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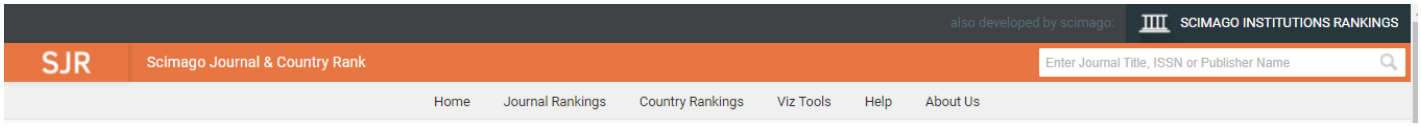

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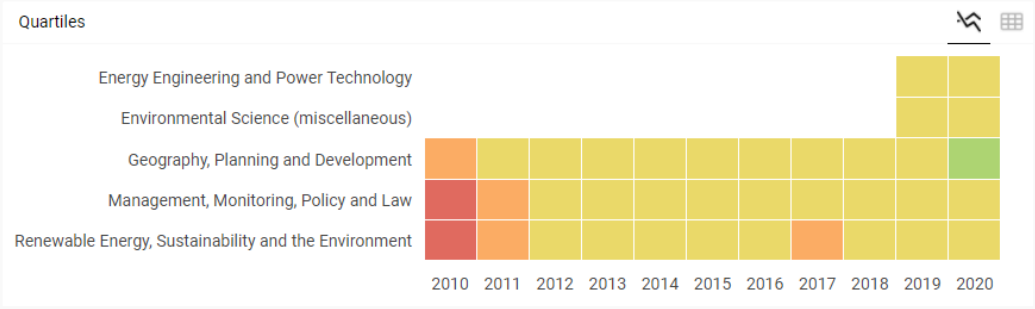

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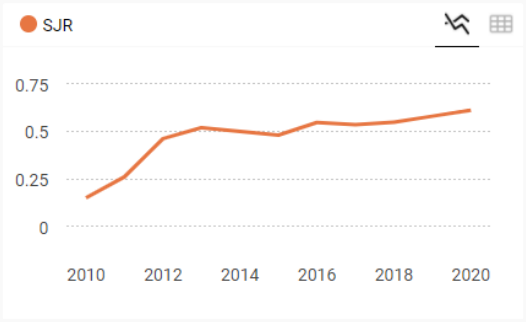

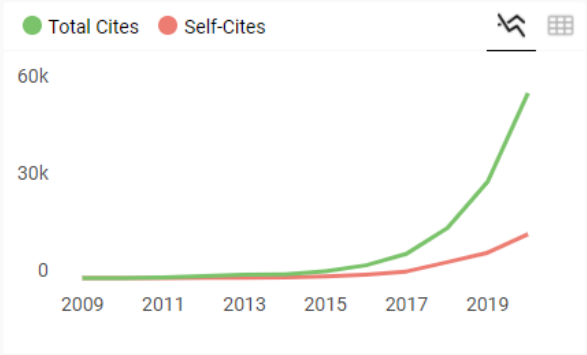

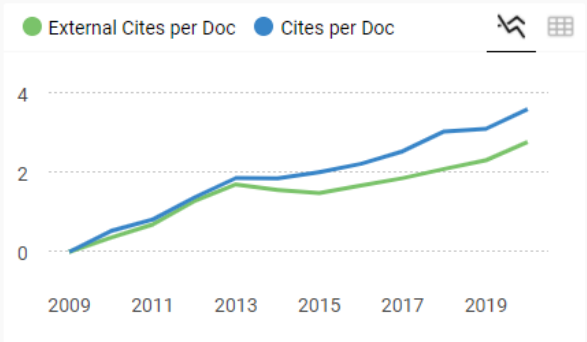

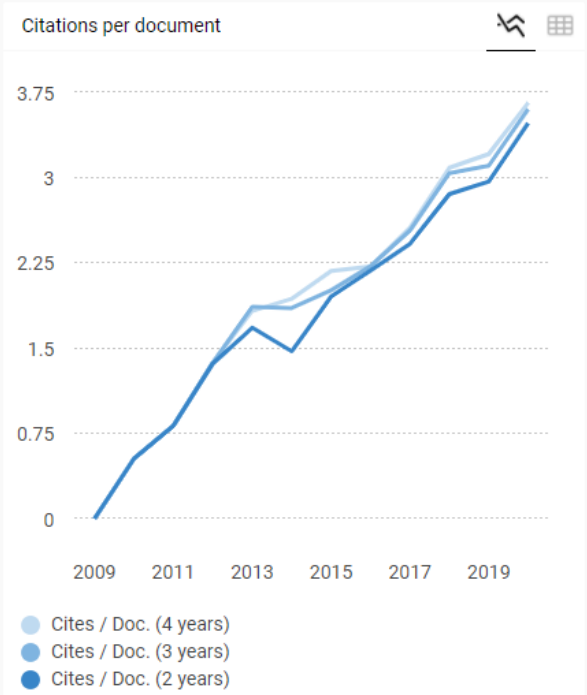

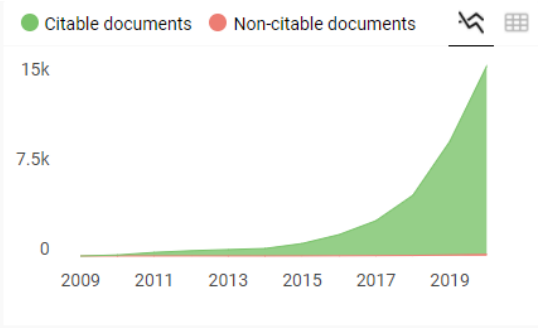

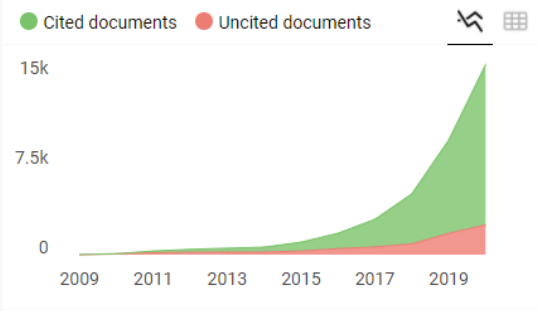

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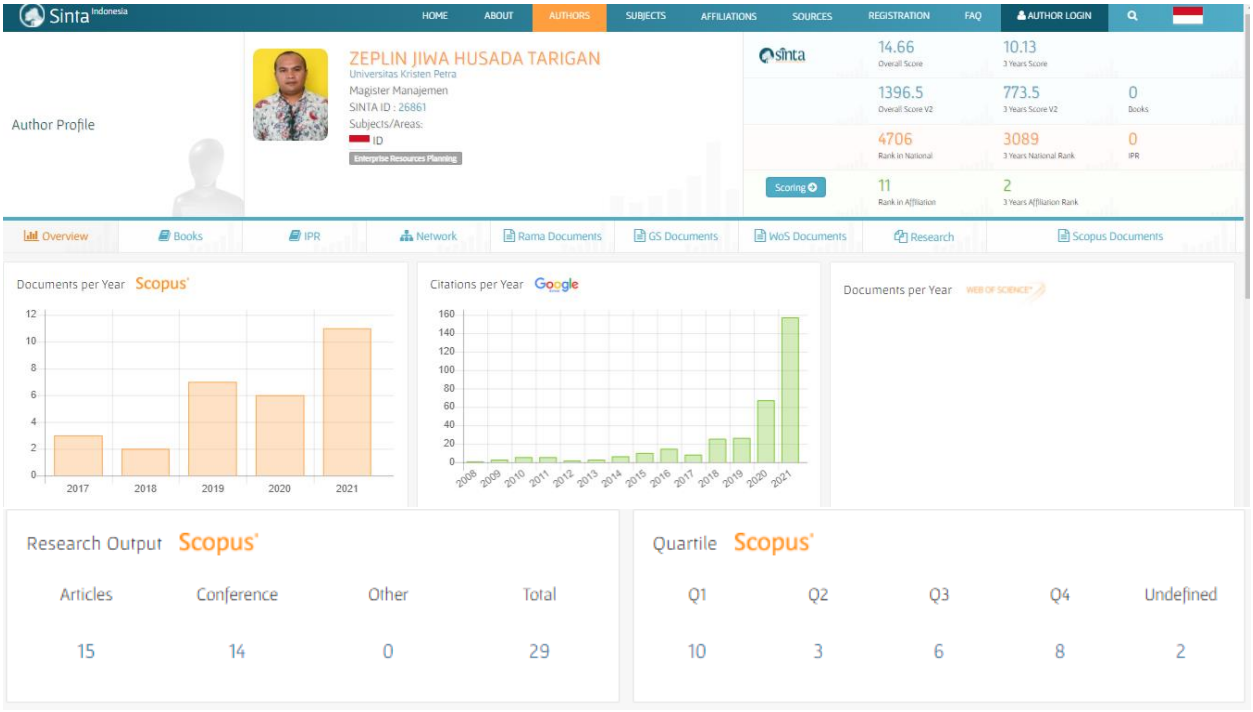
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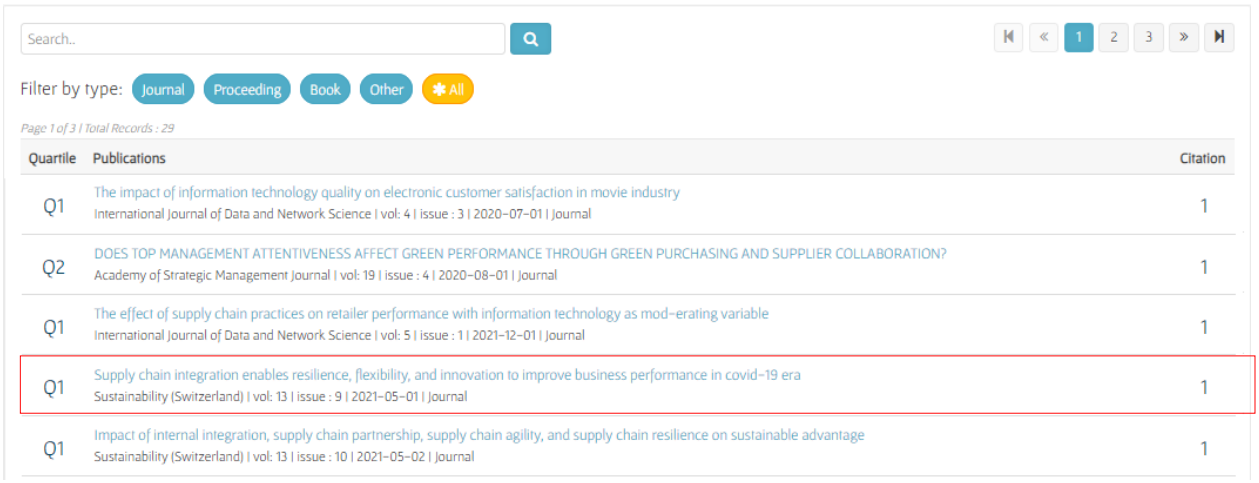
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Sustainability, Volume 13, Issue 9 (May-1 2021) – 731 articles

Cover Story (view full-size image): Existing research suggests that regions can develop their long-term competitive advantage through well-functioning innovation-driven interregional cooperation. In this article, we examine regional innovation approaches in neighbouring Dutch and German regions. Our focus is on the role of academic institutions and innovation brokers in supporting innovation in agri-food SMEs and in facilitating the establishment of a cross-border innovation space. We conclude that regional differences in knowledge infrastructures, economic structures, institutional set-ups, visions and identities can be seen as complementary strengths and should be used by regional innovation actors more strategically, thereby leading to hybridisation effects. Our findings are highly relevant for the further development of the Interreg Europe programme and the implementation of the EU's Territorial Agenda 2030. View this [...] Read more.

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Special Issues and Collections in MDPI journals
Special Issue in *Sensors*: Smart Wireless Acoustic Sensor Network Design for Noise Monitoring in Smart Cities
Special Issue in *Sensors*: Sound Monitoring Acoustic Sensor Network Design for Urban and Suburban Environments
Special Issue in *International Journal of Environmental Research and Public Health*: Crowd-Sourced Data and Distributed Sensor Networks for Environmental Acoustics Assessments in Urban and Suburban Contexts
Special Issue in *Sensors*: Acoustic Sensing Systems and Their Applications in Smart Environments

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Special Issue in *Sustainability*: Sustainability in Social Marketing and Management
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Interests: consumer behaviour; behavioural economics; economic psychology
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Beliefs about Climate Change and Their Relationship with Environmental Beliefs and Sustainable Behavior: A View from Rural Communities

by Willian Sierra-Barón, Oscar Navarro, Diana Katherine Amézquita Naranjo, Eylyn Daniela Teres Sierra and Carol Marcela Narváez González
Sustainability **2021**, *13*(9), 5326; **https://doi.org/10.3390/su13095326** - 10 May 2021
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Abstract The study of beliefs and environmental behavior is of special interest, given the implications of climate change as a social phenomenon and the disagreements about what is socially believed about this phenomenon. This research was aimed at determining the associations between environmental beliefs [...] Read more.
(This article belongs to the Special Issue Sustainable Environmental Beliefs)

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Smart Water Grid Research Group Project: An Introduction to the Smart Water Grid Living-Lab Demonstrative Operation in YeongJong Island, Korea

by Kang-Min Koo, Kuk-Heon Han, Kyung-Soo Jun, Gyumin Lee and Kyung-Taek Yum
Sustainability **2021**, *13*(9), 5325; **https://doi.org/10.3390/su13095325** - 10 May 2021
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Abstract In South Korea, in line with the increasing need for a reliable water supply following the continuous increase in water demand, the Smart Water Grid Research Group (SWGRG) was officially launched in 2012. With the vision of providing water welfare at a national [...] Read more.

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Explanatory Analysis of Factors Influencing the Support for Sustainable Food Production and Distribution Systems: Results from a Rural Canadian Community

by Sahand Ashtab and Robert Campbell

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Abstract Investigating the viability of alternative food networks (AFNs) is more important than before because of the disruptions in global supply chains and evolving resident composition in different regions. In this regard, this paper reports on findings of a project aimed at identifying factors [...] Read more.

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Automatic Detection of Photovoltaic Farms Using Satellite Imagery and Convolutional Neural Networks

by Konstantinos Ioannou and Dimitrios Myronidis

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Abstract The number of solar photovoltaic (PV) arrays in Greece has increased rapidly during the recent years. As a result, there is an increasing need for high quality updated information regarding the status of PV farms. This information includes the number of PV farms, [...] Read more.

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Life Cycle Assessment (LCA) of an Innovative Compact Hybrid Electrical-Thermal Storage System for Residential Buildings in Mediterranean Climate

by Gabriel Zsembinszki, Noelia Llantoy, Valeria Palomba, Andrea Frazzica, Mattia Dallapiccola, Federico Trentin and Luisa F. Cabeza

Sustainability **2021**, *13*(9), 5322; **https://doi.org/10.3390/su13095322** - 10 May 2021

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Abstract The buildings sector is one of the least sustainable activities in the world, accounting for around 40% of the total global energy demand. With the aim to reduce the environmental impact of this sector, the use of renewable energy sources coupled with energy [...] Read more.

(This article belongs to the Special Issue Life-Cycle Assessment of Energy Storage in Building Applications)

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Building Teacher Identity in Environmental and Sustainability Education: The Perspectives of Preservice Secondary School Geography Teachers

by Elizabeth A. C. Rushton

Sustainability **2021**, *13*(9), 5321; **https://doi.org/10.3390/su13095321** - 10 May 2021

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Abstract Geography teachers have an important role within environmental education and, in England, are developing their professional identities at a time when environmental education is contested. This study considers the experiences of five trainee secondary school geography teachers who are all part of a [...] Read more.

(This article belongs to the Special Issue Developing (Transformative) Environmental and Sustainability Education in Classroom Practice)

The Impact of COVID-19 on Highway Traffic and Management: The Case Study of an Operator Perspective

by Carlos Oliveira Cruz and Joaquim Miranda Sarmento
Sustainability **2021**, *13*(9), 5320; **https://doi.org/10.3390/su13095320** - 10 May 2021
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Abstract The COVID-19 pandemic created an enormous disruption to the everyday life of the modern society. Among the various urban systems, transportation services were among those that suffered the most significant impacts, particularly severe in the case of highways. This paper addresses the challenges [...] Read more.
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Photogrammetry as a New Scientific Tool in Archaeology: Worldwide Research Trends

by Carmen Marín-Buzón, Antonio Pérez-Romero, José Luis López-Castro, Imed Ben Jerbania and Francisco Manzano-Agugliaro
Sustainability **2021**, *13*(9), 5319; **https://doi.org/10.3390/su13095319** - 10 May 2021
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Abstract Archaeology has made significant advances in the last 20 years. This can be seen by the remarkable increase in specialised literature on all archaeology-related disciplines. These advances have made it a science with links to many other sciences, both in the field of [...] Read more.
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Spatial and Temporal Measurement of the Interaction between the County Economy and Rural Transformation in Xinjiang, China

by Bo Tan, Hongwei Wang, Chen Ma, Xiaoqin Wang and Jing Zhou
Sustainability **2021**, *13*(9), 5318; **https://doi.org/10.3390/su13095318** - 10 May 2021
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Abstract Given the background of urbanization and rural revitalization in the new era, it is important to explore the synergy between regional macroeconomics and rural transformation, as a balanced and coordinated urban–rural relationship must be built to promote regional sustainable development and rural revitalization. [...] Read more.
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by Sonja Simić, Jovana Petrović, Dušan Rakić, Biljana Pajin, Ivana Lončarević, Antun Jozinović, Aleksandar Fišteš, Sanja Nikolić, Marijana Blažić and Borislav Miličević
Sustainability **2021**, *13*(9), 5317; **https://doi.org/10.3390/su13095317** - 10 May 2021
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Abstract Sugar beet pulp (SBP) is a by-product of the sugar industry in which the dietary fiber content ranges from 73% to 80%. Compared to cereal fibers mainly used in biscuit production, sugar beet fibers are gluten free and have a perfect ratio of [...] Read more.
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Digital Newspapers' Perspectives about Adolescents' Smartphone Use

by María-Carmen Ricoy and Sara Martínez-Carrera
Sustainability **2021**, *13*(9), 5316; **https://doi.org/10.3390/su13095316** - 10 May 2021
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Abstract The growth of ICTs has led to a new socialization model and a continuous dynamic flow of communication and information, wherein smartphones have become very popular with teenagers. This paper investigates what teenagers use smartphones for and the related intervention measures published in [...] Read more.
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The Relationship between HRM Strategies and Sustainable Competitive Advantage: Testing the Mediating Role of Strategic Agility

by Mohamed Battour, Maged Barahma and Mohammed Al-Awlaqi
Sustainability **2021**, *13*(9), 5315; **https://doi.org/10.3390/su13095315** - 10 May 2021
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Abstract This study aims to investigate the impact of strategic agility on the relationship between Human Resources Management (HRM) strategies and Sustainable Competitive Advantage (SCA). A total of 227 large and medium-sized manufacturing companies were surveyed and studied. Using Structural Equation Modelling (SEM), this [...] Read more.

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Seismic Behavior of Stone Pagoda Structure by Shaking Table Test

by Ho-Soo Kim, Dong-Kwan Kim, Geon-Woo Jeon, Sang-Sun Jo and Se-Hyun Kim
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Abstract In general, the stone pagoda structures with discontinuous surfaces are vulnerable to lateral forces and are severely damaged by earthquakes. After the Gyeongju earthquake in 2016 and the Pohang earthquake in 2017, numerous stone pagoda structures were damaged due to slippage, rotation, and [...] Read more.
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A Literature Review of the Impacts of Heat Stress on Human Health across Africa

by Katlego P. Ncongwane, Joel O. Botai, Venkataraman Sivakumar and Christina M. Botai
Sustainability **2021**, *13*(9), 5312; **https://doi.org/10.3390/su13095312** - 10 May 2021
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Abstract Heat stress-related illness attributed to the changing climate, particularly the more frequent extreme high temperatures, is becoming a theme of public concern, especially in the most vulnerable regions, such as the African continent. Knowledge of the existing research directions and gaps on heat [...] Read more.
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The Effectiveness of Online Education during Covid 19 Pandemic—A Comparative Analysis between the Perceptions of Academic Students and High School Students from Romania

by Gina Ionela Butnaru, Valentin Niță, Alexandru Anichiti and Geanina Brînză

Sustainability **2021**, *13*(9), 5311; **https://doi.org/10.3390/su13095311** - 10 May 2021

Abstract The COVID-19 pandemic has disrupted normal activities such as going to school, moving education online. Based on data gathered through a survey (N = 784), this paper analyses students' perceptions regarding the effectiveness of online education in a period when this type of [...] Read more.

(This article belongs to the Special Issue Training, Education and Research in COVID-19 Times: Innovative Methodological Approaches, Best Practices, and Case Studies)

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COVID-19: An Outcome of Biodiversity Loss or a Conspiracy? Investigating the Attitudes of Environmental Students

by Georgios Tsantopoulos, Aristotelis C. Papageorgiou and Evangelia Karasmanaki
Sustainability **2021**, *13*(9), 5307; **https://doi.org/10.3390/su13095307** - 10 May 2021
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Abstract The global environment is being constantly degraded, placing humans at increased risk for outbreaks of infectious diseases. In this regard, environmental quality must be enhanced in order to prevent pandemics in the future. However, it is unknown whether future environmental experts are aware [...] Read more.
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Nature Ideas Exchange: Education of Sustainable Business Principles Based on Parallels with Forest Ecosystem

by Karolina Macháčková, Jiří Zelený, Dana Kolářová and Zbyněk Vinš
Sustainability **2021**, *13*(9), 5306; **https://doi.org/10.3390/su13095306** - 10 May 2021
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Abstract Arne Næss considered nature the best source of knowledge and regarded the economists as morally responsible for the ecological crisis. Therefore, this research focused on students of economic fields at the university level. The experimental group (*n* = 236) led by a [...] Read more.
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The Severity of COVID-19 and Its Determinants: A Systematic Review and Meta-Analysis in China

by Ning Zhang, Tao Xie, Wei Ning, Rongxin He, Bin Zhu and Ying Mao
Sustainability **2021**, *13*(9), 5305; **https://doi.org/10.3390/su13095305** - 10 May 2021
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Abstract To analyse the prevalence of severe and critical COVID-19 cases and its determinants, a systematic review and meta-analysis were conducted using Review Manager. Four English and two Chinese databases were used to identify and explore the relationships between the severity of COVID-19 and [...] Read more.
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Development of Model to Predict Natural Disaster-Induced Financial Losses for Construction Projects Using Deep Learning Techniques

by Ji-Myong Kim, Junseo Bae, Seunghyun Son, Kiyoung Son and Sang-Guk Yum
Sustainability **2021**, *13*(9), 5304; **https://doi.org/10.3390/su13095304** - 10 May 2021
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Abstract This study goals to develop a model for predicting financial loss at construction sites using a deep learning algorithm to reduce and prevent the risk of financial loss at construction sites. Lately, as the construction of high-rise buildings and complex buildings increases and [...] Read more.

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Transport Airships for Scheduled Supply and Emergency Response in the Arctic

by Barry E. Prentice, Yui-Yip Lau and Adolf K. Y. Ng
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Abstract As climate change progresses, the Arctic Ocean creates opportunities for new resource development and navigation routes. Such economic opportunities are attractive, but carry with them an increased risk of accidents and oil spills. Existing methods of emergency response face enormous challenges in the [...] Read more.
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Application of Data Validation and Reconciliation to Improve Measurement Results in the Determination Process of Emission Characteristics in Co-Combustion of Sewage Sludge with Coal

by Michał Kozioł and Joachim Kozioł
Sustainability **2021**, *13*(9), 5300; **https://doi.org/10.3390/su13095300** - 10 May 2021
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Abstract One of the actions popularized worldwide to reduce the consumption of fossil fuels is the combustion of renewable fuels and the co-combustion of both of these fuels. To properly implement combustion and co-combustion processes in power-generation installations, operational characteristics, including emission characteristics are [...] Read more.
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Recognizing the Key Drivers and Industry Implications of Sustainable Packaging Design: A Mixed-Method Approach

by Giovanni Mattia, Alessio Di Leo and Carlo Alberto Pratesi
Sustainability **2021**, *13*(9), 5299; **https://doi.org/10.3390/su13095299** - 10 May 2021
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Abstract Sustainable packaging design plays a strategic role across several industries. Using the Italian market as the perimeter of the analysis, this paper aims to broaden the knowledge of corporate attitudes, perceptions, and behaviors toward sustainable packaging along the entire supply chain. A mixed-method [...] Read more.
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Women Entrepreneurship and Sustainable Business Development: Key Findings from a SWOT–AHP Analysis

by Daniel Stefan, Valentina Vasile, Anca Oltean, Calin-Adrian Comes, Anamari-Beatrice Stefan, Liviu Ciucan-Rusu, Elena Bunduchi, Maria-Alexandra Popa and Mihai Timus
Sustainability **2021**, *13*(9), 5298; **https://doi.org/10.3390/su13095298** - 10 May 2021
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Abstract This study highlights the perception of women entrepreneurs in Romania regarding specific drivers for a sustainable business model. This study uses a SWOT–AHP method to assess the importance of different factors that enforce or create barriers for the success in women entrepreneurial activities. [...] Read more.
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Job Adjustment Strategy for Predictive Maintenance in Semi-Fully Flexible Systems Based on Machine Health Status

by Thirupathi Samala, Vijaya Kumar Manupati, Bethalam Brahma Sai Nikhilesh, Maria Leonilde Rocha Varela and Goran Putnik

Sustainability **2021**, *13*(9), 5295; **https://doi.org/10.3390/su13095295** - 10 May 2021

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Abstract Complex systems consist of multiple machines that are designed with a certain extent of redundancy to control any unanticipated events. The productivity of complex systems is highly affected by unexpected simultaneous machine failures due to overrunning of machines, improper maintenance, and natural characteristics. [...] Read more.

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Food Security and COVID-19: A Systematic Review of the First-Year Experience

by Boglárka Anna Éliás and Attila Jámbor

Sustainability **2021**, *13*(9), 5294; **https://doi.org/10.3390/su13095294** - 10 May 2021

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Abstract For decades, global food security has not been able to address the structural problem of economic access to food, resulting in a recent increase in the number of undernourished people from 2014. In addition, the FAO estimates that the number of undernourished people [...] Read more.

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Exploring Methods of the Sustainable Development for Safety Engineering International Course

by Wei Jiang, Jiankai Zhou, Yangping Gao and Yintong Wang

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Abstract To improve the effectiveness of the international course for safety engineering at China University of Mining & Technology (Beijing) (CUMTB), we explored sustainable development methods, co-occurrence analysis, statistical analysis, and questionnaire survey methods in a discussion of the international course's current state and [...] Read more.

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The Role of Corporate Ethical Management on Trade Relationship Trust and Commitment: B2B

by Shiruo Fei, Chanho Kwon and Changhyun Jin

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Abstract This study investigated whether three components of ethical management—awareness, operation, and practice—have a positive effect on corporate trust and relationship commitment in business-to-business (B2B) transactions. The study examined whether the trust formed in transactions, or relationship commitment, affects the establishment of long-term oriented [...] Read more.

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The Influence of R&D in Mining on Sustainable Development in China

by Jianguo Du, Francis Tang Dabuo, Beverlley Madzikanda and Kofi Baah Boamah
Sustainability **2021**, *13*(9), 5289; **https://doi.org/10.3390/su13095289** - 09 May 2021
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Abstract Mining and the utilization of mineral resources, especially coal for energy consumption, are considered a major contributor to China's total index of environmental pollution, but there is less focus on its sustainable development. This study focused on the influence of research and development [...] Read more.

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Circular Economy at the Firm Level: A New Tool for Assessing Maturity and Circularity

by Pasqualina Sacco, Christian Vinante, Yuri Borgianni and Guido Orzes
Sustainability **2021**, *13*(9), 5288; **https://doi.org/10.3390/su13095288** - 09 May 2021
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Abstract Although the circular economy (CE) concept is gaining traction and methods to assess companies' CE-related aspects exist, there is no established CE assessment tool. In many cases, it is not clear how metrics or indicators included in extant CE assessment methods have been [...] Read more.
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Men's and Women's Style of Living and Motivation to Run in Charity Events

by Joanna Poczta, Nuno Almeida, Mateusz Rozmiarek, Maciej Młodzik and Ewa Malchrowicz-Mośko
Sustainability **2021**, *13*(9), 5287; **https://doi.org/10.3390/su13095287** - 09 May 2021
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Abstract Running has been very popular for years, especially in organized mass runs. Various running events take place all over the world, at different distances and locations, including charity running events. However, there has not been any research on the social impact of these [...] Read more.
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Open Access Editorial

Sustainable Geotechnics—Theory, Practice, and Applications

by Slobodan B. Mickovski
Sustainability **2021**, *13*(9), 5286; **https://doi.org/10.3390/su13095286** - 09 May 2021
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Abstract Today, modern Geotechnical Engineers, who in the past would have considered the phenomena occurring in the (primarily soil) environment, are faced with developments in environmental sciences that are becoming more and more detailed and sophisticated, with the natural phenomena and processes surrounding the [...] Read more.
(This article belongs to the Special Issue Sustainable Geotechnics—Theory, Practice, and Applications)

The Effect of Water Rights Trading Policy on Water Resource Utilization Efficiency: Evidence from a Quasi-Natural Experiment in China

by Shaojian Chen, Yuanyuan Cao and Jun Li
Sustainability **2021**, *13*(9), 5281; **https://doi.org/10.3390/su13095281** - 09 May 2021
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Abstract Water shortage has become a serious problem in the world, and low water efficiency is the key to industrial and agricultural production and sustainable economic development. Based on the data of 30 provinces (municipalities) in China from 2010 to 2017, this study builds [...] Read more.
(This article belongs to the Section Resources and Sustainable Utilization)

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Toward Sustainable Environmental Management of Healthcare Waste: A Holistic Perspective

by Nouf Sahal Alharbi, Jawaher Haji Alhaji and Malak Yahia Qattan
Sustainability **2021**, *13*(9), 5280; **https://doi.org/10.3390/su13095280** - 09 May 2021
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Abstract The management of healthcare waste requires a sustained and holistic approach involving a range of parties. This is challenging for governments, especially in developing countries, where waste management systems have limited capacities for addressing the issue. Using Saudi Arabia as a case study, [...] Read more.
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Amalgamation of Customer Relationship Management and Data Analytics in Different Business Sectors—A Systematic Literature Review

by Lewlisa Saha, Hrudaya Kumar Tripathy, Soumya Ranjan Nayak, Akash Kumar Bhoi and Paolo Barsocchi
Sustainability **2021**, *13*(9), 5279; **https://doi.org/10.3390/su13095279** - 09 May 2021
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Abstract Customization of products or services is a strategy that the business sector has embraced to build a better relationship with the customers to cater to their individual needs and thus providing them a fulfilling experience. This whole process is known as customer relationship [...] Read more.
(This article belongs to the Special Issue Sustainable Customer Relationship Management)

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Socio-Economic Drivers of Fish Species Consumption Preferences in Kenya's Urban Informal Food System

by Oscar Ingasia Ayuya, Katrine Soma and Benson Obwanga
Sustainability **2021**, *13*(9), 5278; **https://doi.org/10.3390/su13095278** - 08 May 2021
Cited by 1 | Viewed by 619

Abstract In an effort to contribute to resilient food and nutritional security in urban slums, a food system approach was applied to understand the key socio-economic factors driving fish species consumption in Kibera, the largest informal settlement in Africa located in Nairobi, Kenya. Data [...] Read more.
(This article belongs to the Special Issue Development of Resilient Urban Food Systems—Exploring Synergies and Making Priorities)

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Impacts of Green Innovation, Institutional Constraints and Their Interactions on High-Quality Economic Development across China

by Chenggang Li, Jun Wan, Zhenci Xu and Tao Lin
Sustainability **2021**, *13*(9), 5277; **https://doi.org/10.3390/su13095277** - 08 May 2021
Cited by 1 | Viewed by 644

Abstract In 2015, China put forward five development concepts, propounded the concept of green development and green innovation, and adhered to the road of sustainable development. China also promoted the vision of high-quality economic development in 2017. It is very important to study the [...] Read more.

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Uptake Prediction of Eight Potentially Toxic Elements by *Pistia stratiotes* L. Grown in the Al-Sero Drain (South Nile Delta, Egypt): A Biomonitoring Approach

by Ebrahem M. Eid, Mohammed A. Dakhil, Loutfy M. Hassan, Shaimaa G. Salama and Tarek M. Galal
Sustainability **2021**, *13*(9), 5276; **https://doi.org/10.3390/su13095276** - 08 May 2021
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Abstract The potential to utilise the free-floating macrophyte *Pistia stratiotes* L. to survey contamination of the Al-Sero Drain in the South Nile Delta, Egypt, by eight potentially toxic elements (PTEs) was investigated in this study. This study considered the absorption of eight PTEs (Cd, [...] Read more.
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Critical Dimensions of Blockchain Technology Implementation in the Healthcare Industry: An Integrated Systems Management Approach

by Satyabrata Aich, Sushanta Tripathy, Moon-Il Joo and Hee-Cheol Kim
Sustainability **2021**, *13*(9), 5269; **https://doi.org/10.3390/su13095269** - 08 May 2021
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Abstract In the digital era, almost every system is connected to a digital platform to enhance efficiency. Although life is thus improved, security issues remain important, especially in the healthcare sector. The privacy and security of healthcare records is paramount; data leakage is socially [...] Read more.
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Energy Transition at Home: A Survey on the Data and Practices That Lead to a Change in Household Energy Behavior

by Jacopo Gaspari, Ernesto Antonini, Lia Marchi and Vincenzo Vodola
Sustainability **2021**, *13*(9), 5268; **https://doi.org/10.3390/su13095268** - 08 May 2021
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Abstract Since energy transition depends significantly on reducing the built environment's energy needs, many regulations and incentives have been implemented globally over the last three decades. Despite some positive results, many scholars suggest that households' behavioral change could greatly accelerate progress. People's levels of [...] Read more.
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Adult Education: A Sustainable Model for the Reduction of Psychosocial and Educational Risks Caused by COVID-19

by Manuel-Jesús Perea-Rodríguez, Juan-Agustín Morón-Marchena, María-Carmen Muñoz-Díaz and David Cobos-Sanchiz

Sustainability **2021**, *13*(9), 5264; **https://doi.org/10.3390/su13095264** - 08 May 2021

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Abstract Education for health and sustainability has to be understood from a new perspective beyond the traditional conceptual limits. Thus, following the lines of the 2030 sustainable development goals, we examine how permanent education and adult education can become a fundamental element for the [...] Read more.

(This article belongs to the Special Issue Health Education and COVID-19 Pandemic: Towards a Holistic Sustainability)

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Social Controls and Bonds of Public Information Consumer on Sustainable Utilization and Provision for Computing

by Kumju Hwang and Hyemi Um

Sustainability **2021**, *13*(9), 5263; **https://doi.org/10.3390/su13095263** - 08 May 2021

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Abstract In public areas, employees are both consumers and producers in information. For sustainable usage of information, employees should be aware of information systems security (ISS). Information systems security (ISS) is critical in further developing public sector information systems, such as e-government. Most ISS [...] Read more.

(This article belongs to the Special Issue Sustainable Consumer Behavior: Emotion, Cognition, Psychology, and Attitudes)

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Green Talk or Green Walk: Chinese Consumer Positive Word-of-Mouth to Corporate Environmental Actions in Polluting Industries

by Jiajia Zhang and Jin Sun

Sustainability **2021**, *13*(9), 5259; **https://doi.org/10.3390/su13095259** - 08 May 2021

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Abstract Although environmental action is regarded as a public relations strategy aiming to manifest a corporate green stance, this not always the case. Many consumers tend to be skeptical of corporate real environmental efforts, especially firms in traditionally dirty industries. However, few studies have [...] Read more.

(This article belongs to the Special Issue Environmental Management Approaches and Tools to Boost Circular Economy)

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A Comprehensive Appraisal of the Wild Food Plants and Food System of Tribal Cultures in the Hindu Kush Mountain Range; a Way Forward for Balancing Human Nutrition and Food Security

by Abdullah Abdullah, Shujaul Mulk Khan, Andrea Pieroni, Aminul Haq, Zahoor Ul Haq, Zeeshan Ahmad, Shazia Sakhi, Abeer Hashem, Al-Bandari Fahad Al-Arjani, Abdulaziz A. Alqarawi and Elsayed Fathi Abd_Allah

Sustainability **2021**, *13*(9), 5258; **https://doi.org/10.3390/su13095258** - 08 May 2021

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Abstract The tribal belt of the Hindu Kush mountains is famous for its unique culture, ethnography, wild food plants, food systems, and traditional knowledge. People in this region gather wild plants and plant parts using them directly or in traditional cuisine, or sell them [...] Read more.

(This article belongs to the Special Issue The Multifaceted Nature of Food and Nutrition Insecurity around the World and Foodservice Business)

Modeling the Influence of Online Social Media Information on Post-Disaster Mobility Decisions

by Takahiro Yabe, P. Suresh C. Rao and Satish V. Ukkusuri
Sustainability **2021**, *13*(9), 5254; **https://doi.org/10.3390/su13095254** - 08 May 2021
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Abstract Disaster risk management, including response and recovery, are essential elements of sustainable development. With the recent increase in natural hazards, the importance of techniques to understand, model and predict the evacuation and returning behavior of affected individuals is rising. Studies have found that [...] Read more.

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The Relationship between Patents, Technology Transfer and Desorptive Capacity in Korean Universities

by Youngseong Koo and Keuntae Cho
Sustainability **2021**, *13*(9), 5253; **https://doi.org/10.3390/su13095253** - 07 May 2021
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Abstract This study sought to examine the relationship between patent rights and technology transfer performances of Korean universities and to analyze the moderating effect of the desorptive capacity of industry-academic cooperation foundations. Through this, we study the impact of universities' patents on both the [...] Read more.

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The Impact of Employees' Perceptions of CSR on Career Satisfaction: Evidence from Saudi Arabia

by Basheer M. Al-Ghazali and M. Sadiq Sohail
Sustainability **2021**, *13*(9), 5235; **https://doi.org/10.3390/su13095235** - 07 May 2021
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Abstract The purpose of this study is to examine the association between employees' CSR perceptions and their career satisfaction. Moreover, the mediating roles of organizational pride, organizational embeddedness, and psychological capital in the relationship between CSR perceptions and career satisfaction are also examined. Finally, [...] Read more.
(This article belongs to the Special Issue Impact of Eco-innovation and Sustainable Product Development on Shaping Circular Economy)

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A Framework for Assessing Commitment Indicators in Sustainable Development Decisions

by Mustafa S. Al-Tekreeti, Salwa M. Beheiry and Vian Ahmed
Sustainability **2021**, *13*(9), 5234; **https://doi.org/10.3390/su13095234** - 07 May 2021
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Abstract Numerous decision support systems have been developed to address the decision-making process in organizations. However, there are no developed mechanisms to track commitment down the line to the decisions made by corporate leaders. This paper is a portion of a study that establishes [...] Read more.
(This article belongs to the Special Issue Advances on Building Performance and Sustainability)

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Coeducation and Citizenship: A Study on Initial Teacher Training in Sexual Equality and Diversity

by Davinia Heras-Sevilla, Delfín Ortega-Sánchez and Mariano Rubia-Avi
Sustainability **2021**, *13*(9), 5233; **https://doi.org/10.3390/su13095233** - 07 May 2021
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Abstract The present study makes an exhaustive review of the conditions and challenges faced by society to transform the school into a truly inclusive, coeducational, and democratic space. It proposes a theoretical model, of a bottom-up nature, to achieve gender equality in the school [...] Read more.
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Striding towards Sustainability: A Framework to Overcome Challenges and Explore Opportunities through Industry 4.0

by José Salvador da Motta Reis, Maximilian Espuny, Thaís Vieira Nunhes, Nilo Antonio de Souza Sampaio, Raine Isaksson, Fernando Celso de Campos and Otávio José de Oliveira
Sustainability **2021**, *13*(9), 5232; **https://doi.org/10.3390/su13095232** - 07 May 2021
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Abstract Sustainability 4.0 (S4.0) enables sustainable development through intelligent technologies to meet economic, environmental and social demands. The main objective of this article is to propose a framework for developing S4.0 in sectors of Triple Helix (TH) (Government, Organizations and Academy). The framework consists [...] Read more.
(This article belongs to the Special Issue Fourth Revolution and Sustainability)

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Priming on Sustainable Design Idea Creation and Evaluation

by Ting Liao and Erin F. MacDonald
Sustainability **2021**, *13*(9), 5227; **https://doi.org/10.3390/su13095227** - 07 May 2021
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Abstract Although three pillars of sustainable design—social desirability, economic competitiveness, and environmental friendliness—are all important, they are not necessarily equally accessible or salient during the design process. This paper applies a collage priming method to activate designers' mindsets regarding sustainability pillars prior to conceptual [...] Read more.
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Changing the Perception of Business Values in the Perspective of Environmental Sustainability

by Mária Demjanovičová and Michal Varmus
Sustainability **2021**, *13*(9), 5226; **https://doi.org/10.3390/su13095226** - 07 May 2021
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Abstract This study provides an overview of practical approaches to sustainability and its communication to the public in the business sector. The research presented in this article is focused on perceived sustainability in micro and small enterprises in Slovakia through research of business models [...] Read more.
(This article belongs to the Special Issue Sustainable Marketing Management)

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Values Building in Social Work Education in Visegrad Countries: Integrated Approach

by Kateřina Glumbíková, Jelena Petrucijová, Ewa Kantowicz, Izabela Kamińska-Jaczak, Miriam Slaná, Katarína Molnárová Letovancová, Boróka Féher, Réka Vályi, Małgorzata Ciczkowska-Giedziun and Magdalena Zmysłowska

Sustainability **2021**, *13*(9), 5222; **https://doi.org/10.3390/su13095222** - 07 May 2021

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Abstract Many key aspects of social work education are not sufficiently researched, and our knowledge of how students build values in social work education, despite its importance for creating concepts about values and their application in practice, is underexplored. The research aims to evaluate [...] Read more.

(This article belongs to the Section Psychology of Sustainability and Sustainable Development)

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What's the Name of the Game? The Impact of eHealth on Productive Interactions in Chronic Care Management

by Carolina Wannheden, Ulrica von Thiele Schwarz, Claes-Göran Östenson, Karin Pukk Härenstam and Terese Stenfors

Sustainability **2021**, *13*(9), 5221; **https://doi.org/10.3390/su13095221** - 07 May 2021

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Abstract Chronic care management is dependent on productive interactions between patients and healthcare professionals. Digital health technologies (eHealth) open up new possibilities for improving the quality of care, but there is a limited understanding of what productive interactions entail. This study explores characteristics of [...] Read more.

(This article belongs to the Special Issue Digital Technology in Healthcare: Opportunities Offered by a Sustainable Relational Ecosystem)

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The Importance of Safety and Security Measures at Sharm El Sheikh Airport and Their Impact on Travel Decisions after Restarting Aviation during the COVID-19 Outbreak

by Thowayeb H. Hassan and Amany E. Salem

Sustainability **2021**, *13*(9), 5216; **https://doi.org/10.3390/su13095216** - 07 May 2021

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Abstract Travel decisions during the COVID-19 pandemic might be substantially influenced by destination-based attributes, in particular, health safety measures at airports. In the current study, we aimed to assess the effects of the perceived importance of safety measures at the Sharm El Sheikh airport [...] Read more.

(This article belongs to the Special Issue Post COVID-19: Sustainable Strategic Management and Consumer Behavior in the Hospitality/Tourism Industry)

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Double Path Optimization of Transport of Industrial Hazardous Waste Based on Green Supply Chain Management

by Ziyuan Liu, Yingzhao Wu, Tianle Liu, Xiaoxue Wang, Wenzhuo Li, Ying Yin and Xiangfei Xiao

Sustainability **2021**, *13*(9), 5215; **https://doi.org/10.3390/su13095215** - 07 May 2021

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Abstract With the deepening of the concepts of "sustainable development", green supply chain management has gradually been attached great importance by the government and enterprises. Based on the green supply chain management method, this paper studies the path optimization of industrial hazardous waste treatment [...] Read more.

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Integration of Theory of Planned Behavior, Sensation Seeking, and Risk Perception to Explain the Risky Driving Behavior of Truck Drivers

by Zhenming Li, Siu Shing Man, Alan Hoi Shou Chan and Jianfang Zhu
Sustainability **2021**, *13*(9), 5214; **https://doi.org/10.3390/su13095214** - 07 May 2021
Cited by 2 | Viewed by 527

Abstract Truck-related accidents account for a substantial portion of traffic accidents. Risky driving behavior is a main cause of traffic accidents. Understanding the risky driving behavior of truck drivers is therefore important in reducing truck-related accidents. This study aimed to propose and validate a [...] Read more.
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Developing Hospital Emergency and Disaster Management Index Using TOPSIS Method

by Mohammad Mojtahedi, Riza Yosia Sunindijo, Fatma Lestari, Suparni and Oktomi Wijaya
Sustainability **2021**, *13*(9), 5213; **https://doi.org/10.3390/su13095213** - 07 May 2021
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Abstract Indonesia is a country prone to experiencing natural hazards and disasters, which have frequently damaged public infrastructure, including hospitals. The role of hospitals is crucial to alleviate the impact of disasters. However, there is still a lack of study that analyzes the factors [...] Read more.
(This article belongs to the Special Issue Disaster Risk Reduction and Resilient Built Environment)

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Sustainable Development of Students' Learning Capabilities: The Case of University Students' Attitudes towards Teachers, Peers, and Themselves as Oral Feedback Sources in Learning English

by Xiaoming Molly Wu, Helen R. Dixon and Lawrence Jun Zhang
Sustainability **2021**, *13*(9), 5211; **https://doi.org/10.3390/su13095211** - 07 May 2021
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Abstract In order to promote the sustainable development of students' learning capabilities, students are expected to take an active role in the feedback process. Ideally, students should not only actively interpret and act on the feedback received from their teachers, but they should also [...] Read more.
(This article belongs to the Special Issue Towards Sustainable Language Learning and Teaching)

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Tourists' Motivation, Place Attachment, Satisfaction and Support Behavior for Festivals in the Migrant Region of China

by Yunyao Zhang, Keun-Soo Park and HakJun Song
Sustainability **2021**, *13*(9), 5210; **https://doi.org/10.3390/su13095210** - 07 May 2021
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Abstract This study aimed to explore the relationships among tourist motivation, place attachment, satisfaction and support behavior for hosting festivals in the migrant region of China. A self-administered questionnaire was used to conduct an on-site survey and a second-order structural equation modeling (SEM) technique [...] Read more.
(This article belongs to the Collection Intention and Tourism/Hospitality Development)

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Examining the Relationship between Income Inequality and Growth from the Perspective of EU Member States' Stage of Development

by Ionuț Jianu, Marin Dinu, Dragoș Huru and Alexandru Bodislav
Sustainability **2021**, *13*(9), 5204; **https://doi.org/10.3390/su13095204** - 06 May 2021
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Abstract In this paper, we examined the relationship between income inequality and economic growth from the perspective of each country's level of development in the European Union, this linkage being reviewed using the median of GDP per capita expressed in the purchasing power standard [...] Read more.
(This article belongs to the Special Issue Social Polarization, Inequality and Segregation)

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Fostering Cultural Sustainability in Early Childhood Education through a Neighbourhood Project

by Aihua Hu and Siv Ødemotland
Sustainability **2021**, *13*(9), 5203; **https://doi.org/10.3390/su13095203** - 06 May 2021
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Abstract Culture is the life blood of a society, which influences people's worldviews, values, and behaviours. Research has confirmed that children's participation in culture helps develop thinking skills, builds self-esteem, and improves resilience. This paper aims to explore how a purposely designed project can [...] Read more.
(This article belongs to the Special Issue Reimagining Early Childhood Education for Social Sustainability in a Future We Want)

Are There Differences and Complementarities between Senior and Young Entrepreneurs? An Intergenerational Perspective

by Adriana Perez-Encinas, Yolanda Bueno, Begoña Santos and Camila Nieto-Mejia
Sustainability **2021**, *13*(9), 5202; **https://doi.org/10.3390/su13095202** - 06 May 2021
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Abstract Social exclusion related to the unemployment of vulnerable population groups constitutes a crucial limitation to achieving a sustainable world. In particular, young and senior populations have specific characteristics that put them at risk of exclusion from the labor market. This circumstance has motivated [...] Read more.
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Modeling Energy Efficiency Performance and Cost-Benefit Analysis Achieving Net-Zero Energy Building Design: Case Studies of Three Representative Offices in Thailand

by Kittisak Lohwanitchai and Daranee Jareemit
Sustainability **2021**, *13*(9), 5201; **https://doi.org/10.3390/su13095201** - 06 May 2021
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Abstract The concept of a zero energy building is a significant sustainable strategy to reduce greenhouse gas emissions. The challenges of zero energy building (ZEB) achievement in Thailand are that the design approach to reach ZEB in office buildings is unclear and inconsistent. In [...] Read more.
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Conserving the Paraguay-Paraná Fluvial Corridor in the XXI Century: Conflicts, Threats, and Challenges

by Claudio Rafael Mariano Baigún and Priscilla Gail Minotti
Sustainability **2021**, *13*(9), 5198; **https://doi.org/10.3390/su13095198** - 06 May 2021
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Abstract The Paraguay-Paraná river system represents a unique, free-flowing corridor that extends about 3500 km southwards from the Pantanal to the Rio de la Plata estuary, crossing four countries. The absence of fragmentation along the main channels and its still well-connected floodplains have preserved [...] Read more.
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Analysis on the Influencing Factors of Farmers' Cognition on the Function of Agricultural Water Price—Taking Hexi Corridor as an Example

by Wei Qu, Jing Yan, Yanmei Tan and Qin Tu
Sustainability **2021**, *13*(9), 5197; **https://doi.org/10.3390/su13095197** - 06 May 2021
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Abstract Analyzing the farmer's behavior and the water-saving incentive mechanism is of great significance to the implementation of the explicit subsidy policy of agricultural water prices. This paper introduces the concept of loss aversion from behavioral economics and conducts a theoretical analysis of the [...] Read more.
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Attitudes, Perceptions, and On-Farm Self-Reported Practices of Shrimp Farmers' towards Adoption of Good Aquaculture Practices (GAP) in Thailand

by Chitrlada Booncharoen and Anil Kumar Anal
Sustainability **2021**, *13*(9), 5194; **https://doi.org/10.3390/su13095194** - 06 May 2021
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Abstract The purpose of this research is to evaluate the perceptions and attitudes relating to Good Aquaculture Practices (GAP) in compliance held by a subgroup of Thai GAP certified shrimp farmers based on a structured questionnaire and in-depth interviews. Different levels of farmers' experiences [...] Read more.
(This article belongs to the Section Sustainable Agriculture)

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Growing the Beautiful Anthropocene: Ethics of Care in East European Food Gardens

by Lucie Sovová, Petr Jehlička and Petr Daněk
Sustainability **2021**, *13*(9), 5193; **https://doi.org/10.3390/su13095193** - 06 May 2021
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Abstract This study contributes to research proposing the ethics of care framework as a way of imagining a food system that cares for Others. We expand this exploration to the everyday practice of home gardening and the related social relationships and material flows. This [...] Read more.
(This article belongs to the Special Issue Geographies of Responsibility for Just and Sustainable Food Systems)

Upshots of Intrinsic Traits on Social Entrepreneurship Intentions among Young Business Graduates: An Investigation through Moderated-Mediation Model

by Hameed Asghar Sana, Salem Alkhalaf, Salman Zulfiqar, Waleed Mugahed Al-Rahmi, Ahmad Samed Al-Adwan and Anas Ratib AlSoud

Sustainability **2021**, *13*(9), 5192; **https://doi.org/10.3390/su13095192** - 06 May 2021

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Abstract Social entrepreneurship has recently become a much-desired area of research for academia, practices, and policymaking. Natural or cognitive personal thoughtfulness like loving-kindness meditation (LKM) and compassion trigger individual intentions towards the social entrepreneurial venture. In this process of individual social entrepreneurial intention personality [...] Read more.

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Climate Change Impact and Variability on Cereal Productivity among Smallholder Farmers under Future Production Systems in West Africa

by Dilys S. MacCarthy, Myriam Adam, Bright S. Freduah, Benedicta Yayra Fosu-Mensah, Peter A. Y. Ampim, Mouhamed Ly, Pierre S. Traore and Samuel G. K. Adiku

Sustainability **2021**, *13*(9), 5191; **https://doi.org/10.3390/su13095191** - 06 May 2021

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Abstract Agriculture in West Africa is constrained by several yield-limiting factors, such as poor soil fertility, erratic rainfall distributions and low input systems. Projected changes in climate, thus, pose a threat since crop production is mainly rain-fed. The impact of climate change and its [...] Read more.

(This article belongs to the Special Issue Sustainability and Production of Cropping Systems)

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Local Communities' Willingness to Accept Compensation for Sustainable Ecosystem Management in Wadi Araba, South of Jordan

by Amani Al-Assaf, Abeer Albalawneh, Mohammad Majdalawi, Lana Abu Nowar, Rabab Kabariti, Amgad Hjazin, Safaa Aljaafreh, Wafa'a Abu Hammour, Mai Diab and Nizar Haddad

Sustainability **2021**, *13*(9), 5190; **https://doi.org/10.3390/su13095190** - 06 May 2021

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Abstract In developing countries, like Jordan, climate change and population growth have prompted land-use and land-cover changes that have profoundly affected ESs, especially by poor people living in fragile ecosystems. This study aimed to analyze the attitudes towards ES among households living in Wadi [...] Read more.

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Determinants of Learning Management Systems during COVID-19 Pandemic for Sustainable Education

by Nadire Cavus, Yakubu Bala Mohammed and Mohammed Nasiru Yakubu

Sustainability **2021**, *13*(9), 5189; **https://doi.org/10.3390/su13095189** - 06 May 2021

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Abstract Research has shown that effective and efficient learning management systems (LMS) were the main reasons for sustainable education in developed nations during COVID-19 pandemic. However, due to slow take-up of LMS many schools in developing countries, especially Africa were completely shut down due [...] Read more.

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Examining the Impact of E-Commerce Growth on the Spatial Distribution of Fashion and Beauty Stores in Seoul

by Sohyun Park and Keumsook Lee
Sustainability **2021**, *13*(9), 5185; **https://doi.org/10.3390/su13095185** - 06 May 2021
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Abstract E-commerce has dramatically expanded its sales, with people being increasingly customed to online shopping. This study aimed to examine changes in the distribution of retail stores that provide fashion and beauty products and services in terms of the number of online shopping transactions [...] Read more.

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Enabling Factors for Better Multiplier Effects of the LEADER Programme: Lessons from Romania

by Alexandru Olar and Mugurel I. Jitea
Sustainability **2021**, *13*(9), 5184; **https://doi.org/10.3390/su13095184** - 06 May 2021
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Abstract LEADER is an EU development method that aims to stimulate local actors to cooperate and co-produce ideas and projects that otherwise would not be possible. Therefore, the Local Action Groups (LAGs) should not only focus on implementing the Local Development Strategies but also [...] Read more.
(This article belongs to the Special Issue Sustainable Rural Development and Land Use Planning)

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Identifying Unwanted Conditions through Chaotic Area Determination in the Context of Indonesia's Economic Resilience at the City Level

by Yuyun Hidayat, Titi Purwandari, Subiyanto and Sukono
Sustainability **2021**, *13*(9), 5183; **https://doi.org/10.3390/su13095183** - 06 May 2021
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Abstract The purpose of this research is to determine the unwanted condition as a strategic criterion in measuring the economic resilience of a city. A new approach in determining economic resilience was developed to overcome the weaknesses of the index method commonly used internationally. [...] Read more.
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Sustainable Development of Foodservices under Uncertainty

by Sohrab Abdollahzadeh
Sustainability **2021**, *13*(9), 5182; **https://doi.org/10.3390/su13095182** - 06 May 2021
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Abstract The purpose of the present study is to provide an approach to identify and investigate the effects of each factor on the development of foodservices in cities. The factors influencing the development of foodservices are extracted. Since there are many factors, interpretive structural [...] Read more.

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A Methodology to Study the University's Online Teaching Activity from Virtual Platform Indicators: The Effect of the Covid-19 Pandemic at Universitat Politècnica de Catalunya

by Joana Prat, Ariadna Llorens, Francesc Salvador, Marc Alier and Daniel Amo
Sustainability **2021**, *13*(9), 5177; **https://doi.org/10.3390/su13095177** - 06 May 2021
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Abstract The Covid-19 pandemic led Catalan universities to do all teaching and evaluation online from 11 March 2020 until the end of term on 30 July. Conventional universities made the transition to online teaching in just a few days and suddenly virtual platforms become [...] Read more.
(This article belongs to the Special Issue Information Systems, E-learning and Knowledge Management)

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Linking Agricultural Index Insurance with Factors That Influence Maize Yield in Rain-Fed Smallholder Farming Systems

by Wonga Masiza, Johannes George Chirima, Hamisai Hamandawana, Ahmed Mukalazi Kalumba and Hezekiel Bheki Magagula
Sustainability **2021**, *13*(9), 5176; **https://doi.org/10.3390/su13095176** - 06 May 2021
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Abstract Weather extremes pose substantial threats to food security in areas where the main source of livelihood is rain-fed crop production. In most of these areas, agricultural index insurance (AII) is recognized as being capable of securitizing food production by providing safety nets against [...] Read more.
(This article belongs to the Section Sustainable Agriculture)

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The Brand Sustainability Obstacle: Viewpoint Incompatibility and Consumer Boycott

by Chih-Chien Wang, Shu-Chen Chang and Pei-Ying Chen
Sustainability **2021**, *13*(9), 5174; **https://doi.org/10.3390/su13095174** - 06 May 2021
Cited by 1 | Viewed by 518

Abstract Brand equity is critical for brand sustainability. Companies participate in social issues to maintain brand equity by making the brand easily recognizable, superior in quality, and favored and affirmed by consumers. However, the ideological incompatibility between a brand and consumers may induce the [...] Read more.

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Modeling the Fourth Dimension of Architectural Heritage: Enabling Processes for a Sustainable Conservation

by Raissa Mammoli, Chiara Mariotti and Ramona Quattrini
Sustainability **2021**, *13*(9), 5173; **https://doi.org/10.3390/su13095173** - 06 May 2021
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Abstract This study focuses on modeling the fourth dimension of historic architectures with an HBIM approach and special regard to stratigraphic analysis. The goal is to push the limits of current technology to understand the history of buildings, with impacts on protecting their authenticity; [...] Read more.
(This article belongs to the Special Issue Affirming Authenticity: Sustainable Conservation of Cultural Heritage)

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Evaluation of the Sustainable Coupling Coordination of the Logistics Industry and the Manufacturing Industry in the Yangtze River Economic Belt

by Ying Gong, Xiao-Qiong Yang, Chun-Yan Ran, Victor Shi and Yu-Feng Zhou
Sustainability **2021**, *13*(9), 5167; **https://doi.org/10.3390/su13095167** - 05 May 2021
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Abstract In order to promote the sustainable and coordinated development of the logistics industry and the manufacturing industry in the Yangtze River Economic Belt of China and provide the policy makers with decision-making references, this paper explored the spatio-temporal evolution of the coupling coordination [...] Read more.
(This article belongs to the Special Issue Sustainable Logistics and Supply Chain Management in the Aspect of Globalization)

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A Systematic Framework for State of Charge, State of Health and State of Power Co-Estimation of Lithium-Ion Battery in Electric Vehicles

by Tao Zhang, Ningyuan Guo, Xiaoxia Sun, Jie Fan, Naifeng Yang, Junjie Song and Yuan Zou
Sustainability **2021**, *13*(9), 5166; **https://doi.org/10.3390/su13095166** - 05 May 2021
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Abstract Due to its advantages of high voltage level, high specific energy, low self-discharging rate and relatively longer cycling life, the lithium-ion battery has been widely used in electric vehicles. To ensure safety and reduce degradation during the lithium-ion battery's service life, precise estimation [...] Read more.
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Sustainability Concepts in Nordic Business Research: A Critical Perspective

by Svein Gunnar Kjøde, Maja van der Velden and Mahsa Motevallian
Sustainability **2021**, *13*(9), 5160; **https://doi.org/10.3390/su13095160** - 05 May 2021
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Abstract Current sustainability challenges force companies to radically rethink their operations to account for their business models' long-term ecological and social impact. Scholarly works on the topic reveal no solid consensus in defining sustainability for businesses, echoing the sustainability discourse in general. Such lack [...] Read more.
(This article belongs to the Special Issue Circular Economy and Corporate Sustainability)

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Management Influence on the Quality of an Agricultural Soil Destined for Forage Production and Evaluated by Physico-Chemical and Biological Indicators

by Silvia Baizán, Fernando Vicente and Adela Martínez-Fernández
Sustainability **2021**, *13*(9), 5159; **https://doi.org/10.3390/su13095159** - 05 May 2021
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Abstract The European Common Agricultural Policy promotes the sustainable use of soils through the principle of cross-compliance that links direct payments to good farming practices. Thus, it is necessary to find sustainable alternatives to the conventional management for forage production in the Atlantic Arc [...] Read more.
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Computer-Assisted Concept Analysis of Customer Centricity: A Review of the Literature on Employee Engagement, Culture, Leadership, and Identity Co-Creation

by Elanor Colleoni, Flavia Bonaiuto, Laura Illia and Marino Bonaiuto

Sustainability **2021**, *13*(9), 5157; **https://doi.org/10.3390/su13095157** - 05 May 2021

Abstract Customer centricity requires having customers at the core of the corporate organizational process. Yet, relationship marketing scholarships have not developed a clear understanding of how corporate culture, leadership, and identity may allow the establishment of customer centricity within the organization. To this aim, [...] Read more.

(This article belongs to the Special Issue Customer Relationship Management—Strategies and Business Implications)

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Open Access Review

The Impact of Social Norms on Pro-Environmental Behavior: A Systematic Literature Review of The Role of Culture and Self-Construal

by Selma Saracevic and Bodo B. Schlegelmilch

Sustainability **2021**, *13*(9), 5156; **https://doi.org/10.3390/su13095156** - 05 May 2021

Abstract This paper documents state-of-the-art research on the impact of social norms on pro-environmental consumer behavior. Our aim was to identify possible research gaps, in particular in terms of the moderating role of culture and self-construal, and to suggest potentially fruitful research avenues. To [...] Read more.

(This article belongs to the Special Issue Pro-environmental Behavior – Social and Cultural Aspects)

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Effectiveness of Public Aid for Inland Aquaculture in Poland—The Relevance of Traditional Performance Ratios

by Magdalena Raftowicz, Bertrand le Gallic, Magdalena Kalisiak-Mędelska, Krzysztof Rutkiewicz and Emilia Konopska-Struś

Sustainability **2021**, *13*(9), 5155; **https://doi.org/10.3390/su13095155** - 05 May 2021

Abstract Public financial aid is approached as one of the most important tools allowing, mainly small and medium-sized enterprises, to implement many of their investment intentions, thus improving their competitive position in the market. It is granted to enterprises regardless of whether they are [...] Read more.

(This article belongs to the Collection Fisheries Economics and Management)

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The Importance of Club Revenues for Player Salaries and Transfer Expenses—How Does the Coronavirus Outbreak (COVID-19) Impact the English Premier League?

by Tommy Quansah, Bernd Frick, Markus Lang and Kieran Maguire

Sustainability **2021**, *13*(9), 5154; **https://doi.org/10.3390/su13095154** - 05 May 2021

Abstract The COVID-19 pandemic has caused significant disruption in the sports industry and has raised the question of whether the football industry is based on a sustainable business model. Using data from the English Premier League (EPL), we develop a regression model to achieve [...] Read more.

(This article belongs to the Special Issue Recovery and Sustainability of the Sport Sector during the COVID-19 Pandemic)

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The Role of Commitment in the Relationship between Components of Organizational Culture and Intention to Stay

by Smart A. Sarpong, Mary Safowah Akom, Emelia Kusi-Owusu, Irene Ofosua-Adjei and Youngjo Lee
Sustainability **2021**, *13*(9), 5151; **https://doi.org/10.3390/su13095151** - 05 May 2021
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Abstract For an institution to be classified as one of the best or worst, it largely depends on the people behind it. An institution's human resource is, therefore, seen as its most important asset. This paper investigates the role of employee commitment in linking [...] Read more.
(This article belongs to the Section Sustainable Management)

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Parque Augusta (São Paulo/Brazil): From the Struggles of a Social Movement to Its Appropriation in the Real Estate Market and the Right to Nature in the City

by Wendel Henrique Baumgartner
Sustainability **2021**, *13*(9), 5150; **https://doi.org/10.3390/su13095150** - 05 May 2021
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Abstract Through a dialectical approach, building a thesis, an antithesis and a synthesis, our goal in this article is to discuss the implementation of the Parque Augusta, in the center of São Paulo, Brazil. For years, an organized social movement struggled with the municipality [...] Read more.
(This article belongs to the Special Issue Greening Cities Shaping Cities: Pinpointing Nature-Based Solutions in Cities between Shared Governance and Citizen Participation)

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Exploring Creative Tourism Based on the Cultural and Creative Cities (C3) Index and Using Bootstrap Confidence Intervals

by Mercedes Mareque, Elena de Prada Creo and Marcos Álvarez-Díaz
Sustainability **2021**, *13*(9), 5145; **https://doi.org/10.3390/su13095145** - 04 May 2021
Cited by 1 | Viewed by 526

Abstract Creative tourism is a novel segment of the tourism market that may turn into a great opportunity for small cities to attract visitors. Thus, it can be a possible economic and social driver for local development. Despite its potentiality, not much empirical research [...] Read more.
(This article belongs to the Special Issue Cultural, Creative and Sustainable Cities)

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A Practical Vision of Heritage Tourism in Low-Population-Density Areas. The Spanish Mediterranean as a Case Study

by Pablo Altaba and Juan A. García-Esparza
Sustainability **2021**, *13*(9), 5144; **https://doi.org/10.3390/su13095144** - 04 May 2021
Cited by 1 | Viewed by 473

Abstract Heritage tourism bases its definition on searching for different, authentic, and somewhat unexplored places. Recent literature speaks of the growth of new forms of tourism based on the tradition that seeks to surprise visitors with popular culture, traditional activities, or actions that bring [...] Read more.
(This article belongs to the Section Tourism, Culture, and Heritage)

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The Effect of Supply Chain Management Strategy on Operational and Financial Performance

by Rok Lee

Sustainability **2021**, *13*(9), 5138; **https://doi.org/10.3390/su13095138** - 04 May 2021

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Abstract Given that small and medium manufacturing enterprises (SMEs) are key to national economic development, the application of supply chain strategies that support their sustainability is critical. This study aims to identify the effects of supply chain management (SCM) on the operational performance of [...] Read more.

(This article belongs to the Special Issue Digitalization and Sustainable Supply Chain Management in a Period of Crisis)

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Predicting Increase in Demand for Public Buses in University Students Daily Life Needs: Case Study Based on a City in Japan

by Ali Bakdur, Fumito Masui and Michal Ptaszynski

Sustainability **2021**, *13*(9), 5137; **https://doi.org/10.3390/su13095137** - 04 May 2021

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Abstract Accessibility and economic sustainability of public bus services (PBS) have been in a continuous decline in Japan's countryside. Rural cities also suffer from population transformation toward industrial centers experiencing rapid economic growth. In the present study, we reviewed the current demand status of [...] Read more.

(This article belongs to the Special Issue Active Transport among University Students: Patterns, Motivations and Challenges)

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Cause-Related Marketing in the Telecom Sector: Understanding the Dynamics among Environmental Values, Cause-Brand Fit, and Product Type

by Tsungjen Shih and Shaojung Sharon Wang

Sustainability **2021**, *13*(9), 5129; **https://doi.org/10.3390/su13095129** - 03 May 2021

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Abstract Due to heightened ecological awareness and concern in recent years, many businesses have started to employ cause-related marketing (CRM) strategies aiming at communicating sustainability-based value to their potential targets. Building on the growing body of research on cause-brand fit and product types, the [...] Read more.

(This article belongs to the Special Issue Sustainable Marketing Management)

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Consumers' and Farmers' Perceptions in Europe Regarding the Use of Composted Bedding Material from Cattle

by Marija Klopčič, Karmen Erjavec, Megan Waldrop, Jutta Roosen, Petra Engel, Paul Galama and Abele Kuipers

Sustainability **2021**, *13*(9), 5128; **https://doi.org/10.3390/su13095128** - 03 May 2021

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Abstract By-products like sawdust and straw are applied in compost bedded-pack barns (CBP) for cattle. These materials, which are gradually mixed with excreta and undergo a composting process, serve as a lying bed for the cattle. This study aims to assess the perception of [...] Read more.

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Exploring the Inclusion of Sustainability into Strategy and Management Control Systems in Peruvian Manufacturing Enterprises

by Luis Jesús Córdova-Aguirre and Juan Manuel Ramón-Jerónimo
Sustainability **2021**, *13*(9), 5127; **https://doi.org/10.3390/su13095127** - 03 May 2021
Cited by 1 | Viewed by 568

Abstract The aim of this work is to explore the incorporation of sustainability into strategy and management control systems (MCSs) in Peruvian manufacturing enterprises in the plastics sector. The study focuses on identifying and analyzing the current way they incorporate and manage sustainability to [...] Read more.
(This article belongs to the Special Issue New and Renewed Manufacturing Paradigms for Sustainable Production)

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Understanding Pro-Environmental Behavior of Citizen Science: An Exploratory Study of the Bird Survey in Taoyuan's Farm Ponds Project

by Shan-Hui Chao, Jin-Zhang Jiang, Kuan-Chu Wei, Eric Ng, Chia-Hsuan Hsu, Yi-Te Chiang and Wei-Ta Fang
Sustainability **2021**, *13*(9), 5126; **https://doi.org/10.3390/su13095126** - 03 May 2021
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Abstract This exploratory study aims to fill the gap by adopting Hirose's two-phase decision-making model with the theory of social networks to explore the environmentally friendly attitudes and environmental behavioral intentions toward pro-environmental behaviors of the citizen scientists who participated in the Bird Survey [...] Read more.
(This article belongs to the Special Issue Pro-environmental Behavior – Social and Cultural Aspects)

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Analyzing Sustainability Reports of Global, Public Corporations by Industrial Sectors and National Origins

by Hyun-Duck Kim
Sustainability **2021**, *13*(9), 5125; **https://doi.org/10.3390/su13095125** - 03 May 2021
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Abstract Due to the demand by stakeholder groups of global public corporations for greater transparency in business operations, corporations have continuously tried to embody the concept of sustainability in their business strategies and operations. That is, they have collectively published sustainability reports to state [...] Read more.

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Multi-Criteria Decision Analysis Using Life Cycle Assessment and Life Cycle Costing in Circular Building Design: A Case Study for Wall Partitioning Systems in the Circular Retrofit Lab

by Neethi Rajagopalan, Stijn Brancart, Sofie De Regel, Anne Paduart, Niels De Temmerman and Wim Debacker
Sustainability **2021**, *13*(9), 5124; **https://doi.org/10.3390/su13095124** - 03 May 2021
Cited by 1 | Viewed by 714

Abstract The Circular Economy (CE) paradigm has been gaining momentum. However, the tools and methods used to design, measure and implement circularity are not immediately suitable for decision making and practice by key stakeholders. This article details a qualitative and a quantitative method to [...] Read more.
(This article belongs to the Special Issue Life Cycle Assessment and Environmental Footprinting)

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Difference in the Attitude of Students and Employees of the University of Ljubljana towards Work from Home and Online Education: Lessons from COVID-19 Pandemic

by Varineja Drašler, Jasna Bertoncelj, Mojca Korošec, Tanja Pajk Žontar, Nataša Poklar Ulrih and Blaž Cigić

Sustainability **2021**, *13*(9), 5118; **https://doi.org/10.3390/su13095118** - 03 May 2021

Cited by 2 | Viewed by 1480

Abstract The COVID-19 pandemic caused a large and involuntary shift to work from home (WFH) or teleworking, and widespread adoption of web-based platforms. This study aims to uncover the attitude and perception of WFH and online education among students and employees of the University [...] Read more.

(This article belongs to the Special Issue Effects of COVID 19 for Sustainable Education, Systems and Institutions)

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An Innovative and Interactive Teaching Model for Cultivating Talent's Digital Literacy in Decision Making, Sustainability, and Computational Thinking

by Yu-Hsi Yuan, Chia-Hui Liu and Szu-Sheng Kuang

Sustainability **2021**, *13*(9), 5117; **https://doi.org/10.3390/su13095117** - 03 May 2021

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Abstract In the modern era, talent cultivation plays an essential role in the transition process to sustainable development. The emerging direction of talent cultivation is intended to achieve global competence in computational thinking and digital literacy; however, there is still a gap in Taiwan. [...] Read more.

(This article belongs to the Special Issue Selected Papers from Eurasian Conference on Educational Innovation 2021)

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The Influence of the Digital Supply Chain on Operational Performance: A Study of the Food and Beverage Industry in Indonesia

by Mohammad Agung Saryatmo and Vatcharapol Sukhotu

Sustainability **2021**, *13*(9), 5109; **https://doi.org/10.3390/su13095109** - 02 May 2021

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Abstract In this rapidly developing digital era, digital transformations take place within every industry, and they have effects on the management of the supply chains. The aim of this study is to delve into the influence of the digital supply chain on the quality, [...] Read more.

(This article belongs to the Special Issue Digital Supply Chain and Sustainability)

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Large-Scale Road Network Congestion Pattern Analysis and Prediction Using Deep Convolutional Autoencoder

by Navin Ranjan, Sovit Bhandari, Pervez Khan, Youn-Sik Hong and Hoon Kim

Sustainability **2021**, *13*(9), 5108; **https://doi.org/10.3390/su13095108** - 02 May 2021

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Abstract The transportation system, especially the road network, is the backbone of any modern economy. However, with rapid urbanization, the congestion level has surged drastically, causing a direct effect on the quality of urban life, the environment, and the economy. In this paper, we [...] Read more.

(This article belongs to the Section Sustainable Transportation)

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Operational and Safety Management at Intersections: Can the Turbo-Roundabout Be an Effective Alternative to Conventional Solutions?

by Vincenzo Gallelli, Giusi Perri and Rosolino Vaiana
Sustainability **2021**, *13*(9), 5103; **https://doi.org/10.3390/su13095103** - 01 May 2021
Cited by 3 | Viewed by 793

Abstract The European Union policy strategies on the sustainability of the transport system pursue the goals of maximizing safety and environmental benefits and reducing the severity and frequency of crashes, congestion, and pollutant emission rates. A common issue is the planning of the most [...] Read more.
(This article belongs to the Special Issue Sustainable and Safe Roundabouts)

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Sustainable Logistics Management Maturity—The Theoretical Assessment Framework and Empirical Results from Poland

by Karolina Werner-Lewandowska and Paulina Golinska-Dawson
Sustainability **2021**, *13*(9), 5102; **https://doi.org/10.3390/su13095102** - 01 May 2021
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Abstract Poland is Europe's leader in international freight transport. The majority of companies in the Polish logistics sector are small-sized enterprises with limited human and material resources, which reduces their ability to implement corporate social responsibility practices. In this paper, we explore the logistics [...] Read more.
(This article belongs to the Collection Sustainability on Production and Industrial Management)

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Impacts of Digital Technostress and Digital Technology Self-Efficacy on Fintech Usage Intention of Chinese Gen Z Consumers

by You-Kyung Lee
Sustainability **2021**, *13*(9), 5077; **https://doi.org/10.3390/su13095077** - 30 Apr 2021
Cited by 1 | Viewed by 755

Abstract The role of digital technostress and self-efficacy in digital marketing research is seldom discussed and even more rarely examined among Gen Z consumers. This study investigates the relationships between four sub-dimensions of technostress (complexity, overload, invasion, and uncertainty), digital technology self-efficacy, and fintech [...] Read more.
(This article belongs to the Special Issue Insurtech, Proptech & Fintech Environment: Sustainability, Global Trends and Opportunities)

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Virtual Airport Hub—A New Business Model to Reduce GHG Emissions in Continental Air Transport

by Wojciech Paprocki
Sustainability **2021**, *13*(9), 5076; **https://doi.org/10.3390/su13095076** - 30 Apr 2021
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Abstract The virtual airport hub business model is an innovative solution supported by digital technologies; the implementation of which in continental air transport may lead to a reduction in energy consumption and to a reduction in greenhouse gas emissions. The prerequisites for the implementation [...] Read more.
(This article belongs to the Special Issue Advanced Transport Systems and Methods for Design of Sustainable Mobility)

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The Effects of Financial Literacy on Sustainable Entrepreneurship

by Alberto Burchi, Bogdan Włodarczyk, Marek Szturo and Duccio Martelli
Sustainability **2021**, *13*(9), 5070; **https://doi.org/10.3390/su13095070** - 30 Apr 2021
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Abstract Entrepreneurship contributes to the economic well-being of every country. Specifically, the level of individual entrepreneurship is crucial in the process of developing and building economic potential, especially in Central European countries. Among the several factors impacting entrepreneurship, the ability to access the necessary [...] Read more.
(This article belongs to the Special Issue Micro and Macroeconomic Determinants of Productivity Growth and Long-Term Sustainable Development in Central European Economies)

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Systemic Innovation Areas for Heritage-Led Rural Regeneration: A Multilevel Repository of Best Practices

by Aitziber Egusquiza, Mikel Zubiaga, Alessandra Gandini, Claudia de Luca and Simona Tondelli
Sustainability **2021**, *13*(9), 5069; **https://doi.org/10.3390/su13095069** - 30 Apr 2021
Cited by 4 | Viewed by 620

Abstract This paper presents the result of the analysis of the data gathered from 20 Role Models (RM) case studies regarding their successful heritage-led rural regeneration models. For the study and comparison of the narratives of these Role Models two tools were used: the [...] Read more.
(This article belongs to the Special Issue A European Perspective on Cultural Heritage as a Driver for Sustainable Development and Regional Resilience)

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Developing a Measurement Scale of Opposition in Tourism Public-Private Partnerships Projects

by Alaa M. S. Azazz, Ibrahim A. Elshaer and Marwa Ghanem
Sustainability **2021**, *13*(9), 5053; **https://doi.org/10.3390/su13095053** - 30 Apr 2021
Cited by 1 | Viewed by 463

Abstract Stakeholder opposition is reported as a central aspect of public-private partnership (PPP) failure; however, it has not gained much attention in either tourism or general PPP studies. Therefore, this study seeks to explore stakeholder opposition and develop a measurements scale of opposition in [...] Read more.

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Investment Leverage for Adaptive Reuse of Cultural Heritage

by Tracy Pickerill
Sustainability **2021**, *13*(9), 5052; **https://doi.org/10.3390/su13095052** - 30 Apr 2021
Cited by 1 | Viewed by 903

Abstract This article tracks the design of a panoptic toolkit of complementary financial (grant and endowment, tax, debt and equity) and non-financial (regulation, real estate, risk mitigation and performance, capacity building, impact metric and digital network) instruments, designed to leverage capital investment and engender [...] Read more.
(This article belongs to the Special Issue The Valorization of the Cultural Heritage and Landscape as the Entrance Point for the Circular City Strategy)

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Family Control and Corporate Innovation in Stakeholder-Oriented Corporate Governance

by Hideaki Sakawa and Naoki Watanabel

Sustainability **2021**, *13*(9), 5044; **https://doi.org/10.3390/su13095044** - 30 Apr 2021

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Abstract This study investigates the effects of family control on corporate innovation activity in publicly traded firms in Japan under stakeholder-oriented corporate governance. In a sample of 14,991 firm-year observations in publicly traded firms in Japan during the period 2007 to 2016, we tested [...] Read more.

(This article belongs to the Section Economic and Business Aspects of Sustainability)

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Perceptions of Teachers in Training on Water Issues and Their Relationship to the SDGs

by Francisca Ruiz-Garzón, María del Carmen Olmos-Gómez and Ligia Isabel Estrada-Vidal

Sustainability **2021**, *13*(9), 5043; **https://doi.org/10.3390/su13095043** - 30 Apr 2021

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Abstract Water conservation is essential for any activity, as well as for the survival of both human and other living beings. It is commonly associated with access to clean water and sanitation, or even to unsustainable production and consumption, or sustainable cities and communities. [...] Read more.

(This article belongs to the Special Issue Intercultural Education and Promotion of Sustainability, as an Improvement in Educational Quality, with a Focus on Technological Advancement)

The Relationship between Endurance Involvement and Travel Behavior in Camping and the Moderating Effect of Place Attachment

by Jehn-Yih Wong, Ming-Lee Hsiung, Shu-Ju Lee and Chia-Ying ChouHuang

Sustainability **2021**, *13*(9), 5016; **https://doi.org/10.3390/su13095016** - 29 Apr 2021

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Abstract Camping tourism is one of the fastest growing segments of the tourism industry. Global trends in camping show that this type of recreational activity has begun to emerge in Asia. Meeting the expectations of potential and current tourists in a camping destination will [...] Read more.

(This article belongs to the Special Issue Marketing Management in Hospitality and Tourism Industries)

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Risk Management in Corporate Governance Framework

by Hania Rehman, Muhammad Ramzan, Muhammad Zia Ul Haq, Jinsoo Hwang and Kyoung-Bae Kim

Sustainability **2021**, *13*(9), 5015; **https://doi.org/10.3390/su13095015** - 29 Apr 2021

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Abstract There is a scarcity of literature involving studies about the effect of risk management on the relationship between corporate governance and a firm's financial performance, especially in emerging markets. The study fills this gap and adds to the existing literature by investigating whether [...] Read more.

(This article belongs to the Special Issue Corporate Governance and Sustainability Performance)

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Assessing the Impacts of Climate Variations on the Potato Production in Bangladesh: A Supply and Demand Model Approach

by Arifa Jannat, Yuki Ishikawa-Ishiwata and Jun Furuya
Sustainability **2021**, *13*(9), 5011; **https://doi.org/10.3390/su13095011** - 29 Apr 2021
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Abstract From the perspective of nutritional security, we investigated the influence of climate change on potato production in Bangladesh using a supply and demand model by considering the potato as an important non-cereal food crop. To provide an outlook on the variation in potato [...] Read more.
(This article belongs to the Section Air, Climate Change and Sustainability)

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Achieving Sustainability in Food Systems: Addressing Changing Climate through Real Time Nitrogen and Weed Management in a Conservation Agriculture-Based Maize–Wheat System

by Kapila Shekhawat, Vinod K. Singh, Sanjay Singh Rathore, Rishi Raj and T. K. Das
Sustainability **2021**, *13*(9), 5010; **https://doi.org/10.3390/su13095010** - 29 Apr 2021
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Abstract The proven significance of conservation agriculture (CA) in enhancing agronomic productivity and resource use efficiency across diverse agro-ecologies is often challenged by weed interference and nitrogen (N) immobilization. The collective effect of real-time N and weed management has been scarcely studied. To evaluate [...] Read more.
(This article belongs to the Special Issue Food Systems to Address Climate Challenges)

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An ISM Modeling of Barriers for Blockchain/Distributed Ledger Technology Adoption in Supply Chains towards Cybersecurity

by Niloofar Etemadi, Pieter Van Gelder and Fernanda Strozzi
Sustainability **2021**, *13*(9), 4672; **https://doi.org/10.3390/su13094672** - 22 Apr 2021
Cited by 2 | Viewed by 692

Abstract Over the last few years, the increasing level of cyber risks derived from the growing connectedness of Industry 4.0 has led to the emergence of blockchain technology as a major innovation in supply chain cybersecurity. The main purpose of this study is to [...] Read more.

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Preparation and Properties of Sustainable Concrete Using Activated Sludge of Industrial By-Products

by Young-Yeop Kim, Hyun-Min Yang and Han-Seung Lee
Sustainability **2021**, *13*(9), 4671; **https://doi.org/10.3390/su13094671** - 22 Apr 2021
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Abstract Industrial sludge byproducts contain CaO, SiO_2, Al_2O_3, etc. When industrial sludge is used in ready-mixed concrete, the performance of the concrete can be enhanced due to the hydration reaction. In the present study, activated sludge was used [...] Read more.
(This article belongs to the Special Issue Low CO_2 Concrete)

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Research on the Sustainable Heterogeneous Catalyst Development for Photocatalytic Treatment of Phenol

by Zan Li, Hongkun Zhang and Wenrui Jiang
Sustainability **2021**, *13*(9), 4670; **https://doi.org/10.3390/su13094670** - 22 Apr 2021
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Abstract A large amount of wastewater from various and discharged sources that are not treated in any way could affect properties of both land and water, causing severe problems for the environment. Advanced oxidation processes seem to be a feasible option to address effluent [...] Read more.
(This article belongs to the Special Issue Sustainable Wastewater Treatments and Reuse)

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Supply Chain Integration Enables Resilience, Flexibility, and Innovation to Improve Business Performance in COVID-19 Era

by Hotlan Siagian, Zeplin Jiwa Husada Tarigan and Ferry Jie
Sustainability **2021**, *13*(9), 4669; **https://doi.org/10.3390/su13094669** - 22 Apr 2021
Cited by 1 | Viewed by 1097

Abstract The COVID-19 pandemic has brought about a sudden change from normal conditions to disruption conditions, and industrial sectors have experienced eroded growth. In particular, the manufacturing industry experienced a slowdown due to the sudden disruption in supply and demand. This situation stimulates the [...] Read more.
(This article belongs to the Special Issue Emerging Emergencies and Sustainability: The Role of Supply Chain and Logistics)

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Path Planning for Autonomous Platoon Formation

by Ouafae El Ganaoui-Mourlan, Stephane Camp, Thomas Hannagan, Vaibhav Arora, Martin De Neuville and Vaios Andreas Kousournas
Sustainability **2021**, *13*(9), 4668; **https://doi.org/10.3390/su13094668** - 22 Apr 2021
Cited by 1 | Viewed by 536

Abstract In the context of automated highway systems (AHS), this work proposes an approach that enables a vehicle to autonomously join a platoon with optimized trajectory in the presence of dynamical traffic obstacles. A notable aspect is the use of Model Predictive Control (MPC) [...] Read more.
(This article belongs to the Special Issue Autonomous Vehicles: Future of Transportation Sustainability)

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Weekly Wellness Variations to Identify Non-Functional Overreaching Syndrome in Turkish National Youth Wrestlers: A Pilot Study

by Hadi Nobari, Zeki Akyildiz, Maryam Fani, Rafael Oliveira, Jorge Pérez-Gómez and Filipe Manuel Clemente
Sustainability **2021**, *13*(9), 4667; **https://doi.org/10.3390/su13094667** - 22 Apr 2021
Cited by 3 | Viewed by 505

Abstract The present study aimed at (i) investigating weekly variations in wellness ratings relative to Hooper indicators (HI): fatigue (wFatigue), stress levels (wStress), delayed onset muscle soreness (wDOMS), sleep quality/disorders (wSleep), and wHI across the full preparation season (PS) and (ii) comparing the aforementioned [...] Read more.
(This article belongs to the Section Health and Sustainability)

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An Approach to Applying the Ability-Motivation-Opportunity Theory to Identify the Driving Factors of Green Employee Behavior in the Hotel Industry

by Adina-Raluca Sibian and Ana Ispas
Sustainability **2021**, *13*(9), 4659; **https://doi.org/10.3390/su13094659** - 22 Apr 2021
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Abstract In the context of climate change and all other harmful effects of pollution, companies should improve their environmental performances. As part of their strategies, companies should explore the consequences of their environmental practices from the perspective of internal stakeholders and must be more [...] Read more.
(This article belongs to the Special Issue Environmentally Sustainable Behavior: Theories, Empirical Evidence and Implications)

Open Access Feature Paper Article

Building Information Modeling as an Effective Process for the Sustainable Re-Shaping of the Built Environment

by Cecilia Mazzoli, Marco Iannantuono, Vieri Giannakopoulos, Anastasia Fotopoulou, Annarita Ferrante and Simone Garagnani
Sustainability **2021**, *13*(9), 4658; **https://doi.org/10.3390/su13094658** - 22 Apr 2021
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Abstract This paper focuses on the definition of a method supported by digital processes for a sustainable and user-orientated re-design of the existing building stock. Based on the analysis of the methodological and procedural aspects of the computational approach to architectural design in relation [...] Read more.
(This article belongs to the Special Issue Integration of BIM and ICT for Sustainable Building Projects)

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Cycling in the Era of COVID-19: Lessons Learnt and Best Practice Policy Recommendations for a More Bike-Centric Future

by Alexandros Nikitas, Stefanos Tsigdinos, Christos Karolemeas, Efthymia Kourmpa and Efthimios Bakogiannis
Sustainability **2021**, *13*(9), 4620; **https://doi.org/10.3390/su13094620** - 21 Apr 2021
Cited by 4 | Viewed by 1315

Abstract The COVID-19 pandemic has affected our cities in monumental ways with no sector likely being more severely impacted than transport. Lockdowns, physical spacing, transport restrictions and stay-at-home guidelines have transformed personal mobility and highlighted the mistakes of an unbalanced pro-car culture that defined [...] Read more.
(This article belongs to the Collection Bicycling Today: Establishing and Learning from the State of the Art)

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Knowledge Criticality Assessment and Codification Framework for Major Maintenance Activities: A Case Study of Cement Rotary Kiln Plant

by Lilian. O. Iheukwumere-Esotu and Akilu Yunusa-Kaltungo
Sustainability **2021**, *13*(9), 4619; **https://doi.org/10.3390/su13094619** - 21 Apr 2021
Cited by 2 | Viewed by 666

Abstract Maintenance experts involved in managing major maintenance activities such as; Major overhauls, outages, shutdowns and turnarounds (MoOSTs) are constantly faced with uncertainties during the planning and/or execution phases, which often stretches beyond the organisation's standard operating procedures and require the intervention of staff [...] Read more.
(This article belongs to the Special Issue Sustainability in Operations Management)

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Capability Assessment toward Sustainable Development of Business Incubators: Framework and Experience Sharing

by Nathasit Gerdsri, Boonkiart Iewwongcharoen, Kittichai Rajchamaha, Nisit Manotungvorapun, Jakapong Pongthanaisawan and Watcharin Witthayaweerasak

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Supply Chain Integration Enables Resilience, Flexibility, and Innovation to Improve Business Performance in COVID-19 Era

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Abstract: The COVID-19 pandemic has brought about a sudden change from normal conditions to disruption conditions, and industrial sectors have experienced eroded growth. In particular, the manufacturing industry experienced a slowdown due to the sudden disruption in supply and demand. This situation stimulates the manufacturing industry to recover from this current challenging disruption. This study investigates the impact of supply chain integration on business performance through supply chain resilience, supply chain flexibility, and innovation system in Indonesia's manufacturing companies. Data collection has obtained as many as 470 questionnaires considered valid for further analysis. Data analysis used the partial least square (PLS) technique using smartPLS software version 3.0. The results show that supply chain integration affects innovation system, supply chain flexibility, and supply chain resilience because of its ability to share complete product information and share production planning. Innovation systems and supply chain flexibility enhance supply chain resilience through the ability to deal with sudden changes in customer demand and production problems. Supply chain integration improves business performance through innovation, supply chain flexibility, and supply chain resilience in the COVID-19 era. This research could be the best practice for managers in restoring manufacturing performance quickly. This study also contributes to the current research in supply chain management.

Keywords: supply chain integration; innovation system; supply chain flexibility; supply chain resilience; business performance

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1. Introduction

The global changes in early 2020 were inevitable due to the Corona Virus disease, called COVID-19, a pandemic that resulted in work culture changes in all sectors. The World Health Organization (WHO) had stated that the new COVID-19 in Hubei Province, China, is a form of a public health emergency and it has become an international concern. The rapid spread of the COVID-19 infection has disrupted international mobility, and in early March 2020, 14 cases were identified in Europe, thus providing an emergency call for public health [1]. The rapid spread of the virus has resulted in uncertainty in many sectors, and many countries have had to lock down to stop the further spread of the virus. The Kenyan government declared a partial lockdown with the COVID-19 pandemic in May 2020, while Uganda implied lockdown at the end of March 2021. Tanzania implemented a policy of closing schools from the learning process directly and limiting public gatherings in March 2021. Zambia implemented a partial lockdown in mid-March 2021 [2].

The impact of COVID-19 has resulted in uncertainty in employment, reduction in the workforce opportunities, increased unemployment in all the country, and the number of employees temporarily suspended for companies' survival [1]. The manufacturing industry in Jordan has reduced employees and reduced salaries to survive as the demand for manufactured products has decreased due to the local government policy [3]. Besides

this, India's manufacturing companies were also adversely affected by the COVID-19 pandemic due to a huge decrease in demand [4].

The COVID-19 pandemic also impacts the manufacturing industry, which relies highly on raw materials supply from China and India [5]. It has reduced the manufacturing industry's productivity by 51%. The utility level was 49% of total capacity due to a decrease in demand and loss of foreign suppliers due to the local government policy related to raw materials import. Moreover, COVID-19 also impacts the tourism sector in the form of the limited mobilization of people from one country to another. Indonesia's government has applied policies on large-scale restrictions throughout Indonesia, resulting in a high supply disruption [6]. Besides this, the mitigation of the risk of COVID-19 transmission has resulted in a declining production capacity due to restrictions on the number of employees working in the office, setting work shifts to two or three shifts, and even conducted a lockdown to reduce the risk of social contact. This condition has caused many companies to maintain company operations at a minimum level to maintain their business and provide regular salaries to their employees [1].

The COVID-19 pandemic has also resulted in an imbalance and high demand for COVID-19–related products such as toilet paper products and hand sanitizer. This high demand has suddenly impacted the companies' production system in fulfilling the demand. However, the productivity is limited due to the limited number of working hours, the number of workers due to work distance restrictions, and running health protocols. Changes in the internal company activities have also forced the suppliers to cope with the high demand fluctuation quickly. On the other hand, the suppliers have difficulties meeting the fluctuating demand for raw material due to international mobilization restrictions [7]. Given the situation described above, the manufacturing company should cope with fluctuating demand from customers and suppliers. How the manufacturing company could meet the demand and obtain the raw material from the supplier has become the concern of this study. COVID-19 resulted in sudden changes so that organizations need a flexible supply chain to increase corporate responsiveness. The decrease in company flexibility will provide relatively long waiting times and impact its raw materials supply [4].

Companies must make decisions according to the uncertainties emerging during the pandemic era [5]. Companies need to optimize supply chain flow planning by considering company agility, company flexibility, company resilience, and sustainable company development [8]. Increasing company flexibility can increase reactive response to build flexibility in supply and demand, which changes suddenly and gradually increases proactive flexibility in overcoming supply chain problems [9,10]. Increasing the flexibility of companies in responding to demands from customers can be enhanced by supply chain integration. Internal integration, customer integration, and supplier integration, which form supply chain integration, can increase competitive capabilities and Business Performance in manufacturing companies by establishing an innovation orientation built on Taiwan's electronics companies [11]. Supply chain integration can also be said as backward integration with the supplier and forward integration with customers [12].

Innovations in the supply chain are conducted by updating technology to be integrated with partners to provide an agile and fast response [13]. Innovation is a way companies use to maintain competition in the market [14]. The companies made innovations by adopting the technology in process innovation and product innovation flexible delivery following the customer demands [15]. Disruption conditions require process innovation that companies use to survive. The company sets boundaries between one employee and another to keep enough distance during a pandemic disruption, the use of information technology for coordinating between departments, and supply chain partners. Innovations by suppliers also affect manufacturing companies' best practices by adopting the idea of supplier during the disruption era [16].

Supply Chain Integration, formed from internal integration and external integration, can increase companies' flexibility in making flexible deliveries and the number of products [17,18]. Supplier integration is part of supply chain integration that improves

manufacturing flexibility in providing materials to meet company needs [19,20]. Supply chain flexibility can provide customer satisfaction because it can provide product quality and product variance as needed [21,22]. The company's ability to manage flexibility properly will improve company performance [22]. Supply chain integration, which consists of supplier integration and internal integration, does not directly impact supply chain agility, but in contrast to customer integration, it has a direct impact on supply chain agility from the Malaysian industry [23].

The company improves planning by involving supply chain partners. Suppliers' involvement will provide a fast response in providing raw materials for pharmaceutical companies to provide medicinal products needed to prevent COVID-19. The demand for pharmaceutical products is soaring, and suddenly the company must involve its suppliers. The integration between companies and suppliers will provide agility and resilience for manufacturing companies [8]. The companies require resilience in response to the disruption [24]. The COVID-19 pandemic is a disruption that resulted in a 67% decline in sales at small and medium manufacturing in Jordan due to reduced demand, logistics, and transportation problems. The same disruption in Jordan resulted in 49% of small-medium manufacturers having to stop their employees from working because of the lockdown [3]. The company's resilience positively responds to maintaining its balance by paying attention to external changes [16,25]. Increasing resilience will provide increased business performance [26].

As has been discussed above, this study has selected five constructs, namely, supply chain integration, innovation, supply chain resilience, supply chain flexibility, and business performance, to consider. The reason for selecting those constructs is their relevancy with the current pandemic situation, disrupting supply and demand, and higher risk due to increasing uncertainty. Then, supported by previous studies, this research builds a model relating those constructs, presenting that supply chain integration enables the innovation, resilience, and flexibility to improve business performance. Based on the review of previous studies, many researchers have proposed the partial relationship between two concepts respectively, where the studies were conducted during a normal situation instead of a pandemic such as the current COVID-19 outbreak situation. However, to the best of the authors' knowledge, there has been no study dealing with these five constructs in one single model to examine whether the supply chain integration enables the supply chain flexibility, resilience, and innovation to improve the business performance in the time of COVID-19 pandemic situation. This research model raised three mainstream research questions: (1) Does supply chain integration affect innovation system, supply chain flexibility, and supply chain resilience? (2) Do innovation systems, supply chain flexibility, supply chain resilience have influences on business performance? (3) Does supply chain integration improve business performance through the mediation role of innovation systems, supply chain flexibility, and supply chain resilience? After investigating those research questions, this study could reveal the extent to which this model could improve the business performance during the disruption era caused by the pandemic. This study also examines which construct is the most affecting among the antecedent construct, which is essential as new insight for the manager to implement. This study's novelty is the new model, which did not exist before, and the model is examined during the disruption era due to the pandemic. This study contributes a managerial implication on how to recover from the current COVID-19 pandemic situation. This study also provides a theoretical contribution to the current research in supply chain management.

2. Review of Related Literature

2.1. Supply Chain Management (SCM) Integration

Supply chain management (SCM) integration is the ability of company leaders to build the integration of all activities within the company's internal function and external partners involving supplier, distributor, and retailer until the finished product arrives at the end customer as the indicator of competitiveness in the supply chain performance [18,27].

Supply chain integration can be a process integration between suppliers, manufacturers, distributors, and customers to benefit supply chain partnership [11,28–31]. The demand for finished products that increase substantially and suddenly from customers affects its production planning, which is increasingly complicated in fulfilling customer demand [32]. Supply chain integration is integration with suppliers, also known as backward integration or upstream integration, and integration with customers, also known as forward integration or downstream integration [12,20,23]. The company's ability to collaborate and integrate with suppliers can help find new sources and ultimately improve the raw materials supply [7]. Integration with external customers makes it easy for companies to get faster and more accurate request information and provide quick information to suppliers in providing raw materials. Supply chain integration can also be a strategic decision to build interconnections between supply chain partners to share valuable information about new markets, products, customers, and potential markets [33]. Supply chain integration consists of three dimensions in industry 4.0: process and activity integration, technology and system integration, and organizational relationship linkages [34].

The information technology used can provide customer needs information and internal process conditions in real-time [35]. The technology can be utilized, adjusted, and repaired to quickly and efficiently inform the need to suppliers. Information provided using information technology reduces the company's waiting time. SCM integration consists of sharing information, joint decision-making, and collaborating with partners [17]. Internal integration consists of three dimensions: communication, relationship, and coordination [22]. Measurement items for internal integration and external integration as supply chain integration used by the International Manufacturing Strategy Survey (IMSS) are share inventory level, share production planning, collaborative forecast, Just-in-time replenishment, and consignment stock [5,19].

2.2. Innovation System

Innovation is a creative and interactive process to produce an added value for the new product to meet the customer demand and benefit the company [36]. The process includes finding ideas, adopting new technology, new skills, new techniques, and new management best practices, which require culture changes for better performance [11]. The company's innovation capability is continuously creating new processes, products, and systems to increase operational excellence [14]. The company's ability to innovate in logistics systems can solve emerging problems and adapt quickly to supply chain practices [37]. Innovation is essential for companies to improve performance, reduce operating costs, and increase customer demand sustainably [38]. Organizations need to adjust and align policies and procedures to rapidly develop new processes and products following the ever-changing market orientation [39]. Innovation is important for companies to adapt their products to the market demand [36]. Innovation in small and medium enterprises is carried out by product innovation and process innovation [15].

2.3. Supply Chain Flexibility

Company flexibility is a company's ability to adjust the internal to suit external changes. Supply chain flexibility (SC flexibility) can be defined as a company's ability to adapt the supply chain practices following environmental changes to improve performance. The company's flexibility is determined by the supplier's ability to anticipate a sudden change to support manufacturing to meet customer demands [23,40]. Company flexibility cannot be determined independently, but it requires collaboration with company partners [41]. The flexibility established by the manufacturing company depends on and relates to vendors' flexibility in complying with the delivery time, order size, and volume flexibility [17]. Manufacturing flexibility is a company's ability to make changes related to production levels, create new products frequently, to enhance company competitiveness [22,42]. The company flexibility also refers to coping with customer needs

quickly and effectively and communicating well to suppliers to deliver the raw materials requirement [19].

Supply chain flexibility for retail companies depends on product variations in various sizes, product variations in various types, and responsiveness in producing new products [21]. Supply chain flexibility in Asian manufacturing companies is measured through comparisons with its competitors and measured by volume flexibility and mix flexibility indicators [17]. Supply chain flexibility relates to the company's ability to obtain, process, and send information to help supply chain activities be efficient and effective [9,43]. Manufacturing flexibility is related to customizing products, volume flexibility, mix flexibility, delivery speed, and delivery reliability [19]. Manufacturing flexibility is measured with item machine flexibility, labor flexibility, material handling flexibility, and routing flexibility [22]. Business flexibility in the supply chain strategy includes flexible suppliers, flexible supply contracts, flexible manufacturing processes, flexible products, and flexible pricing [40]. Supply chain flexibility is divided into reactive flexibility and proactive flexibility with measurement items such as manufacturing flexibility, product development flexibility, supply flexibility, and distribution flexibility [9,44].

2.4. Supply Chain Resilience

The disruption caused by a sudden environmental change cannot be controlled by the company [45]. External changes can only be responded to by adjusting the company's internal response [5]. Company trials to return to the new normal are among the supply chain resilience practices [39,46]. The ability to respond to this disruption to survive and exist is also a form of resilience [25,46,47]. The COVID-19 pandemic has caused a disruption event that results in external changes with catastrophic consequences for its sustainability [3]. Resilience is the company's response to survive by paying attention to its internal conditions [45]. The company's ability to involve suppliers and customers in dealing with disruption is called supply chain resilience [24,44]. Companies need to understand the resilience they have against external changes by adjusting their supply chain capacity [16].

Supply chain resilience (SC resilience) in manufacturing companies in Taiwan is measured by the speed at which the company recovers to initial conditions, quickly recovers the relations with partners, maintains control of the business, and obtains new solutions during the disruption period [48].

2.5. Business Performance

The company's performance assessment continues to evolve, and it now incorporates both qualitative and quantitative methods. Firm performance outcomes are derived from the firm's management activities result as a benchmark parameter for evaluating management effectiveness [49]. The company's management is still focused on the company's operational and financial accomplishments. The company's financial performance can be measured by comparing with similar companies that the company is higher than its competitors including market share, return on sales and return on investment [31]. The process of activities within the organization over particular times concerning predetermined requirements generates company results. Companies use regular, weekly, monthly, quarterly, course, and annual accomplishment cycles to monitor organizational efficiency in general. This operation is monitored regularly to determine how the company's operating results are progressing. Operational efficiency is focused on the company to maximize production output by minimizing the use of internal company resources [30].

The corporation performs financial performance assessments in monthly, quarterly, course, and annual cycles, taking into account return on investment, profitability, market share, and sales growth at a more competitive pace. A balance of tangible and intangible indicators is used to assess performance in performance assessment systems. Building a robust supply chain system is unquestionably a key factor in boosting company efficiency [43]. This partnership will help companies increase the efficiency and quality of

manufacturing processes in the supply chain to manufacture goods, manage costs, and improve supplier relationships, all of which influence overall company performance [50]. The assessment of company success is divided into two categories, according to Ince et al. [51], financial performance and market performance. Growing sales profit margins and increasing ROI (Return on Investment) value are two metrics for assessing financial efficiency. Sales growth, market share growth, and other productivity changes are used to assess market success in contrast. Operational performance in manufacture is measured by product/material quality, order fulfillment, customer satisfaction, delivery time, and flexibility [29].

According to Al-Shboul et al. [52], market and financial success are firm performance indicators. The ability to have market share, the ability to have market share growth, and the ability to have revenue growth are all used to evaluate a company's market success. ROI, the company's ability to increase ROI, the company's profit margin, and the company's competitiveness at this time are all used to calculate financial results. Reduced lead time, increased inventory turnaround speed, reduced faulty goods, reduced product returns from consumers, sales levels, cost reduction, and meeting consumer requirements were all metrics used by Chong et al. [49]. In Sharma et al. [53], firm output was measured with its return on investments, sales, and income. Operational performance is measured by quality performance, flexibility performance, delivery performance and customer service performance [20].

The reduction in management costs, lead time, order time, inventory, and the elimination of late delivery are operational success measures [43,54]. Determining delivery accuracy, increased flexibility, capacity to fulfill orders, and increased customer loyalty are some of the organizational efficiency indicators used and customer satisfaction [55]. This research uses non-financial performance data on manufacturing firms to assess company performance. Owing to the high degree of secrecy that manufacturing firms have, collecting financial performance data is difficult.

2.6. Concepts Relationship

2.6.1. Supply Chain Integration and Innovation System

The integration with suppliers will enhance collaboration between the two parties to innovate product, process, and material requirements. Building a culture of innovation by including external partners enables the company to create innovative products and improve global competitiveness [11,36]. New knowledge provided by external partners is essential in maintaining operational continuity through collaboration [56]. Supply chain management (SCM) integration shares information with partners related to ideas, methods, and initiatives to provide added value in the supply chain [13]. As an example, supply chain integration can provide a significant increase in innovation capability at Ghanaian SMEs [33]. Information system integration used in companies can positively support process innovation and product innovation [14,57]. SCM integration between companies and external parties shows the extent to which the established coordination concerning inventory, production planning, forecasting customer demand, tracking orders, and product delivery impact is increasing innovation in new product development [19]. The above argument proposes the first hypothesis as follows:

Hypothesis 1 (H1). *Supply chain integration influences innovation system.*

2.6.2. Supply Chain Management Integration and the Supply chain flexibility

SCM integration between companies and partners can synchronize the supply chain flow [18,58]. SCM integration with suppliers and customers can increase manufacturing flexibility because it provides accurate information in reducing external environmental uncertainty [19,28]. Increased flexibility provides a faster and more precise response [59]. Internal integration, which is shown as cross-functional in manufacturing companies and external integration (supplier integration and customer integration), can provide manufac-

turing flexibility, for example, for Asian manufacturing companies [17]. SCM integration impacts supply chain flexibility in the Chinese food industry because companies can share information with external partners to get fast information about the market [9]. Supply chain integration consisting of supplier integration, internal integration, and customer integration directly impacts supply chain flexibility in the manufacturing and services industry in Malaysia [23]. Sharing information with partners in supply chain management as a form of integration helps companies improve company efficiency and cash flow as a form of operational performance [27,30]. Supply chain integration integrates internal and external systems to enhance fast-moving consumer goods' business performance (FMCG). Based on the above discussion, the second hypothesis is formulated as follows:

Hypothesis 2 (H2). *Supply chain Integration affects supply chain flexibility.*

2.6.3. Supply Chain Integration and Supply Chain Resilience

SCM integration between companies using information technology can share data or information in real-time [59]. Internal integration integrates all internal functions enabling better communication and quick decision-making processes [34,58]. As in a study done in Taiwan, internal integration and customer integration significantly improve supply chain resilience in third-party logistics providers (3PLs), but logistic collaborator integration on supply chain resilience does not significantly affect [47]. Supply chain integration improves supply chain resilience to build supply chain partnerships [24,44]. Companies' information technology can integrate the system to increase its response as a form of supply chain resilience [60]. The internal integration allows sharing of information, while operational integration between organizations increases supply chain resilience in response to disruption [47]. The above argument proposes the third hypothesis below.

Hypothesis 3 (H3). *SCM integration influences the supply chain resilience.*

2.6.4. Innovation system and Supply Chain Resilience

The ability to innovate, supported by a resilient supply chain, enables the company to respond to the new product demand [26]. Innovation in policies, procedures, and implementations adapting quickly to sudden external changes can enhance supply chain resilience [39]. Developing employee competencies in technical, cultural, and operational competence accelerates generating innovations by turning ideas into best practices that impact supply chain resilience [61]. Moreover, the company's product innovation impacts supply chain resilience and improves company performance [62].

Hypothesis 4 (H4). *Innovation system influences the supply chain resilience.*

2.6.5. Supply Chain Flexibility and Supply Chain Resilience

Supply chain flexibility enables the enterprise to cope with changes in an uncertain environment and increase SCM Resilience to overcome volatile markets demand fluctuation [40]. Supply chain flexibility provides the ability to respond to external changes quickly and return to the normal position in the era of current disruption is a form of supply chain resilience [46,60]. Supply chain flexibility helps companies maintain resources and build strategic partnerships to respond to supply and demand to increase supply chain resilience rapidly [48]. Development, production, supplier, logistics, and supply as dimensions of supply chain flexibility were shown to improve manufacturing companies' operational performance in the USA [63]. Based on this argument, the fifth hypothesis is proposed as follows:

Hypothesis 5 (H5). *Supply chain flexibility affects and the supply chain resilience.*

2.6.6. Innovation System and Business Performance

Innovation integrated into the corporate environment will increase product innovation, process innovation, and innovation in procedures, improve business performance, and maintain a competitive advantage, as shown in Taiwan's electronic manufacturing companies [11]. As part of the systems innovation, process innovation can improve supply chain performance because it enhances its efficiency and effectiveness [35,36]. Moreover, product innovation can improve supply chain performance because they produce new products regularly [57]. An innovation system is carried out by simplifying operational processes, setting operational standards, and adopting technology to solve the problems in reducing goods delivery delays and losing customers [37]. As another example, innovation capability has an impact on the performance of Ghanaian SMEs [33]. Process innovation and product innovation in small and medium enterprises impact operational performance by increasing the ability to meet demand, delivery speed, delivery flexibility, and flexibility in changing demand volume [15]. Product innovation in companies can quickly increase supply chain resilience and improve company performance [62]. This description determines the sixth hypothesis as follows:

Hypothesis 6 (H6). *Innovation system affects business performance.*

2.6.7. Supply Chain Flexibility and Business Performance

Reactive flexibility and proactive flexibility are the company's supply chain flexibility in obtaining data and forming it into information to make the right decisions, which can improve operational performance [9,10]. Supply chain flexibility can be a moderating variable in improving financial performance determined by supply chain resilience [48]. Supply chain flexibility optimizes the internal resource usage to maintain competitiveness and improve organizational performance [41]. Supply chain flexibility in the company can increase operational performance [42]. This argument formulates the seventh hypothesis as follows:

Hypothesis 7 (H7). *Supply chain flexibility affects business performance.*

2.6.8. Supply Chain Resilience and the Business Performance

Supply chain resilience is essential to improve business performance, especially its financial performance [25,26]. Supply chain resilience will allow the company to enhance its competitiveness and improve company performance [26]. The study results by Li et al. [48] states that supply chain resilience has a positive and significant impact on financial performance in terms of increasing return on assets (ROA). A case in Taiwan showed that adapting and responding quickly to any obstacles faced by 3PL companies, as a form of supply chain resilience, has a significant impact on service performance in terms of increasing customer satisfaction and problem-solving improvement in 3PL companies [47]. By improving organizations' agility and performing supply chain reengineering, supply chain resilience can increase Taiwan's shipping industry companies' performance [47]. Supply chain resilience returns the company quickly back to its normal position after experiencing a disruption affecting Business Performance, as in the case of the Sri Lankan apparel industry [39]. Based on this finding, the eighth hypothesis is formulated as follows:

Hypothesis 8 (H8). *Supply chain resilience influences the business performance.*

2.6.9. Indirect Relationship between Constructs

The previous discussion showed that many researchers had each found two consecutive constructs' relationship, and eight hypotheses have been formulated (H1 up to H8). Those hypotheses demonstrate the direct relationship between two constructs. Based on the direct relationship between every two consecutive constructs, the indirect relationship

can be hypothesized to reflect the innovation system's mediating role, supply chain resilience, and supply chain flexibility. Following hypothesis H1 and H6, the following ninth hypothesis is proposed as follows:

Hypothesis 9 (H9). *SCM integration affects business performance through innovation systems.*

Based on the similar principle in formulating hypothesis H9, another four hypotheses are developed as follows:

Hypothesis 10 (H10). *SCM Integration influences business performance through supply chain flexibility.*

Hypothesis 11 (H11). *SCM Integration affects business performance through supply chain resilience.*

Hypothesis 12 (H12). *SCM Integration influences business performance through innovation system and supply chain resilience.*

Hypothesis 13 (H13). *SCM Integration affects business performance through supply chain flexibility and supply chain resilience.*

In summary, all constructs relationship and proposed hypothesis are shown in Figure 1.

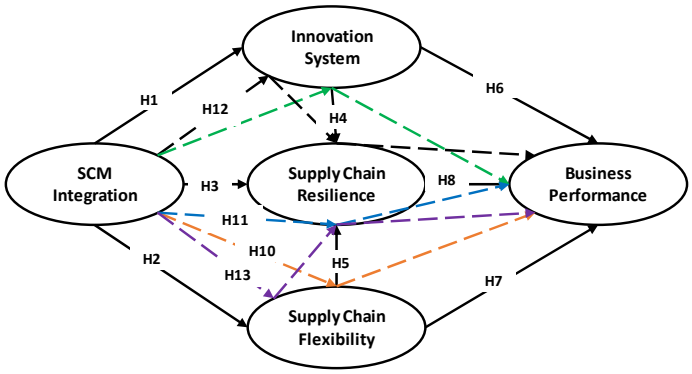

Figure 1. The Research Model and The Related Hypothesis Developed.

3. Methodology

This study uses a quantitative research approach to examine the hypothesis proposed. Five constructs adopted in this study are supply chain integration, innovation system, supply chain flexibility, supply chain resilience, and business performance. Supply chain integration is defined as the extent to which the company integrate with an external partner and is measured using five items, namely, sharing complete product information (SCMI1), involving partners in product development (SCMI2), sharing inventory level (SCMI3), sharing production planning (SCMI4), coordinating with partners (SCMI5) [17,19,22,32,48]. Measurement items for supply chain flexibility consist of five items, namely, production planning flexibility (Fl. Sy1), changes in production processes (Fl. Sy2), volume flexibility (Fl. Sy3), manufacturing flexibility (Fl. Sy4), and product development flexibility [9,21,40,44]. The innovation system measures the extent to which the organization conducts innovation using five items, namely, latest best practice adoption (In.Sy1), continuous product development (In.Sy2), use of technology as needed (In.Sy3), the introduction of new products on an ongoing basis (In.Sy4), and on-time marketing of new products (In.Sy5) [11,15,37,38]. Furthermore, five items measure the supply chain resilience, namely, whether the company can handle sudden changes in customer demand (SCMR1), solve production problems quickly (SCMR2), change production planning

quickly (SCMR3), overcome production material delays (SCMR4), and deal with customer complaints quickly (SCMR5) [25,39,47,48]. The business performance is measured by five items, namely, increased customer satisfaction (Bus.P1), increased company product quality (Bus.P2), increased accuracy of product delivery (Bus.P3), growth in product demand (Bus.P4), and fulfilling customer demand as required (Bus.P5) [15,26,37,39,42,47].

Data collection was done through a questionnaire designed with a five-point Likert scale and distributed via email to manufacturing companies and through WhatsApp groups and other social media. Data collection was carried out in March 2020–December 2020 using a Google Form distributed to companies registered on the Indonesian statistical center agency. The questionnaires were distributed to around 2000 respondents, and each questionnaire completed was rewarded IDR 50,000 as a form of credit assistance in filling out the questionnaire. The sampling technique used the purposive sampling technique approach with predetermined criteria requirements [64], namely, the respondents have been working for the company for at least one year, were permanent employees of the company, and were knowledgeable of the company overview. Of the initial sample of 492, a total of 470 subjects completed and returned the questionnaire (response rate of 95.5%). Hence, as many as 470 questionnaires were considered valid for further analysis. Data analysis used the partial least square (PLS) technique using smartPLS software version 3.0 [65,66]. The profiles of the respondents are indicated in Table 1.

Table 1. Respondent Profile.

Variable	Description	Frequency	Percentage
Gender	Female	246	52.34%
	Male	224	47.66%
Department	Production Department	145	30.85%
	Marketing Department	109	23.19%
	Finance and Accounting Department	69	14.68%
	Warehouse Department	17	3.62%
	Human Resources Department	11	2.34%
	Planning Production Department	60	12.77%
	Purchasing and Supply department	21	4.47%
	Information Department	8	1.70%
	Others	30	6.38%
Length of work	1–3 years	183	38.94%
	3 to 5 years	93	19.78%
	5–10 years	60	12.77%
	More than ten years	134	28.51%
Total manpower	Below 20	204	43.40%
	20–100	134	28.51%
	Above 100	132	28.09%
Average Hours of Work during COVID Era	Less than 4 h	4	0.85%
	4–7 h per day	51	10.85%
	8 h per day or more	415	88.30%

Table 1 shows that there were no significant differences between gender (female and male) who work in certain positions in the Indonesian manufacturing industry. This result revealed that gender is not a precondition to becoming a leader in the company, but it depends on individual capability. The majority of respondents are working in the production and marketing department with 254 respondents (54.04%), followed by the finance and accounting department with 69 respondents (14.68%), and the production planning department with 60 respondents (12.77%). This result indicates that the respondents represented cross-functional in the organization. The highest percentage of respondents' working experience is 2–3 years of work, amounting to 183 respondents (38.94%). This finding shows that those respondents are young and tend to use social media to fill out questionnaires. The second percentage is the group with more than ten years of experience,

at 134 respondents (28.51%), which shows that they have had a good experience. Many of those who have worked for ten years are members of the WhatsApp group with researchers, and there are relationships as college alumni, similarities in hobbies, and others. The number of workers is almost balanced between different company's size involving in this survey (no big difference), which provides a good variance of manufacturing companies in this study. Interestingly, the working hours of 8 h or more applied to 88.30% of the organization. This result shows that during the emergence of the COVID-19 pandemic, Indonesia's manufacturing companies continued to apply eight working hours according to the applicable regulations and only 11.70% had applied less than 8 working hours.

4. Result and Analysis

The first step was to assess the outer model (measurement model) to ensure that each indicator is valid and reliable. An indicator is considered valid when the loading factor value exceeds 0.50, and the factor loading is greater than cross-loading with other variables [65]. Table 2 illustrates the analysis result of factor loading and cross-loading of each indicator. The result demonstrated that the factor loading values are greater than 0.50 (value in bold), and the factor loading is greater than all cross-loading. Hence, those indicators of the variable are considered valid in terms of convergent validity and discriminant validity. Supply chain integration has the lowest factor loading value for item sharing inventory level (SCMI3), of 0.636 > 0.50. Furthermore, the innovation system has the lowest value of 0.759 for the indicator the technology used as needed (In.Sy3), which exceeds 0.50. Supply chain flexibility has the lowest factor loading value of 0.583 > 0.50 for item change in the production process (Fl.Sy2). Similarly, the supply chain resilience indicator with the lowest value at 0.686 is change production planning quickly (SCMR3). The last construct, business performance, has the lowest value of 0.643 for high product quality (Bus.P2). Those findings revealed that all measurement indicators are valid.

Table 2. Indicator validity test result.

Indicators	SCM Integration	Innovation System	Supply Chain Flexibility	SCM Resilience	Business Performance
SCMI1	0.814	0.621	0.571	0.598	0.511
SCMI2	0.742	0.389	0.540	0.481	0.569
SCMI3	0.636	0.215	0.358	0.344	0.443
SCMI4	0.859	0.600	0.588	0.581	0.577
SCMI5	0.809	0.558	0.569	0.499	0.547
In.Sy1	0.563	0.848	0.539	0.594	0.473
In.Sy2	0.484	0.815	0.510	0.596	0.391
In.Sy3	0.485	0.759	0.510	0.567	0.383
In.Sy4	0.573	0.802	0.518	0.665	0.458
In.Sy5	0.521	0.853	0.537	0.652	0.492
Fl.Sy1	0.437	0.531	0.794	0.459	0.439
Fl.Sy2	0.329	0.391	0.583	0.390	0.397
Fl.Sy3	0.516	0.398	0.796	0.463	0.595
Fl.Sy4	0.653	0.563	0.641	0.496	0.478
Fl.Sy5	0.557	0.485	0.867	0.527	0.606
SCMR1	0.562	0.637	0.541	0.786	0.554
SCMR2	0.511	0.557	0.489	0.784	0.540
SCMR3	0.394	0.498	0.427	0.686	0.368
SCMR4	0.491	0.591	0.436	0.687	0.392
SCMR5	0.453	0.491	0.435	0.733	0.553
Bus.P1	0.332	0.364	0.424	0.543	0.675
Bus.P2	0.427	0.295	0.363	0.389	0.643
Bus.P3	0.437	0.361	0.501	0.461	0.637
Bus.P4	0.599	0.486	0.594	0.483	0.809
Bus.P5	0.607	0.394	0.532	0.464	0.775

Reliability is another measurement for the extent to which the block of indicators measures the variable consistently. Table 3 illustrates the reliability test result for each construct in three measurements terms: Cronbach's Alpha, Composite Reliability, and Average Variance Extracted (AVE).

Table 3. Reliability, R^2, and Q^2 Test Result.

Variable of Research	Cronbach Alpha	Composite Reliability	AVE	R^2	Q^2
Supply chain management integration	0.834	0.882	0.602	-	-
Innovation system	0.874	0.909	0.666	0.417	0.274
Supply chain flexibility	0.791	0.858	0.553	0.474	0.246
Supply chain resilience	0.789	0.855	0.543	0.632	0.337
Business performance	0.753	0.835	0.506	0.560	0.276

The block of indicators is considered reliable when the Cronbach's Alpha > 0.70, composite reliability > 0.70, and AVE > 0.50 [66]. Table 3 reveals that the lowest Cronbach alpha value is 0.753 related to the business performance, and the lowest composite reliability value is 0.835, also related to the business performance, while the average variance extracted (AVE) value is above 0.500 for all variables. Based on this finding, all indicators are considered reliable, and further analysis is allowed. The value of R^2 denotes the extent to which independent variables explain the variance of dependent variables. The closer the value of R^2 to 1.0, the more variance of the dependent variable is explained by the independent variable. Table 4 illustrates the value of R^2 for all dependent variables. Business performance has an R^2 value of 0.560, which means that 56% of business performance is explained by four other variables simultaneously: supply chain management integration, innovation system, supply chain flexibility, and supply chain resilience. Another measurement necessary is to examine if the research model has a qualified predictive relevance referring to the predetermined requirement. The predictive relevance is expressed in Q^2, and the result is provided by the analysis using the PLS technique. A research model is considered qualified to predict the value of the dependent variable when the value of Q^2 is greater than 0.0. Table 3 shows the value of Q^2 for each dependent variable of research and all values were greater than zero. This result indicates that the model has a qualified predictive relevance.

Table 4. Direct and Indirect effect test result.

Hypothesis	Path Coefficient	*t*-Value	*p*-Values
SCM Integration → Innovation system (H1)	0.646	18.365	0.000
SCM Integration → Supply chain flexibility (H2)	0.688	20.248	0.000
SCM Integration → SC Resilience (H3)	0.222	4.842	0.000
Innovation system → SC Resilience (H4)	0.514	10.914	0.000
SC Flexibility → SC Resilience (H5)	0.153	3.164	0.002
Innovation system → Business Performance (H6)	−0.079	1.119	0.264
SC Flexibility → Business Performance (H7)	0.471	9.439	0.000
SC Resilience → Business Performance (H8)	0.421	7.226	0.000
SCM Integration → Innovation system → Business Performance (H9)	−0.051	1.122	0.262
SCM Integration → SC Flexibility → Business Performance (H10)	0.325	7.758	0.000
SCM Integration → SC Resilience → Business Performance (H11)	0.093	3.568	0.000
SCM Integration → Innovation system → SC Resilience → Business Performance (H12)	0.140	6.539	0.000
SCM Integration → SC Flexibility → SC Resilience → Business Performance (H13)	0.044	2.898	0.004

Further analysis was done to examine the predetermined hypotheses. The analysis is based on the significant level of 5% or the critical *t*-value of 1.96, or the *p*-value of 0.05. The hypothesis is empirically supported when the *t*-value exceeds 1.96 or the *p*-value less than 0.05 [66]. Figure 2 illustrates the research model and the analysis result using smartPLS software. Table 4 also demonstrates the analysis result from the direct effect reflected in hypothesis H1 up to H8 and indirect effect reflected in hypothesis H9 up to H13.

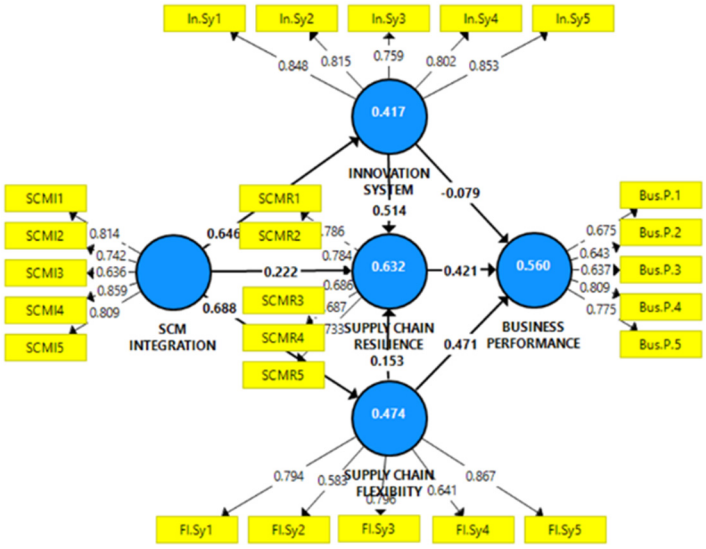

Figure 2. Research Model and Analysis Result.

As shown in Table 4, all *t*-values > 1.96 and *p*-value < 0.05 except for hypothesis H6 for *t*-value < 1.96 and H9 for *t*-value of 1.122 < 1.96.

As determined previously, there are thirteen (13) hypotheses developed, and eleven (11) hypotheses were empirically supported with the *t*-values > 1.96, while two hypotheses (H6 and H9) were rejected with a *t*-value is 1.119 < 1.96 and 1.122 < 1.96, respectively. As shown in Table 4, those hypotheses consist of two groups: the direct effect (H1–H8) and the indirect effect or mediating role of the intervening variable (H9–H13).

5. Discussion and Managerial Implication

The results show that supply chain integration improves the innovation system in the company (H1). This result agrees with a previous study that supply chain management integration could improve innovation systems [11,13,19,33,58]. By sharing complete information with partners, supply chain integration enables the organization to perform innovations such as new product development, process innovation, and information technology application. The organization requires a new idea or part from the supplier to develop a customer's new product. The supply chain management information is possible when the companies have implemented information technology that enables the internal integration between departments and external integration with suppliers and customers.

The second hypothesis (H2), that supply chain integration affects the supply chain flexibility, was supported by the data. This result shows that when the company shared complete product information and production planning with internal cross-function and external partners could increase the company's flexibility, which is called supply chain flexibility. This research supports the research statement that supply chain integration can increase supply chain flexibility [9,17,19,23,27,60]. The third hypothesis (H3), that supply chain integration affects supply chain resilience, as expected, is also supported by data. This result confirmed the previous study by [47,48,61]. This study supports research stating that supply chain integration can improve supply chain resilience by easily responding to sudden changes. The integration with partners allows the company to coordinate and share the information in market demand changes. Since the company has

integrated information systems internally and externally, it enables all parties to cope with changes such as production planning and material requirement, and order fulfillment. This information sharing and coordination between parties enables the supply chain to respond to the demand changes quickly.

The fourth hypothesis (H4), stating that the innovation system affects supply chain resilience, is supported by this research. This study supports previous research results, stating that innovation systems continuously improve supply chain resilience [26,39,62]. The company can innovate rapidly to develop new products and adjust the internal processes to respond to customer demand changes. Quick response to recover to the normal situation is a form of supply chain resilience goals. The fifth hypothesis (H5), that supply chain flexibility affects supply chain resilience, is accepted in this study. This result agrees with previous research that supply chain flexibility supports supply chain resilience [40,46,49,61,64]. The flexibility in product development and volume changes will respond to sudden changes in customer demand. A company's ability to respond to changes quickly is the main goal of supply chain resilience.

In contrast to earlier findings [11,15,33,37,58], this study does not support the sixth hypothesis (H6), stating that innovation system affects business performance. This finding shows that the innovation system in developing new products and upgrading the business process does not directly affect business performance. However, this finding is considered reasonable in the context of the research model. Innovation is conducted by the internal process, while business performance is how the customers are satisfied after the product or services are received and enjoyed by the customer. This argument means that the product should be delivered and received by the customer through supply chain responsiveness. Innovation systems can improve business performance through the mediating role of supply chain resilience to respond to customers' demand. This research can support previous research results that state that innovation systems can improve business performance through supply chain resilience [49,62].

Furthermore, the seventh hypothesis (H7), that supply chain flexibility affects business performance, is also supported. Supply chain flexibility can fulfill product demand following product variety and volume fluctuation to improve company performance. This finding is in line with previous studies stating that supply chain flexibility can improve business performance [9,41,42,49]. The flexibility is a key success factor in responding to high uncertainty during the COVID-19 pandemic era. The pandemic can disrupt the customer demand and material supply at any time as the pandemic exists and even worsen. Hence, the company has no choice other than to be flexible and responsive to the customer demand and material supply uncertainties. As discussed before, flexibility is possible when the company has established the integration with all partners from supplier, distributor, and retailer.

The eighth hypothesis (H8), that supply chain resilience affects business performance, as expected, is confirmed in this research. This study also supports the previous research results that supply chain resilience affects business performance [25,26,39,47,49]. When the company can respond to any change in customer demands such as new product variety, volume fluctuation, and time constraints, the customer will appreciate and dispose of paying it premium and becoming a loyal customer. The ability to cope with sudden customer demand changes and solve production problems quickly increase product demand growth and customer satisfaction. As discussed previously, the current COVID-19 pandemic has caused extreme uncertainty in all business sectors. The company should be able to respond to any uncertainty by practicing a resilient supply chain to survive.

In addition to the direct effect, this study has developed the indirect effect hypothesis through the intervening variable. The ninth hypothesis (H9) states that supply chain integration affects business performance through innovation systems, which is not supported in this study. However, it is reasonable that the hypothesis is rejected because the innovation system itself does not directly affect business performance (H6). Consequently, the innovation system does not mediate the impact of supply chain integration on busi-

ness performance. Why the innovation system does not directly improve the business performance has been discussed previously. The tenth hypothesis (H10), that supply chain integration affects the business performance through supply chain flexibility, is supported. As expected, the mediating role of supply chain flexibility is supported. Supply chain integration in terms of information sharing, production planning, and involving the supplier in new product design will improve the supply chain flexibility in terms of deliveries, volume, time, and planning. Subsequently, this flexibility improves the business performance in terms of delivery as requested and improved customer demand fulfillment. Further, the eleventh hypothesis, that supply chain integration improves business performance through supply chain resilience, is supported. Since supply chain integration improves supply chain resilience and supply chain resilience improves business performance, supply chain integration indirectly improves business performance through supply chain resilience (H11). In this case, this study demonstrated the adoption of supply chain integration and establishing a resilient supply chain provide multiple impacts of the supply chain integration on the business performance.

Moreover, the twelfth hypothesis (H12), which states that supply chain integration improves business performance through innovation and supply chain resilience, is confirmed by this study. This finding proves that innovation supported by the resilient supply chain provides support to improve the business performance. Innovation provides the new product and process, and the resilient supply chain delivers the product to customers even in the extreme uncertainties during the pandemic era. The last finding of this study, hypothesis (H13), that supply chain integration enhances the business performance through supply chain flexibility and resilient supply chain, is supported as predicted. The supply chain integration enables the company to develop a resilient and flexible supply chain. This finding proved that flexibility and resilience are two key success factors to cope with changes and uncertainties caused by the pandemic. However, it is impossible to practice resilience and flexibility without integration with suppliers, distributors, and retailers. In this case, supply chain integration is the main enabler to establish and practice a resilient and flexible supply chain to enhance business performance.

This research gives companies practical contributions to make continuous updates to information technology systems to form internal integration and external integration as a form of supply chain integration. The company's ability to manage integration will provide a fast response to the company's supply chain flexibility, resilience, and innovation system in a pandemic era. Supply chain flexibility and resilience and a robust innovation system allow the company to anticipate sudden changes quickly. The company should practice reliable innovation systems and adaptation flexibility to overcome disruption and improve business performance.

This study's findings can be highlighted in regards to the previous studies referred to in this research. The study has developed 13 hypotheses to be examined. Eight hypotheses concern the direct effect, while the rest concern the indirect effect. The direct effect hypotheses are based on the previous studies, while the indirect hypotheses were based on the direct effect hypotheses developed in the literature review section. Eleven (11) hypotheses were supported, while two hypotheses were not supported. The sixth hypothesis (H6), stating that innovation system affects the business performance, is not supported in this study. Consequently, hypothesis H9, which states that supply chain integration indirectly affects business performance through the innovation system, is not supported. This finding contradicts the previous study, which states that an innovation system affects business performance [12,23,43,48]. As defined previously, the innovation system is the extent to which the organization performs innovation measured with five items, namely, latest best practice adoption (In.Sy1), continuous product development (In.Sy2), use of technology as needed (In.Sy3), the introduction of new products on an ongoing basis (In.Sy4), and on-time marketing of new products (In.Sy5). Meanwhile, the business performance is assessed using five indicators, namely, increased customer satisfaction (Bus.P1), increased company product quality (Bus.P2), increased accuracy of product

delivery (Bus.P3), growth in product demand (Bus.P4), and fulfilling customer demand as required (Bus.P5). Based on the indicators used, the innovation reflects how far the company innovates their product regarding product variation, usage of new technology, and on-time new product introduction. The innovation cannot directly enhance customer satisfaction, delivery, demand growth, and fulfillment. However, it does not mean that innovation is unnecessary. This study's finding indicated that a resilient supply chain should support the innovation's output, such as a new product to deliver it to the customer in the current crisis. During the pandemic, the people spend most of their time at home, and also the people have less money to spend due to unemployment, lockdown, social distancing, and traveling bans in many places. Based on this argument, it is reasonable that supply chain resilience and flexibility become key success factors for manufacturing companies. This finding, therefore, is essential as a new insight for the manufacturing management that, today, a resilient supply chain is highly required to survive and improve business performance. This study provides a managerial implication that the management should emphasize the improvement of supply chain integration to enable innovation, supply chain resilience, and supply chain flexibility to pursue better business performance during the current pandemic.

This work has some limitations, particularly in respect of the population and the variable involved. Further studies on the current topic are suggested to involve the variable such as supply chain risk management and customer relationship management to cover broader parties and functions involved in the supply chain network.

6. Conclusions

This study has investigated the effect of supply chain integration on business performance with the mediating effect of supply chain flexibility, innovation system, and resilient supply chain. The results indicated that, of thirteen hypotheses developed, twelve hypotheses were supported, and two hypotheses were rejected in this study. Supply chain integration affects innovation system (H1), supply chain flexibility (H2), and supply chain resilience (H3). Furthermore, innovation system improves supply chain resilience (H4), supply chain flexibility affects supply chain resilience (H5), innovation system does not affect business performance (H6), supply chain flexibility improves business performance (H7), and supply chain resilience improves business performance (H8).

Meanwhile, in the indirect effect, the innovation system did not mediate the influence of supply chain integration on business performance (H9), but through innovation and supply chain resilience, supply chain integration could improve the business performance (H12). Moreover, supply chain integration also indirectly affects business performance through supply chain flexibility (H10) and supply chain resilience (H11). The last finding indicated that supply chain integration improves business performance through supply chain flexibility and supply chain resilience.

This research has highlighted the importance of supply chain integration in supporting innovation, flexibility, and resilience to improve business performance. The collaboration of all parties in supply chain integration enables all parties to plan, produce, deliver, and share information. However, each party also should be committed to being resilient, flexible, and innovative. The present findings have important implications for solving the uncertainties and disruption caused by the COVID-19 pandemic. This research gives companies practical contributions to make continuous updates to information technology systems to form internal integration and external integration as a form of supply chain integration. The company's ability to manage integration will provide a fast response to the company's supply chain flexibility and innovation system in a pandemic era. Supply chain flexibility, supply chain resilience, and a robust innovation system enable the company to anticipate sudden supply and demand changes quickly. The company should practice reliable innovation systems and best practices in a resilient and flexible supply chain to overcome disruption and improve business performance. This study could contribute to the current research in the field of supply chain management theories.

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