Abstract: Business model innovation (BMI) has been gaining ground, driven by the prevalence of new (digital) technologies, evolving markets and changing commercial, social and environmental demands. However, disproportionate attention has been given to technical aspects and limited attention has been given to other relevant organizational elements to leverage them[1]. Currently, the main challenge for companies in the face of this new technology is the complexity of the data and the capabilities they have to make sense of it. It is therefore proposed to contribute to the BMI literature from the theory of the firm through the underexplored approach of Knowledge-based dynamic capabilities (KBDC) [2]. This approach allows us to analyze how firms adapt to dynamic environments through the firm's most important resource, knowledge, which will be accelerated by big-data. The objective is examine dynamic knowledge-based capabilities (KBDC) to analyze the way in which fintech companies innovate their business model through big-data analysis. Therefore, a concerted research effort seems justified that proposes an empirical investigation with a qualitative approach that, due to the nature of the case, would use the simple integrated case study of an exploratory type and holistic design, considering an analysis of information from the ball interviews. snow And semi-structured sessions carried out for data specialists, managers and company directors. According to the above, the following main question is raised that will guide this research: How do knowledge-based dynamic capabilities (KBDC) enable business model innovation through the use of big-data?. The case study was in a Latin American neobank that offers credit cards simply and quickly to thousands of people who lack formal employment that allows them to demonstrate income as requested by a traditional bank. In addition, the company ensures a better experience with personalized and quick user service through its application. Therefore, the unit of analysis was the CDBC and the IMN. The observation unit is two of the key activities that create value for the company: the creation of learning models and problem solving.

Proposal of an acceptability model for telerehabilitation platforms: perspective of health professionals and patient | *Author(s): Felipe Rubilar, José Silva, Daniel Gálvez, Pavlo Santander and Lorena Delgado*

Abstract: Telerehabilitation platforms are an innovative tool in the health area to support medical centers in their rehabilitation services. Being a recent and widely used tool, it is still evolving, so it is essential to have an evaluation mechanism that allows diagnosing the behavior and reaction of users to this type of platform. This article proposes an acceptance evaluation model based on the identification of the factors that characterize the user's decision to use this type of platform. Assessing this user intention has implications for healthcare centers as it provides support to enhance the design of their platforms.The proposed model is an aid to decision making to improve the user experience with this type of platform and thus improve the remote service.

A proposal of practical harmonization for innovation in healthcare from the assessment of technology maturity levels perspective. | *Author(s): Thiago Negrão Chuba, Gabriela Simões Pazelli, Kei Saito, Kelyane Silva and Alexandre Guimarães Vasconcellos*

Abstract: The complexity of developing new healthcare technologies, compounded by the high uncertainty in radical innovation projects, necessitates a strategic approach to enhance project management and security. This paper proposes a practical harmonization framework for innovation in healthcare through the assessment of technology maturity levels (TRLs). Our work paves the way for more effective innovation assessments in emerging markets by bridging the gap between global TRL standards and local healthcare intricacies. We highlight previous efforts and limitations in implementing TRL adaptations in healthcare and introduce a novel tool designed to facilitate the evaluation of maturity levels within the Brazilian healthcare context by proposing a TRL framework tailored for the healthcare sector, focusing on integrating technical, regulatory, and intellectual property (IP) aspects. It serves as a guide for institutions looking to foster technology-driven advancements in healthcare, ensuring that innovations are groundbreaking and contextually relevant.

Farmers' perceptions of the use of technology for negotiating and trading agricultural products: A case study from a village in Medellin | *Author(s): Silvana Ruiz Moreno*

Abstract: Understanding farmers' perceptions of technology use in their processes is essential for developing accurate strategies and selecting appropriate technologies to support their production and trade. This understanding requires characterizing the current technologies they have access to and exploring their understanding of issues such as usefulness, cost, and trustworthiness of managing processes through technological devices. The aim of this research is to understand farmers' perceptions of the use of new technologies as an important issue for proposing new usable and effective strategies focused on negotiating and trading their products. To this end, semi-structured interviews were conducted among a group of smallholder farmers living in a small community called "El Patio," part of the district of San Cristobal in Medellin. The results were analysed to identify the main barriers they face in terms of technology adoption and the hidden enablers that can enhance the use of new technologies.

Forecasting the travel behavior with autonomous vehicles and car-sharing -A case study of South Korea | *Author(s): Jongmin Han, Ho Lee and Yong-Jeong Kim*

Abstract: For industries closely affected by consumer needs, it is difficult to predict how new technology will diffuse depending on the socio-cultural environment and users’ characteristics. Therefore, the model was developed to forecast how new technologies such as autonomous vehicles or car-sharing services, would impact individual travel. This model built the travel mode selection algorithm based on the vehicle choice algorithm to forecast the change in consumer transport usage by autonomous vehicles and car-sharing, including the social acceptability of a self-driving car and consumer preferences for vehicle attributes. Furthermore, the algorithm based on the multinomial logit and agent-based models can calculate the probability of choosing individual travel, considering one’s characteristics. In this model, consumers are individual actors who differentiate between socio-demographic factors such as gender, age, number of household members, number of children, and occupational status. Thus, it is a simple agent-based model where each agent’s different behavior creates new phenomena.

Unveiling the Path to Success in ERP Systems Implementation in Brazilian Companies: A Prioritization Analysis through the ISM-MICMAC Model | *Author(s): André Romano, Amílcar Arantes, Luís M.D. Ferreira and Walther Azzolini*

Abstract: This research emphasizes the critical role of Enterprise Resource Planning (ERP) systems in ensuring the survival of organizations, while acknowledging the difficulties in implementing them. The study proposes using Interpretive Structural Modeling (ISM) to identify the interdependencies among the crucial success factors and Matrice d'Impacts Croisés Multiplication Appliqués à un Classement (MICMAC) analysis to determine their driving and dependency powers. The data was collected through the focal group approach, which involved experts and company representatives. The ISM model revealed the hierarchical relationships among the factors, while the MICMAC classified them into four clusters. The study highlights the specific challenges that manufacturing companies in Brazil face, and it emphasizes the importance of overcoming these obstacles by cultivating a technological culture and combining human skills with technology to successfully implement ERP projects.

A Proposed Framework for Evaluating the Technological Readiness of Industries in X.0 Era | *Author(s): Ahmed ElSayed and Tarek Khalil*

Abstract: The rapid growth of technological disruptions in the modern world is significantly orchestrating the way that industries and business ecosystems operate. In fact, the lifetime spans of the Industrial Revolutions are dramatically decreasing; there is no place for rigidity. Consequently, coping with these technological disruptions becomes obligatory. As a result, a new terminology of Industry X.0 has been introduced because no fixed revolutionary number could be stable today. Therefore, it is crucial to identify and map these technological gaps to evaluate the technological readiness of different industrial ecosystems. In this paper, a generic framework is proposed to evaluate the technological readiness of specific industrial sectors in the Industry X.0 era. This generic framework employs the Data Envelopment Analysis (DEA) as one of the most common benchmarking approaches to evaluate the technological gaps and identify the technological footprint position of different industries.

Does Gartner's Hype Cycle Theory Match Practice? | *Author(s): Danielle Badenhorst, ST Mashabane, JX Morele, T Mutizwa, PQM Vundla and and S Grobbelaar*

Abstract: The Gartner Hype Cycle has become a widely used industry tool to assess the maturity and potential adoption of emerging technologies. As this model has a prominent influence on investor decision making, an in-depth systematic review of it is necessary. The purpose of this paper is to systematically review and analyse Gartner's Hype Cycle. In doing so, the objective is to describe how the model is analysed in various sources of literature and then assess the continued relevance of the model as a question is raised: Does Gartner's Hype Cycle theory match practice? By conducting a systematic review of multiple articles, a differing view of the Hype Cycle in academic literature was observed in comparison to industry sentiment. The results of this review indicate that there are multiple inconsistencies with the current Hype Cycle implementation. Various factors limit the overall applicability of the model; methodological flaws, information gathering flaws, and oversimplification of complex phenomena make up some of these limitations. Notwithstanding these flaws, some benefits of the model are also discussed. Finally, some future recommendations are illustrated, highlighting the need for an empirically attested mathematical representation of the model. Finally, some future recommendations are illustrated, highlighting the need for an empirically attested mathematical representation of the model.

Proposal for a Decision-Making Dashboard Enhanced by Big Data: An Application in the Portuguese Furniture Industry | *Author(s): Karoline Santos, Arthur Rossi, Fernanda Treinta and Joseane Pontes*

Abstract: Big data analysis in strategic management significantly aids decision-making processes, enhancing their effectiveness. Investigating key themes in this area allows for trend identification, process optimization, and proactive issue prediction, thereby boosting competitiveness. This study aims to develop a visual tool for decision-making support regarding sales behaviour in the operations department of a service industry, utilizing big data analysis within Industry 4.0. The research methodology used was the Design Science, identifying 5 main phases to accomplish the objective. The IDC model was applied to establish decision-making requirements. Subsequently, the DMN method and data architecture were applied, facilitating the comprehension of the significance and scope of the studied topic, along with its main themes. Utilizing Power Query, data analysis and processing were automated, and M language codes were programmed. It was concluded that data quality's relevance significantly impacts decision-making within strategic management, thus enabling the development of digital transformation within the organization.

Who Governs the Chain? An investigation into decentralized governance on blockchain communities | *Author(s): Kenneth Qua, Jorão Gomes Jr. and Verena Dorner*

Abstract: Blockchain technology in the form of cryptocurrencies has ushered in a new paradigm in how digital assets can be stored and transferred electronically. Cryptocurrencies typically espouse decentralization in their governance with the community being responsible for proposing, debating and implementing improvements to the blockchain. However, research substantiating the extent of blockchain communities' governance has been lacking. In this paper, we use Bitcoin, the largest cryptocurrency based on market value, as a case study to analyze community-managed governance for a blockchain community. The results show that users ultimately dictate the governance of a blockchain despite the significant influence of miners, developers, exchanges and related companies.

An Integrated Framework for the Implementation of Business Intelligence Systems | *Author(s): Getnet Bogale Fanta and Leon Pretorius*

Abstract: The surge in data volume and the pressing need for effective decision-making tools have driven Business Intelligence (BI) as a pivotal tool. This paper presents the development of an integrated framework to facilitate the implementation of BI systems across diverse sectors. Conducting a thorough systematic literature review focused on BI frameworks, tools, and implementation success factors, the study examines existing literature findings. The BI success factors are presented in four thematic groups: technology, organisation, social and environment. The analysis identified data sourcing, movement and storage, processing and analysis, and visualisation and reporting as the critical components of the BI framework. This research contributes to ongoing BI studies by offering an integrated BI framework for successful implementation across sectors to enhance organisational decision-making processes and overall performance.

Line manufacturing engineering change management: contrasting views on modelling and governance towards a research agenda | *Author(s): Mads Nielsen and Torben Tambo*

Abstract: This paper investigates the role of digital twins in line manufacturing equipment implementation and change processes, addressing gaps in academic research on success and failure. Focusing on Industry 4.0, the study explores whether digital twins are sufficient or

additional perspectives are needed for improving the implementation. It identifies challenges in contemporary academic investigations and emphasizes the scope of implementation issues, including quality, capability risks, and infrastructural elements. The paper presents cases from diverse industries, revealing challenges in the implementation process despite virtual commissioning. This indicates contrasting views related to the limitations of digital twins. The findings highlight the need for a more holistic research approach considering human, infrastructural, and operational elements in line manufacturing implementation. A proposed research agenda aims to enhance understanding and effectiveness in implementing production line equipment, emphasizing a balanced view hybridizing technological and economic, operational, and organizational factors for a first-time-right implementation thinking.

Developing a Toolbox for Scenario-based Foresight | *Author(s): Patrick Ködding, Christian Koldewey and Roman Dumitrescu*

Abstract: Scenario-based foresight enables companies to remain competitive in rapidly changing and complex environments by systematically dealing with the future. Yet, its use in practice has decreased significantly. One major challenge is the design of a scenario process that is customized to the unique requirements of a new scenario project. Specifically, practitioners are faced with selecting suitable methodical approaches and supporting digital tools out of a high number of possibilities. A comprehensive, structured overview of methods and tools is missing. In this paper, we develop a toolbox for scenario-based foresight using design science research. The toolbox consists of 79 method building blocks and 9 tool building blocks. The building blocks enable practitioners to design their customized scenario process and to select the appropriate digital tools with low effort during the preparation phase of a scenario project. The applicability of the toolbox is shown using a previously conducted scenario project.

Technology domain discovery methodology for technology opportunity based on patent data | *Author(s): Sanghyun Park and Sungjoo Lee*

Abstract: This study proposes a comprehensive framework for analyzing patent data to discover technology opportunities across various domains. Through the case study, we illustrate how domain contexts and implementation method contexts can be encoded and analyzed to calculate similarities from various perspectives. The proposed methodology begins with distinguishing technology domains using machine learning techniques, proceeding to identify areas of technological opportunity with high benchmarking potential from the perspective of individual technologies. This study emphasizes the importance of considering both domain-specific knowledge and implementation methods in discovering cross-domain technology applications.

Technology Foresight: A Literature Review | *Author(s): Madhur Srivastava and Karuna Jain*

Abstract: The pace of technological innovation has made it inescapable for technology developers to continuously track the developments taking place in their environment to withhold their niche. Therefore, decision-makers must foresee the direction of technology development. We present a review of the literature to provide a vista of the Technology Foresight (TF) concept, its dimensions, generic framework, methods and tools, capabilities required, focus, and evaluation determinants of technology foresight. We address the research objective of what technology foresight is and how it is conducted. Based on the literature, we reveal various definitions of TF, the evolution of TF exercise, and various methods for TF. Many countries, including the United Kingdom, China, France, Germany, Italy, India, and Korea, launched TF activities, and the number of countries performing TF activities has significantly increased. This work will aid readers in understanding

the importance of TF exercise and how it shall be conducted to enhance the capabilities and comparative advantage of nations.

Causal Layered Analysis Application in Strategic Technology Foresighting | *Author(s): Petrus Letaba*

Abstract: The world is experiencing an unprecedented environment that is difficult to manage due to the increased volatility, uncertainty, complexity, and ambiguity (VUCA). An investigation of the application of a transformative foresight technique, causal layered analysis (CLA), shows its poor adoption in the real world. Most foresight exercises are shown to be trapped in a perspective that past trends influence the future, which is becoming less of the case. A recommendation is made regarding the need to simplify the CLA to improve its adoption. This study shows that CLA can be used to deepen the signals before the scenario development or directly as part of scenario development.

Assessing contexts of inventions: An explorative study in South Korea | *Author(s): Marc-Armin Weller and Ludwig Martin*

Abstract: This study focuses on the context of technological invention in South Korea (SK), aiming specifically to reveal the processes that lead up to an invention and the factors that influence the probability of inventing. The study achieves that by exploring the various theories, concepts, and ideas that researchers have proposed for different countries and samples which might relate to SK and reveal contextual factors that may be prominent there; insights into the literature only revealed that there are information gaps and limited research concerning SK itself which led to the purpose of this study which is the collection of data regarding technological invention through interviews with Korean inventors. The empirical findings add to existing literature and models. They show that many of the results reported in the literature focusing on other countries can be related to SK, indicating commonalities in the inventive phenomenon that have the potential to support future applied research into it.

Smart Attica EDIH: A Paradigm for DIH Governance and a Novel Methodology for AI-powered One-stop-shop Projects Design | *Author(s): Denia Kanellopoulou, George Giannakopoulos, Periklis Terlixidis and Vangelis Karkaletsis*

Abstract: The Smart Attica European Digital Innovation Hub constitutes a driver of innovation with Artificial Intelligence (AI) in Greece by bridging the adoption gap encountered by businesses and public organisations in the country. Treating AI as a cross-sector (horizontal) enabler for a wide range of state-of-the-art services, this paper explores the hub's value proposition and emphasises the key success factors for ensuring the sustainability of AI adoption efforts. Moreover, the paper introduces a novel holistic approach to the design of AI-powered innovation projects, aiming to enhance impact and cost efficiency. Each such project involves multiple service providers and targets a wide range of beneficiaries. The initial results of this approach are showcased through the hub's initiative to improve resilience in the face of natural disasters by combining the mobilisation of organisations and society as a whole with technological providers, as a response to recent crises experienced in the country.

Strategy formulation for an industrial ecosystem development: HORSE Aveiro case study | *Author(s): Tomás Craveiro, Gabriela Fernandes and Leonel Simões*

Abstract: This article addresses the emergence of Industrial Ecosystems, highlighting the HORSE Aveiro initiative to establish one in the Aveiro district. The objectives include investigating the

strategic formulation process and developing the underlying business model. The adopted methodology involves literature review, an interview with the manager of a French Ecosystem, and in-depth strategic analysis, validated with local major companies and the Chamber of Commerce. The article results in the formulation of a strategy and business model, along with the involvement of large companies in the development of the Industrial Ecosystem in the Aveiro district. This provides a significant practical and methodological contribution for the development of other ecosystems.

Sociotechnical systems as determinants of incremental technological change | *Author(s): Juan Andrés Niño Peñalosa and Luciano Gallon*

Abstract: The recent interest in modelling sociotechnical systems to understand the dynamics of technological change has led to significant advancements in the comprehension of these relationships. One crucial factor to consider is the geographic variable, which is addressed through the analysis of worldwide data over the last four decades. The results are depicted through heat maps illustrating behaviors generated within the sociotechnical system, manifested in key variables and their effects on technological change. The findings reveal a deterministic factor among them. To enhance the understanding of this relationship, a temporal lag is incorporated, highlighting the incrementality of technological changes and the accumulation of results as a foundation for new developments. These developments only occur when the sociotechnical system provides stable conditions for their realization.

Developing a tool for strategizing in innovation ecosystems: the case of digital transformation in a manufacturing sector | *Author(s): Alice Lena, Fabiano Armellini, Elaine Mosconi, Catherine Beaudry and Christophe Danjou*

Abstract: The prosperity of companies is more and more tied to their integration to their ecosystems. As the practice of IE orchestration evolves, there is a gap in theory and practice for strategizing in innovation ecosystems (IE) level. The aim of this research is to fill this gap by suggesting and testing a tool for strategic thinking for a manufacturing digital transformation IE. To attempt this objective, this research adopts the Design Research Methodology (DRM) in four stages. The initial phase involves an in-depth literature review, shedding light on key concepts and current gaps in understanding ecosystem strategy. The second stage entails data-driven exploratory research, mapping the IE according to the technological intentions of stakeholders. The third stage is a prescriptive study where we propose the strategic tool and conduct pretests of its consistency using criteria from the literature. Finally, the fourth stage involves a descriptive study testing the tool within a real IE. The expected outcomes of this research include the development of a workshop process for collaborative strategic thinking within the IE. After mapping technology intentions, stakeholders come together to explore opportunities for collaboration, discuss their capabilities and ambitions, and develop a comprehensive roadmap to foster technology development and collaboration within the IE. This tool aims to help companies seize opportunities within their IE, providing them with a strategic tool for thinking in these complex environments. This research fills a significant gap in the literature by proposing a practical solution to guide the strategic development of digital transformation within innovation ecosystems. By offering an operational tool, this study contributes not only to theory by defining conditions for successful strategic management of innovation ecosystems but also provides a practical application in the specific context of the digital transformation of the manufacturing sector at the municipal level.

Comparative study of the Maturity (Capabilities) of Innovation Spaces at the university of Santiago de Chile | *Author(s): Jessenia Caniumil, Lorena Delgado, Daniel Gálvez and Pavlo Santander-Tapia*

Abstract: In recent decades, universities have expanded their role in society, going beyond the duty of knowledge transmission and research, to embrace a service-oriented role to the community (academic entrepreneurship), aligning with missions defined by UNESCO. In this context, Innovation Spaces (IS) play a crucial role in fulfilling the university's key activities such as teaching and research, establishing connections with industry, technology transfer, etc. Despite the existence of various Innovation Spaces in universities (ISU), they operate autonomously and often lack involvement with ISUs from other disciplines, hindering cooperative and interdisciplinary work. Therefore, it is essential to identify and characterize existing ISUs, recognizing their similarities, differences, and complementarities, along with assessing their current state of maturity. This information aims to contribute valuable insights for the development of networks that facilitate the promotion of cooperation and integration among these spaces.

Charging forward or stalling out? Dynamic role-taking in online communities during technological change | *Author(s): Shu-Yu Chen and Yen-Chen Ho*

Abstract: This study explores knowledge sharing and tensions in online communities (OCs) using Reddit discussions surrounding the North American Charging Standard (NACS) for electric vehicles. OCs can foster knowledge creation through interaction, debate, and a shared focus. However, debates and ambiguities can create tension among OC participants. The research examines the roles of mediators and organisers in managing these tensions and facilitating knowledge sharing. Data was collected from Reddit discussions on NACS, CCS, and SAE standards between March 2015 and February 2024. Analysis shows a shift in focus from various charging connectors to NACS after Ford's adoption announcement. The study also identifies influential users who act as organisers and share information across the community. These findings contribute to the understanding of OC governance and leadership, highlighting the importance of mediators and organisers in fostering knowledge sharing and collaboration.

Robot-based Supermarket – A sustainable system concept for material supply of mixed-model assembly lines | *Author(s): Tobias Ettengruber and Markus Schneider*

Abstract: Supplying parts to mixed-model assembly lines is a complex logistic problem, often characterized by fatigue tasks and a low degree of automation. Emerging economic, ecological, and social challenges are forcing manufacturing companies to adopted internal material supply processes to these upcoming objectives and requires a fundamental change in system design of decentralized logistic areas. This paper presents a novel concept to supply materials to mixedmodel assembly lines based on a network of conventional and collaborative robots and a vertical - integrated system structure. The concept is derived, in a three-step design approach, from sustainable characteristics of logistic subsystems and enables new potentials in performance, flexibility and humancentric material supply for mixed model assembly lines.

ARomaticLens: Augmented reality applied to the identification and classification of aromatic herbs through computer vision and mobile devices | *Author(s): William Aparecido Lopes Celestino, Marcelo Okano João Carlos Lopes Fernandes, Samira Nascimento Antunes and Oduvaldo Vendrametto*

Abstract: Identifying and classifying foods accurately is critical to ensuring food safety. Augmented Reality (AR) stands out as a promising technology in this context. During studies at Companhia de Entreposto e Armazéns Gerais de São Paulo (CEAGESP), difficulties were identified in

classifying aromatic herbs due to the diversity and similarities between species. The project aimed to develop the ARomaticLens application to address these challenges, employing the Design Science Research (DSR) methodology. Validation was carried out through practical tests and questionnaires with CEAGESP experts. The results obtained accurate identification of herbs and a score of 8 on a scale of 0 to 10 in the usability of the application.

Comparing dynamics of technology collaboration in the TFT-LCD industry based on a technology life cycle | *Author(s): Giyun Kim and Sungjoo Lee*

Abstract: We analyzed dynamics of technology collaboration in the thin film transistor-liquid crystal display (TFT-LCD) to identify whether differences exist between each technology life cycle stage in terms of the university-industry-government (UIG) collaboration and the global collaboration. First, a technology s-curve of the TFT-LCD from previous research was used to define the interval of each stage in the technology life cycle. Next, co-applied TFT-LCD patents were collected, and the number of the patents were measured regarding patent applicants' UIG type and nationality. As a result, the differences of technology collaboration patterns during the growth stage and the maturity stage of the technology life cycle were identified. Finally, we discussed why each collaboration type mostly appeared at a specific period and how the results might help to establish technology collaboration policies and analyze a technology life cycle.

Frugal innovation diffusion in developed countries - A Wikihouse study | *Author(s): Tsireledzo Maliehe and Schalk Grobbelaar*

Abstract: Wikihouse is a frugal innovation concept developed in the Netherlands to create affordable, sustainable housing. This literature review set out to determine the benefits of the Wikihouse concept and assess its sustainability. In this review, the literature about Wikihouse was considered. The results show that sustainability is an inherent part of the Wikihouse concept, and this can be seen in the discussed benefits. Wikihouse uses timber, which has significant environmental benefits. Another benefit is that distributed manufacturing allows for global networking and knowledge sharing while creating business for local suppliers and producers, reducing production costs and time. Lastly, modular prefabricated aspects of the Wikihouse ensure quicker construction times and minimise construction noise and waste. The Wikihouse concept can become a valuable tool for solving housing supply challenges.

Proposing a Framework for Identifying and Prioritizing Product Technologies through Design Process: The Case Study of Industrial Generators in MAPNA Group | *Author(s): Mohammad R. Arasti, Mehdi Esfandiari, Mahmoud R. Haqhifam and Maryam Faghei*

Abstract: Design capability is the most important factor explaining the success of a company in international markets. Despite its importance of design capabilities and many researchers in this field, it seems that a precise conceptualization of the relationship between mastering product technologies and improving the level of design capabilities in an enterprise has not yet been done. In this article, while separating product technology from process technology, a framework for operationalizing the concept of design capability is provided. The validity of this framework has been evaluated using the focus group method. Also, using the proposed framework, the process of formation and growth of design capability and its relationship with acquiring product technologies has been explained throught a case study of 230-320 MVA generators in MAPNA industrial group.

Technology-driven strategy for combating corruption in Egypt's construction industry | *Author(s): Khaled Ansary and Mohamed Mamdouh Awny*

Abstract: Corruption remains a significant challenge in the Egyptian construction industry, causing financial losses, project delays, and undermining worker well-being. This paper outlines a human-cantered technology strategy for combating corruption while promoting sustainability within the industry. Through a mixed-methods approach, including a literature review, expert interviews, and a risk-benefit analysis, the study identifies Building Information Modelling (BIM) and e-bidding systems as immediate, high-benefit, and low-risk solutions. Conversely, blockchain, machine learning, and other technologies, while offering high potential benefits, also entail elevated risks, requiring careful risk management. The devised strategy prioritizes technologies that enhance transparency, protect worker rights, and promote ethical practices, offering a roadmap for industry executives to combat corruption while building a sustainable future in construction.

Integrative Dynamics of Technological and Institutional Innovations with Gender Parity in Finance | *Author(s): Jian-Hang Wang, Hsien-Chen Lo and Kuan-Yu Lin*

Abstract. This study explores the systemic operating relationships of the financial services industry in the face of technological innovation in finance and insurance from a synergistic perspective. Since the exploration of both technological and systemic innovation in the financial insurance industry is incomplete, this study assesses the core principle by which corporate performance and value can jointly generate new links through the drive of innovation and development, while also closely examining the balance of gender and consensus building within the industry. With the development of FinTech, a good governance environment is necessary for companies in the financial services industry to survive and be profitable. To explore this, this study develops a model framework to investigate technological innovation as an institutional innovation which plays the role of mediating mechanism to improve the performance of financial industry firms, and to explore the effect of male headcount to examine the adjustment. The study validates this research framework through SPSS process model7 and uses a sample of publicly listed financial services firms in Taiwan covering the eight-year period from 2014 to 2021. The findings show that technological innovation has a positive effect on a firm’s performance, and institutional innovation mediates this relationship. In addition, this study also found that given the presence of men in a firm, the greater the impact of institutional innovation is exerted on the firm's performance with the presence of women in that firm to achieve gender balance. This study concludes that the integration of synergistic technological innovation and institutional innovation can enhance the innovation capacity of the financial services industry, promote technological development, and improve performance. Therefore, future research should focus on improving the performance level of the entire financial insurance industry by using financial technology and the establishment of institutions.

Smart Tablets Behind Bars: Revolutionizing the Inmate Rehabilitation | *Author(s): Nihan Yildirim, Derya Gültekin, Rasim Can Şenay and Sarp Özveren*

Abstract. Integrating digital technologies into correctional facilities can dramatically improve offender rehabilitation and reduce recidivism rates. This study aims to provide an in-depth understanding of the improvement needs of rehabilitation processes and digital technology options and to propose a problemsolving framework designed by engineering management tools. Based on the thematic literature review and field study with stakeholders in Türkiye, the designed project suggests integrating smart tablets into prisons, offering a controlled environment for education, psychological support, and on-site work opportunities. By applying the Quality Function Deployment method, the requirements and the technological solutions for tablet usage

are matched in an intervention canvas. Use case diagrams are also constructed to elaborate on the usage patterns and human system interactions in the proposed system. Tablets that are disconnected from the internet follow the rules and come with pre-loaded educational, therapeutic and vocational materials. This research sets the stage for a future where technology fosters second chances and dignified personal development within the incarcerated population.

Gender and working conditions in supply chains in Latin America: what do we know and what should we know? | *Author(s): Ana Alves and Minelle Silva*

Abstract: This study explores the discussions on gender and working conditions in supply chains in Latin America. A systematic literature review was conducted to scan publications in Latin America about gender and working conditions in supply chain management (SCM). We identified that research on gender in Latin America is basically focused on women, without elements of intersectionality, while studies on working conditions focus on legislation. Unlike current literature, which is interested in understanding gender and working conditions separately, this study expands the interface between both topics within the SCM field. Furthermore, the study expands on the 'one size fits all' idea by highlighting different discussions of gender diversity and working conditions in supply chains.

Working conditions and causes of stress in Brazil's Incredible Places to Work | *Author(s): Marcia Sierdovski, Luiz Alberto Pilatti, Priscilla Rubbo, Claudia Tania Picinin, Bruno Pedroso and Gustavo Tadra Waldmann*

Abstract: The research aims to identify working conditions and reasons for stress in the 100 incredible places to work in Brazil in 2020. To carry out the study, the database of the Faculty of Economics, Administration, Accounting and Actuary was used from the University of São Paulo (FEA-USP), with an analysis of working conditions and the reasons for stress in the opinion of 106,711 employees distributed in the top 100 incredible places to work in Brazil in 2020, being analyzed by the qui- square and descriptive data. The results indicate that they have good health (74.7%), sleep quality "I sleep very well all night" (47.50%), physical activity habits indicate that (41.9%) perform physical activities with little frequency, once a week. Eating behaviors demonstrate healthy eating, but not every day (64.4%). The reasons that produce stress at work are demands for performance/results (14.97%), self-demand (13.22%) and workload (13.18%). It is concluded that working conditions and stress indicators point to necessary changes in individual practices and greater support in the organizational culture to strengthen relationships with leaders to improve happiness and satisfaction at work.

Gender Gap in Patents: The case of the Federal University of Rio Grande do Sul / Brazil | *Author(s): Vitoria Serafim, Fernanda Maciel Reichert and Sara Falcão Casaca*

Abstract: This study investigates the participation of women scientists in patents granted to the Federal University of Rio Grande do Sul (UFRGS) to uncover gender disparities in innovation. Using a descriptive methodology and analyzing 217 patents granted until July 2023, the results reveal a gender disparity, with women representing only 37.39% of patent contributors. Particularly in allfemale teams, women's involvement is scarce at 7.16%, highlighting lasting challenges. The study emphasizes the prevalence of men in teams, defending gender-inclusive measures in research and innovation. The findings hold significance for institutions seeking to enhance gender balance in innovation, offering a nuanced perspective on challenges and opportunities specific to academic patenting.

Organisational digital maturity to obtain value from digital transformation: A case study in the mining industry | *Author(s): Teboho Dibate and Marthinus Pretorius*

Abstract: Organisations adopt new technologies to transform their business models to positively impact productivity, efficiency and profitability. In evaluating whether organisations are attaining value from digital transformation, the research sought to assess how value is defined and measured, and determine whether organisational digital maturity and associated management practices impact their ability to realise value. A mixed methods approach, using an online-based questionnaire as well as structured interviews, was employed to gain insights and opinions from experts in a mining organisation. The results indicate that the respondents are fully aware of what value realisation entails, as well as how value realisation should be defined and measured, however, their organisation does not have a documented, standardised, and socialised process that is applied throughout. Several management practices are hindrances to fully achieving value from digital transformation.

EXTENDED ABSTRACTS

Competing on Terroir: The Cultural Political Economy of Rioja Winemaking | *Author(s): Scott Cunningham, Yorgos Marinakis, Reilly White and Steven Walsh*

Abstract: Globalization opened the flow of international goods into local markets, provoking local strategies for competing on authenticity (Crenn and Techoueyres, 2007, Pratt, 2007, Porciani, 2020, Crossland-Marr and Krause, 2023) and on craft (Bell et al., 2018). Competing on authenticity entailed the production and manufacture of goods using local traditional processes and local traditional ingredients or materials (Aistara, 2014). Those local goods were meant mainly for the consumption by local markets and tourists, but they increasingly became of interest to the international market (Atkinson et al., 2007). In contrast, competing on craft (and in the case of raw materials, organic) entailed competing on provenance (Johnston et al., 2009, Bell et al., 2017: 71) and on limited production. In both cases, authenticity and craft, higher quality and uniqueness were putatively implicit. Both strategies utilize innovation to varying degrees. Incremental innovation (Verganti, 2009) is utilized as part of the authenticity strategies to improve or modernize the quality of the product or of the packaging (Vanhonacker et al., 2013, Abdullah and Azam, 2021) or even just to add a contemporary “spin” on classic products (Giogi and Nino, 2019). Both incremental and radical innovation (Verganti, 2009) is used in craft strategies, as craft production lacks the restriction of traditional wine-making. The authenticity and craft strategies are not necessarily mutually exclusive and demonstrate occasional overlap (Gaytán, 2019, Luckman, 2020) - not only between but within the strategies. Regulatory frameworks (Fandl, 2018) sought to protect tradition by freezing it, particularly in the European wine industry, e.g., as the French Appellation d'Origine Contrôlée (AOC) forced vintners “to promote the importance of tradition, not innovation, in explaining quality” (Gade, 2004: 862). This state of affairs was the case for the past several decades, and continues to be the case today. Yet identifying varying degrees of innovation as a common thread in strategies for competing on authenticity or on craft provides little conceptual clarity. The lack of a theory of innovation as part of authenticity discourses is particularly hard-felt due to the increasing profile of authenticity in regional and national goods. Despite the growing importance of the topic, innovation studies in food authenticity and in craft studies is highly fragmented. It is discussed in food and agriculture journals in terms of commodity fetishism (Gunderson, 2014). Anthropologists discuss it in terms of polytemporality (Hegnes, 2007), which entails path dependence (Mueller, 2022); in terms of the innovation required to reinvent tradition (Grasseni, 2005); as well as in terms of the innovative application of the concept of terroir to products other than wine such as to cheese (Paxson, 2010). Sociologists discuss cultural innovation as a part of authenticity discourses (Greenebaum, 2012, Neuman et al., 2017a, 2017b, Jones, 2017); in terms of the various communicative aspects of consumption (Warde, 2016); and in terms of performances, practices, and understandings (Neuman, 2019). Historians discuss the nature of cultural innovation it in terms of commodity aesthetics and the fetishization of novelty (Murphy, 2010). Business researchers discuss it in terms of local versus global markets (Touzard et al., 2016), and in terms of manufacturing and deploying terroir as a marketing strategy (Gyimóthy, 2017), i.e., specialty products with limited availability (DeSoucey, 2010). Much of this aforementioned theory of innovation involves meaning-making or semiosis, with some exceptions. Semiotics is the study of how we make and interpret the meaning of signs. It also includes the study of the ground on which semiosis occurs, which are material, extra-discursive, extra-semiotic factors. Referring to the preceding theories, polytemporality is an attempt to retain the meaning of traditional practices in the face of the addition to them of contemporary practices such as sanitation and packaging. The rediscovery and resurrection of tradition is an attempt to create meaning where there currently is none. The

application of terroir to products other than wine is an attempt to create meaning in products by endowing them with a sense of place, because place can have cultural meaning. But on the other hand, some of these theories are extra-semiotic. Commodity fetishism refers to the dehumanization of production and exchange. The theories of practice seek to understand certain behaviors as non-communicative and routine. Since semiosis appears to play a key role in innovation theory, we turn to it to understand innovation in authenticity. In particular, we turn to critical semiotic analysis. Critical semiotic analysis is the result of a critical realist analysis of semiosis (Fairclough et al., 2002). Semiosis in this context is described as the "inter-subjective production of meaning" (Jessop, 2004: 161). Critical semiotic analysis acknowledges "the contribution of semiosis to the reproduction and transformation of social structures" (Fairclough et al., 2002: 9). While we await an interdisciplinary synthesis with great anticipation, here we offer instead an analysis of the theory of innovation in food authenticity using a combination of critical semiotic analysis with (critical) political economy, called cultural political economy (CPE) (Jessop, 2004). We believe CPE is well-suited for theorizing about such innovation because it insists that both history and institutions matter -- it takes meaning-making seriously, it accepts complex relations, and it considers politicization. We utilize CPE to perform a multiple case study from Wine Spectator Magazine, "Searching for the real Rioja" (Matthews, 2012). We analyze the case using the method of retroduction (Belfrage and Hauf, 2017) from the tradition of critical realism. Critical realism distinguishes between the real, the actual, and the empirical (Danermark et al., 2019). Objects, their structures or natures and their causal powers and liabilities, are "real." "Actual" is what happens when the powers and liabilities of the real objects create change. "Empirical" is what is experienced by actors. Retroduction entails underlaboring to develop and critically reflect upon a proto-theory about what is actually happening from what is empirically experienced, before settling on a theory. We choose wine making in Rioja for our multiple case study because it is the site of an ongoing authenticity discourse about terroir – a concept that forms the foundation of authenticity claims which link food to place. In the case of Rioja these cases comprise coextant layers of practices each with its own competing claim to authenticity. Our general research question is, what is the theory of innovation in terroir?; and our specific research question is, what does it mean to compete on terroir in Rioja winemaking? We present an exploratory case study, exploratory because there is no clear single set of outcomes and because we utilize retroduction to construct a proto-theory rather than constructing and testing a priori hypotheses. From the cross-case comparison in the multiple case study methodology in light of the CPE theory, we identify wine production -- rather than gastronomic consumption (Demossier, 2001, Spielmann et al., 2020) -- as an expression of nationalism or national semiosis. We explain devotion to terroir by critics, and the controversy of border wines (Monterescu, 2017), as resulting from the role of patriotism or nationalism as a conceptual layer in terroir

Innovation Model for Biotechnology Technological Centres | *Author(s): Gilson José da Silva, Creusa Sayuri Tahara Amaral*

Abstract: Introduction: Biotechnology, a rapidly evolving science and one of the most pertinent technologies, lacks comprehensive literature on governance models, particularly those tailored for biotechnology innovation centres [1], [2]. This study, therefore, presents an innovation model designed explicitly for biotechnology technological innovation centres. The model aims to guide planning actions with partners, collaborators, and researchers, ensuring effective monitoring of information and results with information technology support, including new artificial intelligence tools. Research Design: The research was based on the Design Science Research (DSR) method, supplemented by a review of related topics. The chosen design science research method is grounded in the work of Vaishnavi and Kuechler [3], who outline a series of stages: Problem Awareness (Proposal), Suggestion (Provisional Project), Development (Artifact), Evaluation

(Performance Measures), Conclusion (Results). For model validation, a conceptual and qualitative analysis was conducted by experts in the fields of innovation and biotechnology. These experts, with their deep understanding of the subject matter, provided valuable insights and feedback confirming the proposed artefact's adequacy and feasibility. Thus, for the evaluation, three interviews were conducted. The Innovation Model: The model underscores the importance of coordination among various stakeholders, including collaborators, partners, researchers, support actions from the technological innovation core (TIC), sources of financial support, and critical elements for infrastructure management (administrative management, human resources management, safety and biosecurity management, and maintenance management) [4]. This collaborative approach is essential for the successful implementation of the innovation model. From the perspective of knowledge construction, the study highlighted the need to create a structure for the innovation model composed of interconnected elements that facilitate interaction between the internal and external environment. This process of knowledge construction involves identifying and leveraging existing knowledge and expertise and generating new knowledge and insights. Identified elements include Innovation Governance, Technological Innovation Core, Contexts influencing innovation management, Compliance, Resource Management (Financial, Structural), Actors and Stakeholders, Product Development Process, Intellectual Property, Biotechnology and innovation regulations, Collaboration and Partnership, and Ethical dilemmas in biotechnology. These elements must align with the guidelines and policies of the innovation centre while also meeting the needs of the biotechnology sector. Detailed descriptions of each element allowed for the presentation of the requirements for operationalizing and managing the innovation model, ensuring that each component comprising the proposed model is fully implemented and promoting interaction among them. Finally, the model describes governance best practices, rules, and standards for establishing relationships within the innovation centre and defining compliance pillars to comply with laws, mitigate risks, promote ethics and integrity, and create a responsible and sustainable innovation environment. Thus, the innovation model for the biotechnology innovation habitat is presented in Figure 1. The model outlines a proposal for a code of conduct and ethics. This code contains governance principles such as accountability, transparency, fairness, and corporate responsibility. It also includes prevention measures to mitigate information leakage risks through monitoring. Adopting this code fosters a culture of integrity, transparency, and responsibility within the innovation centre. For instance, the principle of 'accountability' ensures that all stakeholders are responsible for their actions and are answerable to the public and each other. This principle, when implemented, can lead to a more accountable and transparent innovation environment. Compliance, a vital component of the proposed innovation model, is pivotal in innovation management. It ensures that all operations adhere to applicable legal, ethical, and environmental regulations. The model outlines pillars of compliance to establish a program guide, emphasizing the importance of top management for compliance success, prevention to identify and manage potential non-compliance risks, risk assessment, internal control mechanisms to ensure compliance with codes of conduct, education and communication, reporting channels and investigation, due diligence, monitoring and auditing, as well as diversity and inclusion. This emphasis on compliance underscores the model's commitment to ethical and responsible innovation. Findings and Conclusions: Difficulties and problems that biotechnology innovation centres may face include inefficient internal processes, challenges in predicting social demands, market stagnation and lack of differentiation, technological obsolescence risks, knowledge management issues, lack of strategic alignment, ethical and regulatory challenges, insufficient financial resources, and obstacles to partnerships and collaboration.The main contribution of the innovation model is the role of a guide to support and conduct the integration of scientific knowledge, managerial competencies for innovation development, and the establishment of partnerships with companies and other actors in the innovation habitat. The term' innovation habitat' refers to the broader innovation ecosystem,

including business incubators, startups, technology parks, and innovation hubs. The model's relevance to this vast biotechnology innovation ecosystem worldwide is significant. It can be a reference for many of these innovation habitats to develop their biotechnological innovations efficiently and effectively. The model aims to assist innovation centres in conducting their processes. It brings a set of indicators within a balanced system between financial accuracy and future performance drivers, considering four perspectives for evaluation: Financial, Customer, Internal Processes, and Learning and Growth perspectives. In addition to indicators, fostering a culture of cooperation and technology transfer among partner companies, collaborators, researchers, and academics is essential. The success of technology transfer in biotechnology depends on long-term partnerships, communication channels, and favourable conditions for knowledge transfer. Researchers, investors, companies, regulatory bodies, and the community are integral to innovation. These actors must work together and collaborate to exchange knowledge, form strategic partnerships, and share resources. Engagement strengthens the innovation centre and increases the chances of success and adoption of developed innovations.

The rise of a green hydrogen hub in Brazil | *Author(s): Joana Geraldi, Fernando Viana and Breno Nunes*

Abstract: The energy transition is required and urgent. Yet, despite pledges for decarbonization at national levels and burgeoning action on the ground, current initiatives are not bold enough to overcome carbon lock-ins and trigger deep decarbonisation [1]. One challenge lies in the development of new or redesign of existing supply networks. However, mega projects have the potential to offer such step-change action and accelerate energy transition deliberately[2]–[4], because they concentrate and direct large investments to one area, promoting significant infrastructural changes, which can trigger systemic changes. Extend research on projects argues for the relevance and difficulties related to the front-end of the project, that is, the project's early phases after sanction [5]. Yet, what happens before sanction? How do these mega projects break the lock-ins and emerge? We build on project studies, the sociology of expectations [6] and multi-level transition to theorize about how projects come to life. To address this question empirically, we have studied the rise of green hydrogen in the northeast of Brazil in the industrial complex of the port of Pecém, in state of Ceará. We have been following the developments of the Brazilian Northeast coast for the last two years, and tracking the hype wave around it. Understanding the developments in Pecém is useful to shed light on how mega projects can act as a driving force for the green transition also in countries and regions with natural potential but not necessarily favorable political and economic conditions. In light of Hirschman's (1967) argument [7], we will shed light on how countries develop not for what they are, but what they believe they can become, and their own actions towards it. Being the first in Brazil to produce green hydrogen, the case of Ceará is also justified by their optimal (natural) conditions to produce green electricity using solar, onshore and offshore wind. Its strategic geographical location makes it one of the Brazilian ports closest to North America and Europe. After a period of absent political support, Brazilian federal government changed and green developments are welcomed and supported again. Green hydrogen is developing at a staggering pace internationally. Ceará in general, and port Pecém in particular, are navigating and making use of the shifts in federal and global developments. Based on snowballing sampling, we are tracking different core actors in the development of green hydrogen in the port Pecém and its economic and political context. We conducted 8 interviews and site visits. Our interviews track the actors' expectations, as well as concrete practices to act on these expectations. Thus, we have been able to map what we termed as the battles of expectations. The port is a joint venture between the State of Ceará and the Rotterdam port. With around 20 years of operations, Pecém experiences one of the highest expected growth and development rate in the region. It counts for a forecast of more than US$ 34 billion in investments

in projects related to 36 memoranda of understanding (MoU) for the development of green hydrogen that have been signed by core international actors, representing most of the large energy corporations in the field. The project is still imminent, and we continue following their actions to capture its potential emergence. While it is still early, we preliminary findings link the hype of expectations to external and internal forces such as global energy outlook (due to geopolitical tensions), interest/investment of global companies, international contracts / guarantees for purchase of high volumes, solid local governance, diversity of players in the ecosystem (green energy, cement, coal and gas, steel, etc) and domestic entrepreneurial activity. Forces undermining the hype are uncertainty around the global legal environment (hydrogen classification), domestic regulatory issues (including low speed, bureaucracy, etc), behavior of competitors, and lack of sense of urgency in Brazilian institutions (federal and state levels). Our case is an excellent illustration of these complex intertwined nature of developments. This paper discusses the emergence of an ecosystem for green transition. We explore how different actors shape this emerging supply networks, by using facts to support fiction and fiction to trigger the creation of facts. Insights into these early phases prior to the actual project are fundamental to understand how projects can break Carbon-lock-ins and drive urgent and required action towards the energy green transition. This research extends the current literature on supply chain management, extending ideas of hooking and unhooking (Srai, forthcoming) with the sociology of expectations, driving the enactment of new supply networks between facts and fiction.

Networks and internationalization of Small Medium Enterprises | *Author(s): Ludwig Martin and Hector Gomez Macfarland*

Abstract: Development of theory / background: The world of business schools knows many theories describing business development strategies and paths of developments of companies. Early writings on this topic are from the 1950s, e.g. Ansoff [1]. Johanson & Vahlne [2] and Porter [3], are further contenders from the 1970s and 1980s, looking at how companies develop their international growths. Many of the develop theories developed out of personal observations of a rather small subset of companies, e.g. [1] had its own employer`s situation in mind when developing the now known Ansoff matrix, or [2] looked at Swedish firms only. [4] added his cultural experiences and extensive surveys to the realm of theories pertaining companies and their international footprints. So, some critique, e.g. [5], aimed at the established theories looked at the empirical basis of the proposed theories and development models. Additionally, many of the popular models, are focusing on large companies, their development and their options of internationalization. Aim: This contribution aims to highlight some less-known theories on internationalization and particularly focus on theories with a high level of congruity with theories stemming from social capital and network theories [6] as well as the international development paths of small medium enterprises (SME). These theories which include the aspects of SMEs are less prominent in the literature; possibly due to a less attractive “market” for scholars. Since some of these theories at times lack empirical validation, some points of validation of existing theories are offered. Method: A literature review on key concepts of business development and strategies was conducted. Here some trends and issues within established theories are noted. Using literature which focuses at SMEs and social capital issues of companies, the concept of outsidership is further explored. Some case studies drawing from secondary sources, gained through a desktop study, shows some typical development paths of companies and links these to existing less known theories. Outcomes: theories such as [7], new conceptual model such as [8] and [9], but also the updated versions of [2] i.e. [10], draw from network theories. Companies are part of networks and ecosystems [11]. From the case studies reviewed it can be deduced that the internationalization of SMEs, heavily relies on personal relationships and human centered approaches. Networks are key to access structures and industry organizations abroad. Further

personal networks enable innovation and adaption of approaches and processes within companies when working abroad. These aspects are almost nonexistent in the classical business school teachings and need to be highlighted more.

Navigating Synergies: A Deep Dive into Diversification, Internal Collaboration, and RDI in a Portuguese Company | *Author(s): Marcella Mendes, João Claro and Cipriano Lomba*

Abstract: Introduction A company with multiple business units (BUs) has the opportunity to innovate by exploring cross-unit synergy benefits, sharing resources, and managing projects and processes collaboratively [1], [2]. This happens often in diversified contexts, where resources and knowledge sharing could increase a company's market power and provide business leverage by using cross-unit communication to identify new opportunities for innovation, maximize benefits, and mitigate risks [3]. Diversification is the differentiation of economic activity within a company and can be related or unrelated. Diversification is considered related when a company has several operational units with related characteristics, and the unrelated diversification is the opposite [1], [4]. This research will focus on related diversification and internal collaboration, as the studied environment is a related diversified company. In fact, our focus on related diversification, which creates a close relationship between BUs of the same firm, naturally encouraging them to collaborate internally and seek synergies to innovate, justifies a focus on internal collaboration. Our goal with this research is to understand how the specificities of related diversification can shape both the path and outcomes of collaborative RDI. More specifically, this research seeks to answer two questions: (i) "How does related diversification shape the cross-unit collaborative resource recombination path through which the RDI process unfolds?", and (ii) "How do cross-unit collaboration paths influence the outputs of RDI?". Research Method: This study consists of embedded case research design with collaborative RDI projects as its focus. We have adopted an embedded case design to explore mechanisms and develop a theory on the relationship between related diversification, collaboration, and RDI development in a Portuguese company with eight BUs. An embedded design allows us to examine the similarities and differences among collaborative RDI projects, and compare them with non-collaborative projects, to understand better their effects on the RDI activities and outcomes of companies with more than one BU. Also, the chosen design can provide additional information, variation, and relevant differentiation to investigate cross-unit collaborative RDI projects compared to single-unit projects. It can create more robust empirical evidence and analytical arguments for this category of settings. An embedded case study in a context like ours is appropriate because it combines multiple data sources to capture the interplay of activities and their logic in their organizational context. As part of the embedded case study design, we have adopted some ways of gathering data, i.e., observation, surveys, and individual interviews. Participant observation has been conducted in the field throughout the research project. Furthermore, a survey has already been completed with a sample of 527 professionals from the company to understand the organizational culture concerning innovation. We have conducted 49 semi-structured interviews, to collect data based on the experience of professionals who work with collaborative projects inside the company, to understand the relationship between related diversification, collaboration, and RDI development, mainly how the context can affect the process and outcomes of RDI projects. At the core of our research, we are running an in-depth study of 9 company's RDI projects. The context and project data will be analyzed using statistical tests, for survey, and content analysis, for interview, observation, and documents, to achieve our research goals and address our research questions. Discussion: Fostering cross-unit linkages through social capital and strategic relationships significantly boosts innovation in a diversified company. Strengthening connections between business units enhances communication and collaboration, facilitating the easy exchange of ideas and information. This connectivity enhances innovation by combining diverse knowledge,

skills, and resources across the company. Social capital provides employees with valuable external connections, such as business partners, customers, and suppliers, offering additional sources of ideas and knowledge. Investing in social capital and strategic relationships emerges as an effective strategy to drive innovation by enabling collaboration among business units and accessing external resources for the development of new ideas and products [6], [7]. Also, the divisionalization and hierarchy can help to manage complex tasks in general [7]. Bringing this approach to the context under study, the presence of hierarchy and the possibility of intervention during RDI projects, whether to assist the RDI team in decision-making or to manage conflicts, is a very specific mechanism present in a context of related diversification that impacts on RDI development and the achievement of the desired results. These mechanisms were validated and often mentioned in the interviews already conducted. Conclusions: The following steps in our work will involve finalizing the data analysis of the embedded case study. This study of collaborative projects in a company with eight business units holds great promise to identify patterns and improve our understanding of how related diversification shapes the path of cross-unit collaborative resource recombination through which the RDI process unfolds in such settings. This study is of potential significance to research and practice. For researchers, it may extend and further open empirical investigation on innovation in related diversified environments and on “bounded” collaborations in innovation, which assume an intermediate position between more extreme entirely in-house or open modes. For practitioners, it may contribute to better informing the management of innovation processes in related-diversified contexts to achieve more positive outcomes.

INDUSTRIAL CASES

Application of Human-centered design approaches to improve the implementation process of New Technologies in the Industry | *Author(s): Marcelo Sousa, Guilherme Neves, Tatiana Teixeira, Maria Covas, Nilza Ramião, Soraia Alves and Flávia Barbosa*

Introduction: As industries increasingly embrace automation and digitization, the effective adoption of new technologies by shop floor workers becomes crucial for boosting productivity and efficiency in different industrial sectors. However, this acceptance is often met with resistance due to factors such as fear of job displacement, unfamiliarity with new technologies, and perceived complexity. Human factors allow Occupational Health and Safety teams to conduct comprehensive and adaptable workplace analyses. Evaluating employee's health during their tasks is crucial for identifying the benefits of new technologies. This assessment helps determine how innovations can reduce physical strain, lower injury risks, enhance productivity, and improve well-being. Understanding workers' baseline health ensures that new technologies are tailored to their needs, maximizing efficiency and safety. This thorough evaluation supports the effective integration of innovative solutions, leading to a healthier and more productive workforce. To better understand the factors that impact the success of the implementation of New Technologies (NT), this research combines two approaches - a methodology based on Unified Theory of Acceptance and Use of Technology (UTAUT) and human factors methodologies. The first approach allows to understand and predict worker's intentions to use (IU) NT within the industrial setting, while the second one focus on the mental and ergonomic analysis of the worker's task, providing useful insights on the benefits that the NT bring to the workforce. By incorporating principles from UTAUT, UTAUT-for-Industry seeks to foster an inclusive and supportive environment for technology adoption. Meanwhile, by adding a complete ergonomic analysis, data on the current task's impact on the workers' health will be collected, allowing to define a set of specifications to improve the implementation of the NT. The combination of both methodologies align with Industry 5.0 principles by emphasizing the importance of human-machine collaboration, where advanced technologies are seamlessly integrated into the workflow, ensuring that technological advancements complement human capabilities rather than replace them. In this context, the proposed model is designed to help companies in the manufacturing sector to make informed strategic decisions about technology implementation. By identifying the key factors that influence technology implementation, companies can develop targeted strategies to enhance the success rate of NT integration. This human-centered approach improves operational efficiency and contributes to sustainable industrial practices by fostering a supportive work environment that values workers' input and well-being. By emphasizing the human aspect of technology adoption, this study aligns with the conference's goal of promoting sustainable and human-centered technological practices to address various societal challenges.

Case Study: The validation of the model was performed within the kit-assembly section of a company undergoing the implementation of two new technologies: a robot for picking and sorting screws and a vertical warehouse. This process is divided into five main steps, starting with the warehouse loading, followed by the product selection based on the shipping order. The workers select the product that will compose each kit, consisting mainly of screws, nuts and rings. A set of these products will be introduced in raffia bags with weights varying between 4 and 6 kg. These bags will then be introduced into a shipping module, following then for shipment. Currently, the shop floor process requires enhancement to meet Industry 5.0 standards, aiming for a more sustainable work environment that reduces health impacts on workers while increasing productivity. To achieve these goals, the company plans to introduce two new technologies: a digital warehouse and a collaborative robot, which implies a restructuration of the shop floor layout. These technological introductions will significantly impact the daily activities of workers,

being essential to apply a technology acceptance methodology to prepare both the workforce and the organization for these changes, ensuring the successful implementation of these technologies. This methodology will be employed before the technology's implementation, collecting feedback from the workers. This entails: a. Assessing workers' perceptions regarding the benefits and their willingness to embrace these technologies in their work environment; b. Gathering quantitative data and identifying key criteria that significantly influence workers 's acceptance of these technologies and their ergonomic status; c. Providing to the organization specifications and requirements that comply with the needs of the workers.

Methodology: As previously mentioned, two approaches were implemented in this study, UTAUT-for-Industry and the analysis of working conditions. UTAUT-for-Industry: The proposed model is an extension of the existing UTAUT framework, designed to provide a more nuanced understanding of technology adoption within industrial settings, accounting for the dynamics inherent to such environments. With that, it answers the main limitations of current models, such as the scattered and redundant acceptance factors and the lack of consideration for the user's satisfaction with the current technology/system. Therefore, the primary objective of the study is to propose and validate the UTAUT-for-Industry model. By doing so, the model aims to provide a comprehensive understanding of the factors influencing workers' IU new technologies in the manufacturing industry. The UTAUT-for-Industry framework comprises eight macro dimensions categorized into two groups: personal factors and external factors. The personal factors group encompasses dimensions related to the user's personal perceptions and characteristics and includes the perceived usefulness, ease of use and safety of use as well as satisfaction with the current system. In contrast, the external factors group includes dimensions associated with the organization and the use environment, focusing on the implementation process, social influence in the work environment, organizational support and long-term consequences, which are more directly within the company's control. Additionally, the framework utilizes two classes of control variables representing individual user factors: reaction to new technologies and socio-demographic factors. Considering the present approach, the methodology implementation consists of six main steps: 1. Objective definition: identification of the specific technology to evaluate acceptance; 2. Factor's selection: identification of the key factors that influence technology acceptance contextualizing with the environment and type of activities; 3. Surveys definition: three surveys were implemented – a socio-demographic participant's characterization; assessment of operator satisfaction with current tasks, and technology acceptance. A Likert-type scales (1-5) to rate participant's agreement or disagreement with statements was used; 4. Analysis and data interpretation: survey responses were analyzed using appropriate statistical methods to capture and understand each factor's impact.

Analyze Working conditions: The implementation of methodologies that assess the ergonomic status of industry workers brings a range of significant benefits. These methodologies are designed to analyze working conditions from an ergonomic perspective, identifying potential health and safety risks for workers. By assessing aspects such as posture, repetitive movements, physical exertion, and biomechanical load, these methodologies allow companies to identify areas for improvement in the workplace and implement appropriate preventive measures. This not only reduces the risk of musculoskeletal injuries and other occupational health issues but can also lead to increased productivity, employee satisfaction, and quality of the work environment. The proposed model focuses on methodologies aimed at identifying and categorizing the ergonomic risk faced by workers. Considering this approach, the methodological implementation consists of these stages: 1. Collection of sociodemographic characteristics and the clinical history of the workers (Questionnaire 1 – Personal Information) and characterization of musculoskeletal injuries through Questionnaire; 2. Analyzing task requirements and ergonomic suitability, taking into account factors such as task demands, work duration, workloads and physical effort. The

work cycles performed by each worker were monitored on-site, with photographic and video recordings; 3. Evaluation of ergonomic risk factors, including awkward postures, repetitive motions, forceful exertions, and prolonged sitting or standing. Regarding data processing, it is handled through numerical analysis and descriptive statistics, based on normative references adapted to each monitored task.

Results and Discussion: Participant's characterization: The participants involved in the study were all the workers responsible for kit assembly, as they will be the users directly involved with the new technologies/systems implemented. Most of the participants were female (66,7 %). From the total respondents, only 33,3 % are performing the activity for less than two years, while 66,7 % have been using the current system for over 5 years. All participants claimed they only have primary or secondary education level.

Acceptance factors: The results are divided into the analysis of the satisfaction of the workers with the task, followed by technology acceptance. Starting with satisfaction, five dimensions were analyzed - ergonomics, perceived utility of the task, working resources, motivation and training. Survey's results revealed that satisfaction with the current system was notably low. Ergonomics and working resources received the lowest ratings. This finding underscore a concerning trend among workers, indicating a widespread dissatisfaction with the existing technology infrastructure. Such low levels of satisfaction may have significant implications for the adoption of new technologies within the company, as it indicates a potential readiness for change among workers. Regarding the technology acceptance, the survey's results show that both technologies, a robot designed for picking and sorting kits of screws, and a vertical warehouse system, received above average ratings. However, notable differences emerged in some dimensions. Perceived usefulness, for example, presented the highest deviation between the two technologies, while organizational support was the second. Additionally, social influence received identical scores for both technologies, as expected due to the workplace social environment being the same.

Evaluation of Working Conditions: The most critical worker responsible for kit assembly, a woman, was analyzed. The worker's history of surgeries on both wrists due to carpal tunnel syndrome and foot surgery to remove a plantar cyst and high pain ratings from the Musculoskeletal Symptoms Questionnaire, underscore the severe impact of her work conditions on her health. This questionnaire revealed that the worker rated her pain as 9 on a scale from 0 (No Pain) to 10 (Maximum Pain) for the neck, thoracic region, and hips/thighs. Maximum pain was reported in the right shoulder, right elbow, right wrist/hand, lumbar region, knees, and ankles/feet. During the observation of the workstation, it was noted that the main postures maintained include wrist rotation, constant hand movements, elevation of the arm and forearm, and trunk rotation due to bag handling. There are tasks that involve trunk bending, which leads to higher tension and load concentration in the lumbar region. For example, the angle between the trunk and the vertical is 69.3°, as can see in Figure 1, whereas normative references recommend angles not exceeding 60°. During manual load handling, exemplified in Figure 2, the wrist, shoulder, elbow, arm, and forearm joints are constrained. This task involves arm elevation greater than 60°, shoulder lifting, and constant extension/flexion of the elbow and wrist. Regarding head inclination, the values obtained are around 64°, and neck inclination is 49.62°, which is not advisable. As expected, in the observational analyses of the workstation, movements were identified that require attention due to critical postures and workloads, exhibiting a risk of developing work-related musculoskeletal disorders (WRMDs). Some tasks were indicated by the worker as having maximum effort on the perceived physical effort scale (Borg:10), highlighting the severe impact of her work conditions on her health and the need for ergonomic interventions to mitigate these risks. Relevant values were noted in the Working rhythms, Work conflicts, Horizontal trust,

Work/family conflict and Sleep problems scales, which can be reflected in incorrect postures and consequently present relevant symptoms, as mentioned above.

Conclusions: The present study focuses on the combination of two methodologies, UTAUT-for-Industry and the analysis of workers conditions in order to consider relevant human factors on the implementation phase of new technologies in a company. By assessing the factors that influence an individual's intention to use new technologies, in an industrial context and personalizing ergonomic and mental analysis of workstations before and after implementing technology, acceptance, efficiency, and productivity can be maximized for each organization, whether for a single workstation or multiple ones. The results generated by the model can also support designer's decision-making in identifying and improving the requirements for new technologies implementation. By analyzing the aspects that impact both the worker's acceptance and health, designers can gain valuable insights into the practical needs and preferences of the end-users. This understanding allows for the development of technologies that are more user-friendly and efficient but also better aligned with the actual work environment and tasks. By incorporating user feedback into the design process, companies can enhance the overall implementation and effectiveness of NT on the shop floor, ensuring they meet the operational and ergonomic needs of their workforce.

Acknowledgment: This work has been supported by the European Union under the Next Generation EU, within the scope of the project PRODUTECH R3 – "Agenda Mobilizadora da Fileira das Tecnologias de Produção para a Reindustrialização". The authors acknowledge the funding provided by LAETA under project UIDB/50022/2020.

Circularity Assessment in Industry: A methodological approach | *Authors: Bruna Oliveira, Teresa Gonçalves, Marcelo Sousa, Sandra M. Pimenta, Octávio F. Ramalho and Flávia Barbosa*

Introduction: The circular economy has become a widely adopted concept among companies, but some industries, like the tannery sector, require more attention due to their significant environmental impact. This impact is due to the industry's large scale, intensive resource consumption, lack of product recyclability, and the generation of industrial effluents. Consequently, achieving zero-waste goals and meeting European sustainability objectives is challenging for this sector. To overcome this issue, the EU Circular Economy action plan, launched in 2020, promotes a transition to a more sustainable industry, providing important guidelines for companies in several industrial sectors. Although several tools and guidelines were provided by the EU, there is a need for an effective methodology to determine the level of circularity within tannery companies. Given the complexity of the circular economy concept, few factories have sustainability specialists to assess their circularity or to implement beneficial circular strategies. Although several methodologies exist for assessing circularity in specific industrial sectors, a straightforward approach for factories aiming for cleaner production is lacking. In this context, this work presents and discusses a methodology to assess the circularity of the tannery industry, enabling any company to measure the impact of its activities. The proposed methodology involves calculating the Overall Circular Index (OCI) by evaluating four key domains: energy, material, economy, and social aspects within a specific factory. The index ranges from 0 to 1, where 0 indicates a linear economy and 1 represents a fully circular economy. Each key area has a sub-index, derived from key performance indicators (KPIs) relevant to each domain, and the OCI reflects the average of these sub-indexes. Fieldwork was necessary to gather all required data from the selected company. By analyzing separate sub-indexes, companies can identify which domains are more linear and need improvement. Strategies can then be implemented to enhance the OCI, and the index is recalculated to measure improvements and changes in the

sub-indexes. This continuous improvement methodology ensures constant reevaluation and enhancement of factory circularity. The methodology is also flexible and can be adapted to any industrial sector by modifying the KPIs. This methodology was implemented in a selected Portuguese SME tannery industry, proving to be a valuable tool for measuring factory circularity. It enabled non-specialists to evaluate circularity, identify solutions to enhance it, and understand how actions impact the environment. As a result, energy and environmental inefficiencies were identified and corrected, increasing the company's sustainability and circularity. This work significantly contributes to helping Portuguese SMEs achieve European and UN 2030 sustainable goals.

Case Study: As previously stated, the tannery industry must follow a more circular approach. Therefore, the use case selected to apply and test the proposed methodology is a tannery SME whose manufacturing processes range from tanning the leather into hair to the final product, specializing mainly in varnishes, suedes, x-tan and wet-white items. The company employs approximately 50 workers and its main sectors are the footwear, clothing and leather works. The company’s concept already revolves around circularity as it benefits from the wastes of slaughterhouses, by upcycling the animal skins into valuable products. Specifically, the target chosen is the factory and the manufacturing processes their products involve. Depending on the type of leather produced and the kind of feedstock received, some steps of the process can be ignored or skipped. Some products are sold in the Wet-Blue phase, others in Crust, and finally some are sold finished. Besides, not all products are manufactured from raw skins as some are produced from skins at later phases as a service.

Methodology: The present methodology was developed in order to face up to the challenges the SME’s meet in assessing and improving their circularity. By creating a simple rationale around the steps needed to be taken to improve the circular economy, the companies that do not have enough specialized resources to tackle this issue can work on it without much investment or research. The methodology consists of four main steps, target characterization, circularity level assessment, goals definition, strategy formulation and strategy implementation. Each step that characterizes the methodology is expressed bellow. First, it is necessary to define the target for assessing circularity, which could be a product, process, factory, company, or entire industrial sector. For example, when evaluating a product's circularity, one must consider its entire life cycle, from production to end-of-life, and its overall impact. Regardless of the target, the methodology follows the same approach, ensuring a comprehensive assessment of circularity. The assessment of circularity begins with defining the target, such as a product, process, factory, or industry. The circularity is measured using an OCI, ranging from 0 (linear) to 1 (circular), based on KPIs in four domains: Environmental, Material, Economic, and Social. Each domain has its own sub-index, also ranging from 0 to 1, and the OCI is the average of these sub-indexes. The Environmental domain assesses energy use and effluents, the Material domain focuses on recyclability and reuse, the Economic domain evaluates financial sustainability and circular practices, and the Social domain considers worker safety, client relations, corporate governance, and community impact. KPIs are tailored to each target, normalized, and given equal weight to ensure a comprehensive and balanced assessment. After defining the KPIs and collecting data, sub-indexes are calculated to determine the OCI which provides a baseline for comparing future improvements in circularity. To construct each sub-index, the indicators are normalized due to their varying units. The OCI reveals which areas have lower scores and which align with EU circularity goals. The objective is to improve the lower sub-indexes by addressing the key indicators that reduce them. This involves analyzing the OCI to identify which domains need urgent attention to enhance circularity. Setting clear objectives, such as increasing a specific sub-index by 50 %, is one approach to achieving this goal. With this goal in mind, it follows the formulation of some strategies to increase specific indexes related to each KPIs. A different

strategy must be applied depending on the domain, the specific goal and the target. Since the methodology tries to be as generic as possible, it is challenging to suggest concrete ideas, taking specific actions adapted to different situations. Finally, the strategies identified in the previous step are implemented to improve circularity. This involves making specific changes to the target, such as modifying a product, updating machinery, or introducing new company policies. These modifications and adjustments are employed to achieve the previously defined circularity goals.

Results and Discussion: The implementation of the methodology on the use case started with the definition of the main goal which was defined as the assessment of the circularity index of the entire company. KPIs were selected based on the different domains previously identified, resulting on a total of 32 KPIs, specifically, 6 for material, 9 for environmental, 8 for economical and 9 for social. After gathering data, normalization was conducted to create an index ranging from 0 to 1, enabling meaningful comparisons across different indicators. A lower index indicates a more linear economy, while a higher index implies greater circularity. Minimum and maximum values for each KPI were established based on company objectives or benchmarks from relevant literature. The normalization method used was MADM (Multiple Attribute Weighting Method). If minimum or maximum values do not align with the desired principles, targets should be adjusted annually. The OCI is then calculated by the average of the four sub-indexes, achieving a value of **0,352**. This number reveals that the use case is more linear than circular and has much room for improvement. Notably, the highest sub-index is the Social one with a value of **0,517** and, even so, it is still half way to a score of 1. The factors that most elevate the Social Circularity Index (SoCI) are the lack of worker absenteeism and temporary workers, as well as very little turnover in the company and all employees being from the nearby community. The Material Circularity Index (MCI) presents the second higher value, **0,358**. The indexes are moderately average except for the indicators of reused consumable (salt only) rate and recovered chromium percentage which lower significantly the sub-index by having no reutilization/recovery whatsoever, despite in previous years the chromium being fairly recovered on an outside facility. The highest index of this group belongs to the indicator that represents the percentage of mineral, vegetal and synthetic agents since the use case shows preference to the natural tanning agents rather than synthetic ones, given their significantly lower environmental impact. The Environmental Circularity Index (ECI) is the second lowest sub-index of the group, with a value of **0,277**. This fact does not come as surprising since the environmental issue is pertained to this industry due to the high usage of water, chemicals and effluents and emissions of pollutant gases. The heat recovery and water reuse indicators reveal an index of zero due to the non-existent system to recover neither the heat generated nor the water used within the factory. The index that reflects the percentage of energy produced by the company's solar photovoltaics power plant, which is almost a quarter of their full energy demand is equal to 0,231. Lastly, the index that presents the maximum value index of the environmental domain is related to the dangerous wastes generated, since all wastes generated are forwarded to a waste management facility, resulting in no landfill disposal. The Economic Circularity index (EcCI) is generally low, characterized by an average value of **0,256**. Excepts for the photovoltaics power plant, the ROI on other sustainable solutions is zero, as new investments were made last year and have not yet yielded returns. The sale of leftovers is also zero due to the absence of a policy for selling leftover skins. However, the company profits from the sale of sub-products generated during manufacturing. Productivity indexes show variation across production lines, with line 4 being most profitable due to selling finished products, while lines 2 and 3 are intermediary phases with lower profits. Line 1 is less profitable despite selling finished products due to high feedstock costs. Overall, the factory's OCI indicates a predominantly linear economy with potential for circularity improvements. From this analysis, a set of considerations and strategy design were presented to the company, in order to increase the value of the lowest sub-indexes. As reflected by the analysis previously presented, the focus will be first

on the economical aspects of the company, followed by the environmental issues and material reuse and recovery. Although the social index presents the highest value, there are still space for improvement and mitigation and improvement measures were presented.

Conclusions: This study presents a novel circularity methodology that aims to address gaps in previous approaches, particularly for SMEs, to assess and improve their circularity levels. The methodology calculates an OCI that can be continually enhanced to achieve higher circularity over time. It distinguishes itself by enabling reassessment of goals and production strategies, influencing both production lines and company management to foster a more sustainable economy. Applied to a Portuguese SME in the tannery industry, the methodology yielded an initial OCI of 0,352, based on the average index of for main domains, social, environmental, material and economical, indicating a predominantly linear economy. The assessment highlighted areas needing significant changes, which could improve the index with minimal investment without affecting product quality. Future work includes testing the methodology on more targets with different products to validate and refine it, potentially incorporating weighting factors to prioritize specific concerns.

Acknowledgment: This work has been supported by the European Union under the Next Generation EU, within the scope of the project PRODUTECH R3 – “Agenda Mobilizadora da Fileira das Tecnologias de Produção para a Reindustrialização”.

Enhancing Workplace Efficiency, Productivity, and Well-Being through Human-Centric Methodologies | *Autor(s): Tatiana Teixeira, Maria Covas, J. C. Guedes and Nilza Ramião*

Introduction: Industry 5.0 integrates human-centered, sustainable, and resilient concepts into manufacturing, allowing human workers to focus on creative and complex tasks while intelligent robots handle repetitive ones. This revolution is transforming industrial production, work processes, and human-machine interactions. However, challenges such as security, privacy, a lack of skilled workers, lengthy processes, and substantial budget requirements persist. Training workers for new technologies incurs additional costs and effort [1], [2]. Occupational risk assessment tools currently show gaps, complicating risk identification in workplaces. Despite automation, a high incidence of work-related musculoskeletal disorders (WRMSDs) and occupational diseases remains, contributing to increased absenteeism. The International Labour Organization (ILO) reports nearly 2 million annual deaths from occupational diseases and workplace accidents [3], [4]. General information and initial context: Instrumental Assessment: Occupational health and safety services focus on preventing diseases and rehabilitating workers, yet reallocating new tasks and reducing exposure to risk factors remain difficult. Companies increasingly use technology, such as collaborative robots and AI, to address human resource shortages. The human factors approach, emphasizing the interplay between organizational, physical, cognitive, and psychosocial systems, are becoming crucial for creating safe and sustainable work environments [5]. Manual handling tasks in sectors with high physical demands, such as logistics and metalworking, contribute to WRMSDs. Innovative methodologies, including real-time monitoring of physiological data and biomechanical assessments, are essential for identifying ergonomic and health risks. These methods enable detailed analysis of work impacts on health, optimize task customization, and improve workplace suitability. Integrated physiological assessments and 3D digitization technologies facilitate rehabilitation and layout redesign, promoting worker health and well-being [6]. This study presents case studies that applied new methodological approaches in ergonomics and human factor analysis to support workstation and process redesign, aiming to enhance productivity, efficiency, and worker health.

Methodology: The methodology developed to assist companies in configuring workstations that focus on efficiency, productivity, and employee well-being follows a structured and systematic

process beginning with an initial diagnostic of the current situation. This diagnostic involves a detailed analysis of workstations, activities, tasks and subtasks performed by employees, work objectives and an assessment of occupational risks. Only scientifically validated questionnaires are included to assess population characteristics evaluation of anthropometric data, clinical and professional history. Scales are used to assess physical and mental workload and/or job satisfaction, musculoskeletal symptoms and other relevant information about the company. Following the initial diagnostic, we proceed to the monitoring phase, where real-time data collection allows for continuous analysis of working conditions and employee well-being. The tools used in the monitoring phase include: Bioimpedance assessments; Accelerometry measurements (wrist and waist); Kinematic and anthropometric analysis; Cardiovascular overload analysis (heart rate monitoring); Sleep quality assessment; and Virtual capture of the factory floor with a digital scanner. Real-time monitoring effectively identifies critical work situations by evaluating employees' maximum aerobic work capacity and task requirements, preventing physiological overload and managing effort. Energy expenditure and metabolic rate assessments, using accelerometry and heart rate monitors, provide detailed diagnoses of work overload and physical demand. These assessments, combined with image capture and kinematic analysis, visualize postures, movement angles, applied forces, and muscle recruitment. Biomechanical parameters, such as muscle activity, joint reaction forces, and metabolism, help understand health impacts and identify musculoskeletal injury risks. This methodology allows for optimizing and customizing tasks to minimize physical effort and biomechanical load on workers. Based on the data collected, we design customized solutions for each company, always focusing on a human-centric approach. The solutions include the study of ergonomic equipment and solutions, the analysis of effort management and fatigue, innovation and product development aligned with user needs, and the optimization of processes and operational efficiency. Increasingly, methodologies based on physiological and individual characteristics approaches are needed for better workplace adaptation and product development. It is with these approaches that the science of occupational health and safety will undergo a revolution, keeping pace with the evolution of workplaces. Solutions Quality: The final step of the methodology involves supporting the implementation of solutions, working closely with company management and operational leadership. Continuous improvement is ensured through constant monitoring and adjustments. The adaptable methodology can be tailored to meet diverse needs and specific objectives. Integrated physiological assessments help identify and categorize ergonomic and health risks. Occupational health and safety teams can use 3D digitization to monitor anthropometrics and ensure workplace suitability, aiding in rehabilitation and layout optimization. By following this methodology, companies can enhance efficiency and productivity while promoting employee well-being, creating a healthier and more sustainable work environment. In physically demanding sectors like logistics and metalworking, where manual handling tasks are common, innovative methodologies are crucial for predicting and reducing work-related musculoskeletal disorders. The case studies presented below are the result of a consultancy service requested by the companies. This specialized service arises in response to risk factors identified in the workplaces, which pose a challenge to occupational safety and health teams. A company in the logistics sector involves tasks requiring manual handling of loads with variable weights, which can reach up to 25 kg. Workers may perform these tasks in extreme environments, including temperatures as low as -24°C. This manual handling of loads over an 8-hour workday caused severe fatigue among the workers. In the long term, even with process automation, a high incidence of work-related musculoskeletal disorders (WRMSDs) was observed among the workers, consequently leading to increased absenteeism.

Results and Discussion of a Study Case: Case Study 1: A total of 357 employees were monitored, including 235 males and 122 females. Of these, 15.41% (55) reported musculoskeletal disorders, such as lumbar hernias (22.11%), intervertebral disc ruptures (8.42%), shoulder tendinitis (13.68%), and elbow tendinitis (7.37%). According to the Musculoskeletal Symptom Questionnaire, the lumbar region caused the most pain, discomfort, or numbness over the past 12 months (57.86%). Employees perform manual handling of various loads, involving repetitive lifting, carrying, and lowering. Shorter individuals lift loads above shoulder height to stack pallets, while taller individuals bend more, stressing their lumbar region and knees. All employees experienced physical and cardiovascular fatigue beyond recommended limits. Consequently, innovative solutions were proposed based on physiological and biomechanical data, leading to the implementation of an Integrated Health and Well-Being Promotion Program, which includes: Organisational Measures: ✓ Employee monitoring program focused on raising awareness of health and well-being, motivating the adoption of healthy lifestyle habits (regular sports practice and promoting quality sleep); ✓ Creation of a Physical Prevention and Rehabilitation Centre that monitors the evolution of the intensity and frequency of symptoms and detects the first signs of injury early on, thus enhancing the success of a rehabilitation program; ✓ Creation of a nutrition and healthy eating program; ✓ Reducing the number of lifts and the mass of the loads carried, adjusting the daily objectives to the limits indicated in the normative references; ✓ Rotation of tasks within the same area and between work areas by different employees throughout the working week, opting for tasks that allow for active recovery; ✓ Study the possibility of making product boxes with a distribution of loads to avoid musculoskeletal injury and improve the execution of the task. ✓ Defining a greater number of breaks for workers to recover between tasks. Engineering measures: ✓ Provide automatic pallet trucks whenever the task allows; ✓ Provide a camera system on the retractable stakes that allows the worker to visualise the stakes so as to avoid the cervical spine rotating to the right and upwards; ✓ Provide a permanent vitafilm robot. To prevent and mitigate new occupational risks and apply new approaches, there is a growing need to improve training, rehabilitation, and risk management for workers. Interventions increasingly focus on adapting workers and workplaces with a human-centric approach [7]. Virtual reality-based training projects are valuable innovations, identifying worker difficulties and enhancing interaction with work equipment. Advanced education in occupational health and safety boosts literacy for employees and employers, reducing human error, increasing productivity, and decreasing workplace accidents [8], [9]. Rehabilitation for musculoskeletal disorders is more effective with programs based on biomechanical movement and posture analysis. AI algorithms further enhance rehabilitation processes and monitoring by healthcare professionals [10], [11], [12]. Occupational risk management programs now prioritize worker interaction with the work environment, integrating physiological, anthropometric, biomechanical, environmental, and organizational variables to improve conditions, reduce fatigue, and decrease occupational diseases [13].

Conclusion: The revolution in occupational health and safety has necessitated advances in risk assessment and management methodologies, as well as in adopted approaches. Through these advances, there has been a strong need for assessments more centered on the worker and their physiological and biomechanical response to tasks. It is with these approaches that critical situations are identified during different task execution moments, potentially leading to the appearance of long-term occupational diseases. Adapted training, prevention, rehabilitation, and management programs appear to be the future of occupational health and safety. These programs will increasingly focus on integration into advanced worker-focused analyses. The challenges encountered in the field can be addressed with the need for the development of products capable of responding to the absence of equipment suitable for physiological monitoring in all work

environments and across all types of activity sectors. The methodologies developed are crucial for helping companies navigate the challenges of Industry 5.0 by effectively integrating advanced technologies and human-centric work practices. Key benefits include efficient human-machine collaboration through optimized workstations, enhanced productivity and efficiency with real-time monitoring tools, and skill development via health and well-being programs alongside specialized training. These methodologies foster sustainability and resilience with human-centric approaches, leverage technologies like digital twins and IoT, and provide customized, data-driven solutions tailored to specific company needs. They bridge gaps in occupational risk assessment, manage risks, and facilitate the safe adoption of advanced technologies such as AI, blockchain, and big data analytics. Additionally, they ensure compliance with evolving regulations, helping companies navigate legislative complexities. Overall, this approach guarantees a safe, productive, and sustainable work environment in the era of Industry 5.0.

Acknowledgment: The authors acknowledge the funding provided by LAETA under project UIDB/50022/2020. Additionally, this work has been supported by the European Union's Next Generation EU, through the Fundo Ambiental, as part of the BioShoes4all project - Innovation and Capacity Building for the Sustainable Bioeconomy in the Footwear Sector.