



Digital Manufacturing Industry 4 0 7 Springer

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Digital Manufacturing Industry 4.0 Springer:

Industry 4.0 for Manufacturing Systems Vishal Ashok Wankhede, VIMAL K.E.K, Pankaj Sahlot, 2025-04-24 The book highlights the importance of intelligent decision making in advanced production systems and optimization of process parameters using fuzzy based multi criteria decision making tools It discusses the decision making aspects of Industry 4.0 using machine learning and optimization techniques and helps in moving toward the digitalization of manufacturing systems It further covers several important topics including the role of digital twins in advanced manufacturing processes machine learning based prediction of overall equipment effectiveness intelligent quality control tools and life cycle assessment models in Industry 4.0 Key features Presents a conceptual framework to measure the readiness of adopting Industry 4.0 in advanced manufacturing systems Discusses the impact of smart manufacturing on sustainable development and integration of Industry 4.0 and additive manufacturing Covers topics such as intelligent automation systems machine learning based preventive maintenance and the Internet of Things enabled additive manufacturing in Industry 4.0 Explains cyber physical system integration with Industry 4.0 technologies cyber physical systems in industrial robotics and green cyber physical systems Illustrates optimization of process parameters using fuzzy based multi criteria decision making tools and life cycle assessment models in Industry 4.0 This book is primarily written for senior undergraduates graduate students and academic researchers in the fields of industrial engineering production engineering mechanical engineering supply chain management and manufacturing engineering

Computational Intelligence in Industry 4.0 and 5.0 Applications JOSEPH BAMIDELE AWOTUNDE, Kamalakanta Muduli, BISWAJIT BRAHMA, 2025-02-06 Industry 4.0 and 5.0 applications will revolutionize production enabling smart manufacturing machines to interact with their environments These machines will become self aware self learning and capable of real time data interpretation for self diagnosis and prevention of production issues They will also self calibrate and prioritize tasks to enhance production quality and efficiency Computational Intelligence in Industry 4.0 and 5.0 Applications examines applications that merge three key disciplines computational intelligence CI Industry 4.0 and Industry 5.0 It presents solutions using Industrial Internet of Things IIoT technologies augmented by CI based techniques modeling controls estimations applications systems and future scopes These applications use data from smart sensors processed through enhanced CI methods to make smart automation more effective Industry 4.0 integrates data and intelligent automation into manufacturing using technologies like CI the IoT the IIoT and cloud computing It transforms data into actionable insights for decision making and process optimization essential for modern competitive businesses managing high speed data integration in production processes Currently Industries 4.0 and 5.0 are undergoing significant transformations due to advances in applying artificial intelligence AI big data analytics telecommunication technologies and control theory These applications are increasingly multidisciplinary integrating mechanical control and information technologies However they face such technical challenges as parametric uncertainties

external disturbances sensor noise and mechanical failures To address these this book examines such CI technologies as fuzzy logic neural networks and reinforcement learning and their application to modeling control and estimation It also covers recent advancements in IIoT sensors microcontrollers and big data analytics that further enhance CI based solutions in Industry 4.0 and 5.0 systems *Semantic Technologies for Intelligent Industry 4.0 Applications* Archana Patel, Narayan C. Debnath, 2023-10-06 As the world enters the era of big data there is a serious need to give a semantic perspective to the data in order to find unseen patterns derive meaningful information and make intelligent decisions Semantic technologies offer the richest machine interpretable rather than just machine processable and explicit semantics that are being extensively used in various domains and industries These technologies reduce the problem of large semantic loss in the process of modelling knowledge and provide sharable reusable knowledge and a common understanding of the knowledge As a result the interoperability and interconnectivity of the model make it priceless for addressing the issues of querying data These technologies work with the concepts and relations that are very close to the working of the human brain They provide a semantic representation of any data format unstructured or semi structured As a consequence data becomes real world entity rather than a string of characters For these reasons semantic technologies are highly valuable tools to simplify the existing problems of the industry leading to new opportunities However there are some challenges that need to be addressed to make industrial applications and machines smarter This book aims to provide a roadmap for semantic technologies and highlights the role of these technologies in industry The book also explores the present and future prospects of these semantic technologies along with providing answers to various questions like Are semantic technologies useful for the next era industry 4.0 Why are semantic technologies so popular and extensively used in the industry Can semantic technologies make intelligent industrial applications Which type of problem requires the immediate attention of researchers Why are semantic technologies very helpful in people's future lives This book will potentially serve as an important guide towards the latest industrial applications of semantic technologies for the upcoming generation and thus becomes a unique resource for scholars researchers professionals and practitioners in the field *Handbuch Industrie 4.0* Birgit Vogel-Heuser, Michael ten Hompel, Thomas Bauernhansl, 2024-11-07 Mit der Neuauflage des erfolgreichen Werkes wird die Geschichte der vierten industriellen Revolution fortgeschrieben und der Dynamik Rechnung getragen mit der die Vision in den vergangenen zwei bis drei Jahren weiterentwickelt und verwirklicht wurde Experten aus Wissenschaft und Technik beleuchten verschiedene Facetten der Industrie 4.0 sowohl aus akademischer als auch aus praktischer Sicht und schaffen gleichermaßen einen Überblick über den Stand der Technik und die Vision selbst Dies gelingt nicht zuletzt dank einer ausgewogenen Mischung aus wissenschaftlichen Erkenntnissen Praxisbeispielen und Beiträgen Die Themen der Beiträge reichen von Basistechnologien bspw. cyber physische Systeme über Integrations- und Migrationsansätze bis hin zu Geschäftsmodellen und Dienstleistungen für die Industrie 4.0 Zudem werden die Datensicherheit und auch rechtliche Aspekte behandelt In der 3

Auflage werden die Themenfelder um Künstliche Intelligenz aktuelle Mobilfunkstandards und den daraus resultierenden Potentialen für eine zukünftige Plattformökonomie erweitert Die dritte Auflage wurde bearbeitet und erweitert erscheint nun in 3 Bänden Dieser zweite Band beinhaltet neue und bearbeitete Beiträge zur Automatisierung Online ist dieses Nachschlagewerk auch bei Springer Reference verfügbar

Industrial Revolution 4.0 Dr. Ashish Bhanabhai Patel, 2025-05-31 The book *Industrial Revolution 4.0 Concepts Technologies and Applications* provides a comprehensive insight into the transformative impact of Industry 4.0 on modern manufacturing and industrial systems It serves as a valuable academic and practical reference for students researchers and professionals in mechanical production and industrial engineering Key Topics Covered Introduction to Industry 4.0 Historical evolution of industrial revolutions leading up to the fourth industrial era Core Technologies Cyber Physical Systems CPS Internet of Things IoT and Industrial IoT IIoT Artificial Intelligence AI and Machine Learning Big Data Analytics Cloud and Edge Computing Additive Manufacturing 3D Printing Augmented Reality AR and Virtual Reality VR Digital Twins Blockchain in Industry Smart Manufacturing and Automation Integration of smart sensors robotics and real time data in modern production environments Sustainable and Smart Supply Chain Management Role of Industry 4.0 in enabling efficient transparent and eco friendly supply chains Applications in Indian Industries Focus on textile automobile and MSME sectors with practical case studies Challenges and Future Directions Addressing cybersecurity workforce readiness and technological barriers

Introduction to Industrial Internet of Things and Industry 4.0 Sudip Misra, Chandana Roy, Anandarup Mukherjee, 2021-01-07 Industrial IoT IIoT and Industry 4.0 are newly developing and fast emerging domains of interest among students researchers and professionals in academia and industry Due to the popular demand of this topic *Introduction to Industrial Internet of Things and Industry 4.0* is written to serve a diverse readership from the domains of computer science and engineering mechanical engineering information technology industrial engineering electronics engineering and other related branches of engineering Based on the lead author's massive open online courses MOOCs this book can be used as a textbook on the emerging paradigm of Industry 4.0 and IIoT as well as a reference for professionals working in sectors of IIoT The book covers the significant aspects of IIoT in detail including sensors actuators data transmission and data acquisition which form the core of IIoT Topics and concepts are presented in a comprehensive manner so that readers can develop expertise and knowledge The book helps beginners to gain a basic idea of Industry 4.0 and IIoT as the first section is an overview of IoT applications infrastructure based protocols cloud computing and fog computing The second section is designed to impart a basic knowledge of Industry 4.0 and IIoT as well as of the different phases of development in industry Delving into more advanced areas other sections in the book cover The business models and reference architecture of IIoT The technological aspects of Industry 4.0 and IIoT Predictive and prescriptive analytics applied in IIoT based implementations Applications and case studies of IIoT Key enabling technologies of IIoT To aid students and professional master IIoT and Industry 4.0 the book includes conceptual questions exercises and

learning objectives *Intelligent Manufacturing and Industry 4.0* Alka Chaudhary,Vandana Sharma,Ahmed Alkhayyat,2024-11-27 The use of intelligence in manufacturing has emerged as a fascinating subject for academics and businesses everywhere This book focuses on various manufacturing operations and services which are provided to customers to achieve greater manufacturing flexibility as well as widespread customization and improved quality with the help of advanced and smart technologies It describes cyber physical systems and the whole product life cycle along with a variety of smart sensors adaptive decision models high end materials smart devices and data analytics Intelligent Manufacturing and Industry 4 0 Impact Trends and Opportunities focuses on Intelligent Manufacturing and the design of smart devices and products that meet the demand of Industry 4 0 manufacturing and cyber physical systems along with real time data analytics for Intelligent Manufacturing The usage of advanced smart and sensing technologies in Intelligent Manufacturing for healthcare solutions is discussed as well Popular use cases and case studies related to Intelligent Manufacturing are addressed to provide a better understanding of this topic This publication is ideally designed for use by technology development practitioners academicians data scientists industry professionals researchers and students interested in uncovering the latest innovations in the field of Intelligent Manufacturing Features Presents cutting edge manufacturing technologies and information to maximise product exchanges and production Discusses the improvement in service quality product quality and production effectiveness Conveys how a manufacturing company s competitiveness can increase if it can manage the turbulence and changes in the global market Presents how intelligence production is essential in Industry 4 0 and how Industry 4 0 offers greater manufacturing flexibility as well as widespread customisation improved quality and increased productivity Covers the ways businesses handle the challenges of generating an increasing number of customised items with quick time to market and greater quality Includes popular use cases and case studies related to intelligent manufacturing to provide a better understanding of this discipline **Industry 4.0 Technologies for Education** P. Kaliraj,T. Devi,2022-12-27 The transformative digital technologies developed for Industry 4 0 are proving to be disruptive change drivers in higher education Industry 4 0 technologies are forming the basis of Education 4 0 Industry 4 0 Technologies for Education Transformative Technologies and Applications examines state of the art tools and technologies that comprise Education 4 0 Higher education professionals can turn to this book to guide curriculum development aimed at helping produce the workforce for Industry 4 0 The book discusses the tools and technologies required to make Education 4 0 a reality It covers online content creation learning management systems and tools for teaching learning and evaluating Also covered are disciplines that are being transformed by Industry 4 0 and form the core of Education 4 0 curricula These disciplines include social work finance medicine and healthcare Mobile technologies are critical components of Industry 4 0 as well as Education 4 0 The book looks at the roles of the Internet of Things IoT 5G and cloud applications in creating the Education 4 0 environment Highlights of the book include Technological innovations for virtual classrooms to empower

students Emerging technological advancements for educational institutions Online content creation tools Moodle as a teaching learning and evaluation tool Gamification in higher education A design thinking approach to developing curriculum in Education 4.0 Industry 4.0 for Service 4.0 and Research 4.0 as a framework for higher education institutions Eye tracking technology for Education 4.0 The challenges and issues of the Internet of Things IoT in teaching and learning

Innovation in PMBOK through Industrial Revolution 4.0 Muhammad Ali Musarat, Muhammad Irfan, Maria Ghufra, Wesam Salah Alaloul, 2024-04-25 In this textbook for upper undergraduate and postgraduate students Dr Ali and colleagues provide the reader with information on the effect of Industrial Revolution 4.0 on the construction industry particularly regarding PMBOK knowledge areas The authors furnish readers with an understanding of IR 4.0 and reasons for adopting it and provide an in depth insight into the impact of IR 4.0 on technology and society particularly in the construction industry Further to this they also compare traditional and IR 4.0 project manager's competencies so that readers can develop their understanding of Project Management Knowledge areas and how IR 4.0 can be used to enhance these knowledge areas The book is structured logically and sequentially to benefit even novice readers as they progress from basic to more advanced topics related to IR 4.0 and PMBOK The final main chapter of this book provides an in depth discussion of the enhancement of PMBOK knowledge areas using IR 4.0 including topics such as project integration management IR 4.0 enhancements such as digitalization and a conceptual framework for industry betterment By the end of the book readers will have the knowledge and skills to apply IR 4.0 techniques in their future careers in the construction industry This book is an invaluable resource for students of construction engineering and management at upper undergraduate and postgraduate levels and for existing industry professionals as part of their continuous professional development

Manufacturing from Industry 4.0 to Industry 5.0 Dimitris Mourtzis, 2024-06-26 Manufacturing from Industry 4.0 to Industry 5.0 Advances and Applications unfolds establishing three main pillars i it investigates the theoretical background of the current industrial practice within the framework of industry 4.0 by presenting its key definitions and backbone technologies ii it discusses the methods and state of the art developments employed in the ongoing digital transformation of companies worldwide to promote more resilient sustainable and human centric smart manufacturing and production networks and iii it outlines a strategic plan for the transition from industry 4.0 to industry 5.0 Written by an international group of expert scientists this volume offers an overview of the most recent research in the field and provides actionable insights to benefit audiences in both academia and industry Appeals to readers with its systematic and coherent approach that includes fundamental theoretical concepts as well as applied practical knowledge Includes state of the art information on disruptive smart manufacturing technologies real life case studies of their impact in business scenarios and gap analysis creating an evidence based path to recognize the opportunities and challenges originating from an industry 4.0 to industry 5.0 transition Serves as a guide to the next generation of engineers and facilitates making the next manufacturing paradigm a reality

Logistik 4.0 Inga

Pollmeier, Sonja Schade, 2022-06-29 Die Logistik bildet die zentrale Querschnittsfunktion einer modernen arbeitsteiligen Wirtschaft und sorgt im jeweiligen Unternehmen für die effiziente Organisation Durchführung und Kontrolle sämtlicher betrieblicher Güter und Informationsflüsse Entsprechend große Gestaltungsspielräume eröffnet Industrie 4.0 in diesem Funktionsbereich geht es doch um die informationstechnische Vernetzung von Menschen Maschinen und Objekten im Rahmen betrieblicher Wertschöpfungsketten die ohne logistische Begleitprozesse nicht konkurrenzfähig zu steuern sind Das geplante Werk stellt Möglichkeiten und Grenzen der Digitalisierung und Vernetzung in den einzelnen Logistik teilbereichen verständlich strukturiert zusammen

Smart Factory Marion Steven, Jan Niklas Dörseln, 2020-01-22 In einer Smart Factory koordinieren Maschinen selbstständig Fertigungsprozesse kooperieren motorisierte Serviceroboter in der Montage mit Menschen und Maschinen und erledigen fahrerlose Transportsysteme eigenständig Logistikaufträge Maschinen Werkzeuge oder Transportmittel sind dazu mit Sensoren Prozessoren und Aktoren ausgestattet durch die Informationen aufgenommen verarbeitet und darauf aufbauende Handlungen ausgelöst werden Dadurch lassen sich alle Instanzen einer Wertschöpfungskette mit Informationen versorgen was eine netzwerkbergreifende Produktionskooperation ermöglicht Dies unterstützt die Vision einer wirtschaftlich sinnvollen Herstellung der Losgröße Eins Die Beitragsautoren diskutieren den aktuellen Stand die technischen Voraussetzungen und die perspektivischen Möglichkeiten eines konsequenten bergangs von der klassischen Produktionsweise zur Smart Factory

Datenbasiertes Qualitätsmanagement Roland Jochem, 2024-12-09 Qualität neu denken Durch die Digitalisierung und Vernetzung der Produktion und die damit verbundene Zunahme von Daten kommt dem Qualitätsmanagement in Zukunft eine noch bedeutendere Rolle zu Dieses Buch zeigt wie diese Datenverfügbarkeit im Qualitätsmanagement in Vorgehensweisen Methoden und Werkzeugen intelligent genutzt werden kann um Qualitätsprozesse im Unternehmen zu gestalten und zu optimieren Dafür werden zunächst mathematisch statistische Grundlagen sowie Data Analytics und KI Methoden vorgestellt mit deren Hilfe Informationen bzw. Qualitätswissen aus den Daten erzeugt werden Danach wird dargestellt wie diese Methoden für verschiedene Bereiche des Qualitätsmanagements zum Beispiel Prozessregelung Risikomanagement oder Kundenbedürfnisse eingesetzt werden können um so schließlich eine intelligente Entscheidungsunterstützung zu bieten Beiträge aus der Praxis geben Einblick in die Umsetzung eines datenbasierten Qualitätsmanagements in der Industrie Qualitätsprozesse datenbasiert gestalten und optimieren Neues Qualitätsverständnis entwickeln und aktuelle Herausforderungen meistern Praxisorientiert und wissenschaftlich fundiert Mit vielen Beispielen aus der Praxis

Machine Learning for Sustainable Manufacturing in Industry 4.0 Raman Kumar, Sita Rani, Sehijpal Singh Khangura, 2023-11-03 The book focuses on the recent developments in the areas of error reduction resource optimization and revenue growth in sustainable manufacturing using machine learning It presents the integration of smart technologies such as machine learning in the field of Industry 4.0 for better quality products and efficient manufacturing methods Focuses on machine learning applications in Industry 4.0 ecosystem such as resource optimization data analysis and predictions

Highlights the importance of the explainable machine learning model in the manufacturing processes Presents the integration of machine learning and big data analytics from an industry 4.0 perspective Discusses advanced computational techniques for sustainable manufacturing Examines environmental impacts of operations and supply chain from an industry 4.0 perspective This book provides scientific and technological insight into sustainable manufacturing by covering a wide range of machine learning applications fault detection cyber attack prediction and inventory management It further discusses resource optimization using machine learning in industry 4.0 and explainable machine learning models for industry 4.0 It will serve as an ideal reference text for senior undergraduate graduate students and academic researchers in the fields including mechanical engineering manufacturing engineering production engineering aerospace engineering and computer engineering

Digitalization of Decentralized Supply Chains During Global Crises Taghipour, Atour, 2021-06-18

During global crises apart from humanitarian concerns at the economic level supply chains around the world can be impacted These crises can cause huge uncertainties in both the supply and demand parts of supply chains On one side the demand for some products and services can be reduced On the other side manufacturers around the world are facing shortages of supplies of raw materials and parts because of interruptions in production disruptions to transportation and labor shortages In this context organizations start to re-examine their production and service systems based on digitization of operations to not only mitigate the risk but also to build a resilient supply chain while continuing to reduce costs and maximize profits The question that can be asked is how the decentralized supply chains can integrate new technologies to compete in a risky environment in global crises Digitalization of Decentralized Supply Chains During Global Crises provides new approaches of digitalization of decentralized supply chains and industries to help researchers educators consultants and practitioners deal with global crises and improve the global performance of supply chains Important topics covered include blockchain internet of things 3D technologies and Industry 4.0 technologies within the context of digital supply chains This book is important for supply chain managers manufacturers producers logistics personnel economists practitioners stakeholders researchers academicians and students

Advances in Additive Manufacturing Ravi Kant Mittal, Abid Haleem, Ajay Kumar, 2022-11-24 This edited book is a compilation of scholarly articles on the latest developments in the field of additive manufacturing discussing nature inspired and artificial intelligence aided additive manufactured processes for different materials including biomanufacturing and their applications as well as various methods to enhance the characteristics of the materials produced the efficiency of the manufacturing process itself as well as optimal ways to develop a product in minimum time The book explores the advancements in additive manufacturing from prefabrication stage to final product with real time defect detection control and process efficiency improvement covered This book will be a great resource for engineers researchers and academics involved in this revolutionary and unique field of manufacturing Discusses modeling of additive manufacturing processes by artificial intelligence Looks at the optimization of designs technologies and

material fabrication and the use of simulation in additive manufacturing Includes case studies and real world industrial problems and solutions *Big Data Analytics in Supply Chain Management* Iman Rahimi, Amir H. Gandomi, Simon James Fong, M. Ali Ülkü, 2020-12-20 In a world of soaring digitization social media financial transactions and production and logistics processes constantly produce massive data Employing analytical tools to extract insights and foresights from data improves the quality speed and reliability of solutions to highly intertwined issues faced in supply chain operations From procurement in Industry 4.0 to sustainable consumption behavior to curriculum development for data scientists this book offers a wide array of techniques and theories of Big Data Analytics applied to Supply Chain Management It offers a comprehensive overview and forms a new synthesis by bringing together seemingly divergent fields of research Intended for Engineering and Business students scholars and professionals this book is a collection of state of the art research and best practices to spur discussion about and extend the cumulant knowledge of emerging supply chain problems Current Trends on Innovability and Sustainable Innovation Anna Ujwary-Gil, Anna Florek-Paszkowska, 2025-06-01 Introduction to the Innovability Index More than the fusion of innovation and sustainability The integration of innovation and sustainability conceptualized as innovability represents a strategic construct for addressing global challenges such as climate change resource constraints and social inequality The conceptual understanding of innovability has advanced but its empirical measurement and operationalization remain underdeveloped This conceptual paper introduces the Innovability Index designed to evaluate the extent to which countries regions or organizations embed sustainability principles The index encompasses four dimensions technological innovation for sustainability environmental sustainability social inclusiveness and sustainable business practices Each dimension is assessed through a set of indicators normalized weighted and aggregated to generate a composite performance score The Innovability Index provides a structured approach for benchmarking sustainable innovation capabilities It is a practical tool for policymakers firms and researchers to align innovation ecosystems with sustainability imperatives and the Sustainable Development Goals SDGs This conceptual paper opens the thematic issue of innovability and sustainable innovation as well as addresses a gap in the literature by introducing the initial attempt to measure innovability Keywords Innovability Innovability Index sustainable development ESG sustainability sustainable innovation technological innovation environmental sustainability social inclusiveness sustainable business practices Leadership competencies for innovability Bridging theory and practice for sustainable development PURPOSE This study explores the critical leadership competencies necessary for fostering innovability the integration of innovation and sustainability within organizations particularly in education institutions HEIs and the business sector The research seeks to address the gap in understanding how these competencies are developed in HEIs and whether they effectively prepare graduates with the skills needed for the current business context Additionally the study emphasizes the need to identify robust instruments for measuring these competencies to ensure their practical application in organizational settings

METHODOLOGY A systematic literature review SLR was conducted using Scopus and Web of Science databases The study employed a rigorous selection process to identify relevant empirical studies published between 2015 and 2024 A total of 53 articles were analyzed to address three key research questions related to the characteristics of innovability leadership recommendations for developing immovability in organizations and the methodologies or instruments used to identify these competencies The analysis involved thematic synthesis and content analysis to extract insights and identify gaps in the existing literature **FINDINGS** The study identifies five key categories of leadership competencies essential for innovability including strategic leadership fostering a culture of collaboration commitment to sustainability continuous education and sensitivity to global megatrends Despite the recognition of these competencies the study reveals a significant lack of empirical research on their practical implementation and measurement The findings also highlight the need for robust tools to assess these competencies effectively Additionally the study provides several recommendations for developing innovability for their integration into the business sector emphasizing the importance of leadership development programs the integration of sustainability into corporate strategy and the promotion of a collaborative organizational culture **IMPLICATIONS** Theoretically the study contributes to the conceptual framework of innovability leadership by identifying critical competencies and suggesting a more integrated approach to leadership development in business education Practically the research underscores the importance of developing targeted training programs and assessment tools to cultivate these competencies in future leaders This is particularly relevant for business schools which play a crucial role in preparing students to address complex global challenges **ORIGINALITY AND VALUE** This study fills a gap in the literature by providing a detailed examination of the competencies required for innovability leadership and proposing directions for future research and practice It offers a unique contribution by bridging the theoretical and practical aspects of innovability in leadership particularly within the context of higher education **Keywords** innovability leadership competencies sustainability business education systematic literature review Sustainable Development Goals SDGs leadership development educational innovation higher education Integrating science technology and experimental knowledge for sustainable innovation A Living Lab approach to urban biodiversity management **PURPOSE** This study aims to enhance understanding of STI Science Technology Innovation and DUI Doing Using Interacting integration dynamics in sustainable innovation specifically investigating its role in innovation outcomes stakeholder engagement and the institutionalization of sustainable practices in urban lawn management **METHODOLOGY** Using a single case study design the study captures real time dynamic interactions between STI and DUI practices observing ongoing processes Data were collected through five focus group interviews with 32 stakeholders individual interviews project documentation and a project diary Stakeholders included public sector officials NGOs private garden owners and business representatives each offering insights into policy environmental practices and market driven solutions The Living Lab methodology emphasizing co creation and iterative feedback guided both data

collection and analysis with NVivo software and manual coding used to identify key themes and challenges in integrating STI and DUI for sustainable innovation

FINDINGS The investigation revealed that integrating STI and DUI modes fosters a dynamic synergy STI provided scientific rigor while DUI leveraged stakeholder input and local contexts to co develop adaptive urban biodiversity solutions This approach addressed location specific challenges balancing ecological goals with practical feasibility For instance stakeholder engagement refined scientific recommendations ensuring broader applicability and adoption Despite tensions between rigor and practicality the participatory Living Lab methodology facilitated co creation aligning scientific insights with real world needs to enhance sustainable lawn care practices

IMPLICATIONS The study contributes to innovation theory by showing how integrating STI and DUI modes fosters socially responsive adaptable solutions for urban biodiversity management From a practical standpoint it underscores the importance of stakeholder engagement in developing tools and strategies that balance scientific insights with practical real world application The project offers a replicable model for integrating formal research with user driven innovation in sustainability projects

ORIGINALITY AND VALUE This paper provides a unique contribution by showcasing how the integration of formal scientific research STI with practical user centered approaches DUI can foster innovability The use of the Living Lab methodology to co create urban biodiversity solutions bridges the gap between academic research and practical application offering a novel framework for addressing complex environmental challenges through collaborative innovation

Keywords sustainable innovation Science Technology Innovation STI Doing Using Interacting DUI urban biodiversity lawn management Living Lab stakeholder engagement participatory innovation co creation climate change adaptation The role of green blue ocean strategy in enhancing frugal innovation through IoT and AI A resource based view perspective

PURPOSE This study explores the role of Green Blue Ocean Strategy GBOS in promoting frugal innovation by leveraging IoT and AI from an RBV theoretical perspective targeting creative entrepreneurs in Central Java Indonesia

METHODOLOGY A quantitative approach was used with Structural Equation Modelling SEM analyzed via AMOS Data from 262 creative entrepreneurs were collected through an online closed questionnaire using purposive sampling

FINDINGS The study reveals that 1 IoT does not significantly impact frugal innovation 2 AI positively influences frugal innovation and 3 GBOS effectively mediates the relationship between IoT AI and frugal innovation suggesting that integrating sustainable strategies with technology can lead to more cost effective and inclusive innovations

IMPLICATIONS for theory and practice The study extends the RBV framework by integrating the GBOS concept demonstrating its effectiveness in optimizing digital technology for sustainability driven innovation It contributes to the literature on sustainability strategies and the Resource Based View by introducing a novel theoretical model that links GBOS IoT and AI with frugal innovation Practically GBOS offers a pathway for creative entrepreneurs to overcome resource constraints and achieve competitive advantages through sustainable practices

ORIGINALITY AND VALUE This study introduces Green Blue Ocean Strategy GBOS as a novel conceptual

framework that extends the traditional Blue Ocean Strategy BOS by integrating sustainability principles GBOS addresses both economic and environmental concerns enabling businesses to achieve cost effective innovation Grounded in the Resource Based View RBV this study systematically develops and empirically tests GBOS by linking it with IoT AI and frugal innovation The framework offers a new lens for sustainable competitive advantage in resource constrained environments

Keywords internet of things artificial intelligence green blue ocean strategy frugal innovation resource based view sustainability sustainable strategy digital technology sustainability driven innovation sustainable innovation The impact of eco innovation on circular economy in EU countries How patents affect circular material use rate

PURPOSE The main objective of this study is to examine how eco innovation activities measured by the number of patents related to recycling and secondary raw materials affect the level of use of circular materials in economic processes in European Union countries Simultaneously to take into account the impact of the other drivers of the circular economy the study includes control variables such as GDP per capita share of income from environmental taxes age structure of the population and level of education of the population

METHODOLOGY This study uses a generalized linear model for panel data For all analyzed explanatory variables greater inter group variation than intra group variation was observed so a panel averaged effects estimator was used The study sample includes 28 European Union EU countries The time scope of this study is 2010 2019 Eurostat database was the source of the unbalanced panel data This study seeks answers to the following research question What is the impact of patents related to waste management and recycling on the circularity rate of the EU economies

FINDINGS The results indicate that leaders in the area of circularity are the Netherlands France and Belgium Ireland Romania and Portugal occupy last place in terms of the circularity of the economy There is considerable variation in the number of patent applications related to waste management and recycling in the EU countries Luxembourg Finland Belgium and the Netherlands have the highest propensity for patents In contrast Bulgaria Greece and Croatia show the lowest patent activity Finally the higher the propensity to patent in waste management and recycling technologies the higher the rate of circular use of materials

IMPLICATIONS The results provide a compelling rationale for prioritizing and incentivizing investments in promising technologies to achieve both environmental sustainability and economic prosperity in the long term

ORIGINALITY AND VALUE Our study sheds new light on the link between eco innovation and circular economy in EU countries We address the issue of possible nonlinearities between circularity and its drivers Given the fractional nature of the response variable i e circular material use rate we apply the generalized estimating equations GEE approach to model both the mean structure and association structure of fractional responses

Keywords circular economy CE circularity eco innovation patent circular material use CE driver EU countries generalized estimating equations recycling technologies waste management Unitary Patent System and innovation dynamics in the European Union The role of economic resources and R D investments

PURPOSE The EU supports competitiveness and sustainability via innovations by the patent protection

of inventions On 1st June 2023 the EU launched the Unitary Patent System UPS with the Unitary Patent as a universal innovation protection tool The data regarding its first 20 months of operations offers indices about innovation and patenting trends

METHODOLOGY The contextual exploration of the UPS was projected into four aims addressing the absolute and relative numbers of Unitary Patents A1 and the relationship between Unitary Patents and GDP per capita A2 and GERD A3 and comparatively juxtaposing them A4 This deeper contextual understanding of Unitary Patenting dynamic entails EU member states and their top four competitors China Japan South Korea USA The data regarding the GDP GDP per capita GERD number of Unitary Patents in total and per millions of inhabitants was collected and visualized via tables and charts and submitted to a critical comparison

FINDINGS The first 20 months of the UPS operations suggests that the Unitary Patent is a viable but not the most popular patenting option and that there is a positive impact on the GDP per capita and GERD for the majority of the EU member states and that there are differences between EU member states in their efficiency to generate Unitary Patents

IMPLICATIONS The performed study confirms the parallel co existence of various patenting strategies and the importance of investments in patented inventions However the size of GDP per capita followed by GERD is a mere pre requirement that leads to diversified efficiency even among similar jurisdictions with at least an average GDP per capita and GERD Arguably the UPS magnifies the differences and the six original European integration jurisdictions are not the best UPS players There are indices about positive trends for Northern EU member states and negative trends for Southern EU member states

ORIGINALITY AND VALUE This is a pioneering contribution regarding a newly launched system showing that despite the same regime EU member states differ dramatically in their approach to patenting and that the level of GDP per capita and GERD are just the starting points

Keywords Unitary Patent System EU member states GDP gross domestic expenditure on research and development GERD GERD per GDP GERD Index innovation sustainability economic resources patent protection The Digital Sustainability Ecosystem A conceptual framework for digital transformation and sustainable innovation

PURPOSE This study introduces the Digital Sustainability Ecosystem a conceptual framework to integrate digital transformation and sustainable innovation It examines how emerging digital technologies including artificial intelligence blockchain and the Internet of Things drive sustainability transitions by serving as strategic enablers Addressing a critical gap in the literature this research focuses on the dynamic mechanisms and synergies that connect digital transformation with sustainable innovation within a complex ecosystem

METHODOLOGY The study employs a systematic literature review SLR of 50 studies and a comparative analysis of 13 existing frameworks to identify and analyze key mechanisms that link digital transformation and sustainable innovation culminating in the development of the Digital Sustainability Ecosystem framework

FINDINGS The study identifies five interconnected mechanisms efficiency gains dematerialization circular economy enablement innovation acceleration and digital collaboration These mechanisms illustrate the relationships between technological advancements and sustainability objectives while addressing synergies and tensions

such as the trade offs between energy demands and environmental benefits The Digital Sustainability Ecosystem emphasizes multi stakeholder collaboration iterative feedback loops and adaptable processes to address gaps in existing models positioning digital transformation as a transformative force for systemic sustainability improvements IMPLICATIONS The Digital Sustainability Ecosystem advances theoretical discourse by positioning sustainability as a systemic outcome of digital transformation extending beyond traditional efficiency focused models It emphasizes organizational resilience and stakeholder collaboration as pivotal for achieving sustainability objectives Practitioners can leverage AI IoT and blockchain to enhance resource optimization and foster sustainability driven innovation ecosystems Policymakers and organizations are encouraged to combine digital strategies with sustainability imperatives emphasizing adaptive leadership regulatory alignment and multi stakeholder engagement ORIGINALITY AND VALUE This study presents a conceptual framework that bridges theoretical and practical gaps in the literature by integrating foundational theories that associate digital transformation with sustainability imperatives while fostering innovation and competitive advantage The framework sets the stage for future research emphasizing potential applications in industry specific contexts cross sectoral collaborations and the evolving role of emerging technologies in sustainability transitions By incorporating dynamic feedback loops and systemic adaptability this framework establishes a foundation for advancing both academic inquiry and practical implementation It offers guidance for exploring unanswered questions about scalability policy integration and multi stakeholder engagement in the digital age

Keywords digital transformation sustainable innovation digital sustainability ecosystem sustainability transitions artificial intelligence blockchain Internet of Things circular economy efficiency gains dematerialization acceleration digital collaboration stakeholders

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