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Managing Nature 5.0: The Role of Digital Technologies in the Circular Economy

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Building on my 2019 editorial note from last year on managing nature 5.0 in the industrial revolution 4.0 and society 5.0 era, I would like to expand our discussion on how the concept can be a booster for the circular economy. Innovative digital technology supported by a human-centered society is required to balance our economic advancement and environmental regeneration. Nature has provided us with useful resources that speed up the growth of our industries and economies and their shift toward sustainability. The well-being of our future will be dependent on how we can produce technology that can govern our climate, health, social equity, and stability.

The circular economy is defined as a redesign of industrial systems to make them restorative and regenerative. The system aims to eliminate waste and continually use resources by reusing end life-cycle products and product waste, and recycling them for other uses or as regenerative resources for nature. As such, the circular economy becomes a systemic economic approach that contributes to the environment and yields society-wide benefits.

Managing Innovation in the Circular Economy

Innovation thus plays an important role in the development and implementation of the circular economy in which all production and consumption chains must be effective and efficient. Digital technologies increase production and resource efficiency in order to contribute to business performance improvement.

The digital technologies, such as big data, artificial intelligence, internet of things, 3D printing, and machine learning, could be used to improve project, product, and service delivery in different industries and to create value added. The technologies should be created to support economic and social development goals, such as economic, social, health, education and environmental sustainability.

The technologies have been used to enhance productivity, increase the quality of education, enhance quality of life, and promote healthy lives for everyone. For example, we are using technology to tackle global challenges, such as for Covid-19 pandemic-related health improvement and virtual activities. Furthermore, the cities are more sustainable in terms of providing economic resource sharing, autonomous mobility systems, zero-emission industrial products, recycling materials and food organic urban to name few. Digital technology solutions can be used to integrate circular economy principles from the

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design stage to the post construction/manufacturing stage. The technological revolution has made it possible to transform entire systems of production, management, and governance into more effective and efficient systems in connected societies. With current advances, digital technology has the power to support the circular economy by increasing productivity, efficient and effective resource usage, and the digital ecosystem.

The creation of new technologies that foster research and stimulate innovation is thus required. These processes can be boosted by strengthened knowledge sharing and collaboration among stakeholders in both national and international contexts. The plans and execution actions to achieve the circular economy require strong collaboration from various stakeholders. Governments need to produce robust policy and legal frameworks for implementing the economic system by providing incentives as well as mitigating barriers, business industries need to produce added value via eco-friendly products and services, and society requires positive behaviors in terms of utilizing recycling products and waste reduction. Intensive collaboration in private and public partnerships will accelerate appropriate and sustainable technology development, scale-up, and transfer in order to generate more social benefits and reduce environmental impacts alongside economic returns.

Enhancing Scientific and Technological Capacity

Technologies have been invented to improve project, product, and service performance for our benefit. In this edition, we are pleased to present 20 papers dedicated to the study of various technological design and management areas as a way to foster sustainable technological development to improve product/project/service performance and end results.

The first paper, written by M.E. Nenni, V. Di Pasquale, S. Miranda, and S. Riemma, investigates the use of drones in emergency medical services (EMS) to improve response times. The authors argue that a drone-integrated service drastically improves response time compared to the traditional service and does so at a viable cost.

The second paper, written by T. Kudryavtseva, N. Kulagina, A. Lysenko, M.A. Berawi, and A. Skhvediani, proposes a method to assesses the level of cluster structure development by considering cluster transformation analysis in the information and communication sectors of the Russian regional economy, prerequisites for cluster formation, and the current level of digital cluster development in the region. The authors argue that the method can be used to compare clusters from different regions and monitor their development.

The third paper, written by S.S. Abdulameer, N.A. Yaacob, and Y.M. Ibrahim, measures the supply chain, the Leagile supply chain (LASC), and information sharing (IS) as well as their impacts on supply chain performance (SCP). Based on case studies in manufacturing industries, the authors argue that valid and reliable measurements have been developed to evaluate LASC, IS, and SCP.

The fourth paper, written by D.L. Widaningrum, I. Surjandari, and D. Sudiana, analyses land use changes in tourism development areas, particularly in cultural World Heritage Sites (WHS). The authors argue that land use changes have resulted in significant increases in the size of built-up areas from year to year and encounter significant changes from croplands to built-up areas, including cultural WHS.

The fifth paper, written by S. Deepradit, P. Ongkunaruk, and R. Pisuchpen, presents a tactical procurement plan for an aromatic coconut manufacturer. The authors argue that the stochastic model helps factories and farmers evaluate the price, supply quantity, and demand uncertainties and organize it to respond optimally.

The next paper, written by S. Candra, F. Nuruttarwiyah, and I.H. Hapsari, presents the technology acceptance model with e-trust for peer-to-peer lending. The authors argue that the dimensions of e-trust contribute to determining the perceived usefulness, perceived ease of use, attitude toward adopting peer-to-peer lending fintech services, and the intention to use peer-to-peer lending applications.

The seventh paper, written by S.Y. Baper, M. Khayat, and L. Hasan, provides a framework for testing material effectiveness (i.e., thermal, availability, waste, and toxicity) and its impacts on shifting to regenerative architecture. The authors argue that material selection plays a significant role in reducing energy consumption and toxicity levels that result from moving from architectural design towards regenerative design.

The eighth paper, written by A. Abed and M. Yakhlef, proposes a flexible strategy for brownfield regeneration to encourage implementation efforts. The authors argue that the strategies require collaboration between stakeholders and highlight the policy is to adopt a management strategy to expedite the sustainable development of brownfield sites.

The ninth paper, written by S. Pramono, W.A. Prakoso, S. Rohadi, D. Karnawati, D. Permana, B.S. Prayitno, A. Rudyanto, M. Sadly, A.P. Sakti, and A.Y. Octantyo, investigates the ground motion and local site characteristics of the Lombok earthquake sequence. The authors highlight the importance of actual motion characteristics and the limitation of the site class system in providing necessary predictive information.

The tenth paper, written by M.S. Perdani, M.D. Juliansyah, D.N. Putri, T.S. Utami, C. Hudaya, M. Yohda, and H. Hermansyah, investigates cholesterol oxidase immobilization in chitosan magnetite material for biosensor application. The authors argue that optimum conditions for the oxidation reaction were achieved with an immobilized enzyme at a 2 mg/mL concentration.

The eleventh paper, written by B. Irawan, A. Darmawan, A. Roesyadi, and D.H. Prajitno, improves reaction selectivity with NaOH charges and reaction time in the medium consistency oxygen delignification process. The authors argue that higher NaOH charges enhance the delignification rate and that, based on variations in the NaOH charge, reaction selectivity decreases according to increases in the NaOH charge.

The twelfth paper, written by H.T.B.M. Petrus, A.D.P. Putera, I.P. Wangi, M.A. Ramadhian, H. Setiawan, and A. Prasetya, examines the characterization of nitrogen release in modified controlled-release fertilizer using rice husk biochar. The authors argue that their models increase the fertilizer's ability to hold nitrogen longer than pure fertilizer and meet the need for nitrogen in plantations.

The thirteenth paper, written by D. Tristantini, B. Elya, S. Robbani, and L.L. Santoso, tests herbs for pH stability and bacterial count using the total plate count (pour plate) method by varying the temperature and duration storage for 48 hours. The authors argue that the pH value of anti-atherosclerosis herbs was constant (pH 5.7–5.6) for 48 hours in the refrigerator and 6 hours at room temperature.

The fourteenth paper, written by B. Davron, M. Mukhtar, K. Nurbek, X. Suyun, and J. Murod, investigates the interaction characteristics of an anion-exchange resin PPE-1 formed using phosphonic acid and granular polyvinyl chloride. The authors argue that the synthesis shows strong coordination bonds of copper(II) ions with functional groups in the polyampholyte.

The fifteenth paper, written by I. Trisnawati, G. Prameswara, P. Mulyono, A. Prasetya, and H.T.B.M. Petrus, discusses sulfuric acid leaching of heavy rare earth elements (HREEs) from zircon tailing. The authors argue that the optimum point of leaching experiments occurs at 0.5 M H_2SO_4, 60°C, and a solid-to-liquid (S/L) ratio of 10 g/100 mL.

The sixteenth paper, written by H. Desvita, M. Faisal, Mahidin, and Suhendrayatna, determines the effectiveness of chitosan (ch) combined with liquid smoke (Ls) as an edible coating for beef preservation. The authors argue that edible coatings made from a combination of ch and liquid smoke can serve as alternative beef preservatives.

The seventeenth paper, written by A. Hasan, M. Aznury, I. Purnamasari, M. Manawan, and C. Liza, examines the curing characteristics and physical properties of natural rubber composites using modified clay filler. The authors found a significant increase in tensile strength and changes in hardness, modulus, tear strength, and compression due to the modification.

The eighteenth paper, written by S. Yudha S., A. Falahudin, Asdim, and J.I. Han, examines the utilization of dammar gum as a soft template in titania synthesis for photocatalysts. The authors argue that the obtained product is effective as a photocatalyst in rhodamine degradation under sunlight irradiation.

The nineteenth paper, written by Y.D.I. Siregar, E. Saepudin, and Y.K. Krisnandi, investigates the one-pot reaction conversion of delignified sorghum bicolor biomass into levulinic acid using a manganese metal base catalyst. The authors argue that the sorghum stem conversion using the catalyst leads to a higher percentage yield of levulinic acid.

The last paper, written by D. Paroka, investigates yaw motion stability and the course-keeping ability of a ro-ro ferry through an analysis of the characteristic alteration of the eigenvalues obtained in a steady state maneuvering equilibrium. The author argues that the limit cycles are stable for wind velocities between 0.34 and 1.95.

I hope that this edition of IJTech conveys some new insights into the way we conduct our research. I am pleased to accept and respond to any comments or enquiries you may have on the direction and content of IJTech, and I invite you to join us in this venture by sending your work for consideration.

With warmest regards from Jakarta,

Dr. Mohammed Ali Berawi
Editor-in-Chief