RESKILLING AND UPSKILLING FOR CIRCULARITY: TALENT MANAGEMENT STRATEGIES TO UNLOCK SMART CIRCULAR ECONOMY OPPORTUNITIES IN THE DIGITAL AGE

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ABSTRACT

In the era of digitalization, reskilling and upskilling are pivotal in facilitating the realization of circular economy prospects through the amalgamation of digital technologies and circular economy principles. The integration of Industry 4.0 technologies has the potential to facilitate the execution of circular economy methodologies, particularly for small and medium enterprises, by utilizing digital instruments to bolster the circular transformation. Research indicates how digital technologies, such as artificial intelligence, big data analytics, and the Internet of Things, can enhance circular design principles, resulting in decreased wastage and enhanced material recycling rates in sectors like construction. Moreover, a comprehensive examination of existing literature underscores the significance of deploying diverse digital technologies throughout the product lifecycle to effectively implement circular economy tactics, advancing goals like resource optimization, prolonged product durability, and loop closure. Hence, talent management approaches that concentrate on enhancing the digital and circular economy proficiencies of employees are imperative for fully capitalizing on the potential of the intelligent circular economy model and fostering sustainable innovation and advancement in enterprises. Study literature review, Firstly, this study was focused on the whole articles that had been published from 2016 to 2024; all of which were in published semanticscholar.org. Secondly, this study was devoted to investigating a number of articles that focused primarily on human resources in the smart circular economy in the digital age. Thirdly, various parameters were used as foundations for content analysis. To enhance knowledge on human resources in smart circular economy paradigm, researchers and practitioners are advised to: (i) Skills and Competencies, (ii) Learning and Development (iii) Learning and Development (iv) Change Management

Keywords: Smart circular economy paradigm, digitalization, literature review, human resource, sustainability

1. Introduction

The prevailing linear economic model of "take-make-dispose" has proven unsustainable, depleting finite natural resources, generating excessive waste, and exacerbating environmental degradation. In the face of escalating ecological crises, such as climate change, biodiversity loss, and resource scarcity, a fundamental transformation of our economic systems is imperative. The circular economy paradigm emerges as a promising solution, offering a restorative and regenerative model that keeps materials and products at their highest value for as long as possible through intentional design, innovative business models, and closed-loop systems (Kottmeyer, 2021).

Despite the conceptual appeal of the circular economy, its large-scale implementation has been hindered by various systemic barriers, including entrenched linear thinking, technological limitations, and inadequate infrastructure. However, the rapid proliferation of digital technologies presents unprecedented opportunities to overcome these barriers and catalyze the transition towards a circular economy. The convergence of disruptive innovations, such as the Internet of Things (IoT), big data analytics, artificial intelligence (AI), blockchain, and digital platforms, is enabling novel approaches to product design, manufacturing, logistics, and consumption models that could unlock the transformative potential of circularity. Digital technologies enable circular economy transition for sustainable development goals. Circular economy tools like life cycle costing support smart digitalization (Hoosain et al., 2020). Digital technologies enable circular economy implementation through smart solutions.

The application of the circular economy in human resource management practices results in a significant reduction in the need for natural resources. By utilizing principles such as recycling, efficient use, and sustainable renewal, organizations can optimize the use of human resources and reduce dependence on finite natural materials. This not only enables greater operational efficiency, but also supports efforts to preserve the environment and reduce negative impacts on the global ecosystem. As a result, the circular economy opens up opportunities for more sustainable and environmentally-friendly human resource management practices (Bombonatti Filho, 2023).

HR practices crucial for competitive advantage and business performance. HRM capability can help achieve superior business performance. Human resource management practices play an important role in achieving competitive advantage and superior business performance. Human resource management capabilities can help achieve superior business performance (Turulja & Bajgorić, 2016).

Human capital crucial for digital economy development. Training specialists for digital economy enhances innovation and growth (Yurina, 2019). Human capital plays a vital role in fostering the development of the digital economy. Providing specialized training for digital economy professionals contributes significantly to fostering innovation and fostering growth within this sector.

Firstly, this study was focused on the whole articles that had been published from 2016 to 2024; all of which were in published semanticscholar.org. Secondly, this study was devoted to investigating a number of articles that focused primarily on human resources in the smart circular economy in the digital age. Thirdly, various parameters were used as foundations for content analysis.

2. Literature Review

Metallurgical Internet of Things (m-IoT) enables circular economy through digitalization. Digital technologies optimize resource efficiency and sustainability in circular economy (Reuter, 2016). Circular economy model involves reusing, recycling, and sharing materials/products. Digital technologies enhance eco-friendly practices, supporting sustainable manufacturing and purchasing (Khan, 2022).

IoT, machine learning, robotics enhance circular economy through digitalization. Digital technologies optimize supply chain systems for sustainability and efficiency (Romagnoli et al., 2023). IoT, machine learning, robotics enhance circular economy through digitalization. Digital technologies optimize supply chain systems for

sustainability and efficiency (Trevisan et al., 2021). Digital technology crucial for circular economy transformation and sustainability. Smart digital solutions optimize resource use and enable collaboration. Linear economy model is no longer viable, transition to circular economy needed. Digital technology plays crucial role in enabling circularity and sustainability (Shirazi, 2023).

Digital technologies crucial for sustainable circular business models. Smart technologies like IoT, AI, big data enhance circularity. Study confirms close connection between digitalization, sustainable development, and circular economy. Identifies set of digital technologies for sustainable circular business models. Digital Technologies and Circular Value Chains for Sustainable Development. Construction industry is a major consumer of resources and producer of waste. Digital technologies have potential to support circular economy in AEC industry (Kovacic et al., 2020).

Circular economy and digital technologies support environmental efficiency in buildings. Digitalization and smart technologies enhance material- and eco-efficiency in construction. Building sector can address environmental challenges through circular economy and digital technologies. Circular practices and digital technologies can achieve higher environmental benefits. Digital technologies enable circular economy through smart product management. IoT and blockchain support circular management of electronic equipment (Magrini et al., 2021).

3. Research Method

This article focuses on conducting a literature review and constructing a conceptual framework. In order to fill the research gap, a literature review was conducted on the emergence of the smart circular economy paradigm, following the procedures outlined in Figure 1. Specifically, scholarly articles addressing the convergence of the circular economy and digitization were sought on the semanticscholar database. The term 'circular economy' was paired with various terms related to digitalization, such as 'digital technologies,' 'smart,' and 'digitalization.' The search was executed in Februari 2024 and updated in May 2024. The search strategy title-abs-key ('circular economy') AND title-abs-key ('digital technologies' OR 'digitalization' OR 'smart'). Title-abs-key Human Resources OR Labor market OR Labor market OR talent). Resulted in retrieving 80 documents. Initially, a screening process eliminated articles not in English. Moreover, a crucial determination was made concerning the article type: due to the scholarly essence of the study, only articles published in international, peer-reviewed scientific journals were included to ensure publication quality. Thus, conference proceedings and book chapters were excluded at this stage. Out of the initial pool, 73 articles progressed to the next phase, which involved reviewing titles and abstracts to assess article eligibility. Considering the research aim of defining, describing, and conceptualizing the smart circular economy paradigm for the manufacturing sector, the focus was solely on research articles presenting such definitions or conceptualizations. Following this stage, 53 documents were retained. The same inclusion criterion was applied during the full-text evaluation, resulting in a final selection of 20 documents forming the foundation of this study.
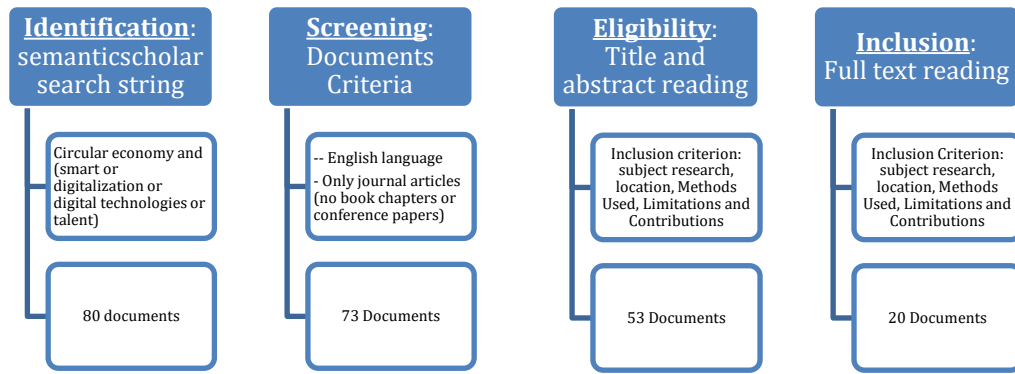
Figure 1. Literature Review methodology.

Building upon prior research (Bressanelli et al., 2022), a definition of the emerging smart circular economy paradigm is presented, along with a framework that encompasses the fundamental concepts that underpin it. The objective is to utilize this framework for the purpose of delineating and recommending human resource role and impacts of digital technologies in realizing sustainability within the smart circular economy paradigm. In order to validate the framework and exhibit its utility, a decision was made to apply it to the seven articles featured in the special edition, 'Circular Economy in The Digital Age'. Ultimately, drawing from the literature review and the application of the framework, potential avenues for research are outlined to propel the scholarly discourse on how organizations can exploit digital technologies to transition towards the smart circular economy paradigm.

4. Results and Discussion

4.1 Using the framework to the seven submissions in the "Circular Economy in the Digital Age" special issue of Sustainability.

Table 1. Using the framework to the seven submissions in the "Circular Economy in the Digital Age" special issue of Sustainability.

Article		Year	Subject Research
Circular Economy Models in Industry: Developing a Conceptual Framework	(Khan, 2022)	2022	The study's main topic is creating a conceptual framework for circular business models in the mining sector, with a particular emphasis on the production of metals, power, and coal. By taking into account the cyclical nature of goods and materials at every level of production, the research seeks to optimize these flows, with particular emphasis on cutting production costs, broadening the product offering, enhancing sustainable development metrics, and boosting business value. The efficiency of circular models is examined, and fundamental circular models are modified to fit the operating environment of coal firms through the use of an interdisciplinary approach. Russian coal firms can create company strategies and long-term development plans using the suggested conceptual framework.
Open strategy and dynamic capabilities: A framework for circular economy	(Rocca et al., 2020)	2023	The research subject of the paper is the intersection of the circular economy and the strategy literature.

business models research			
Fashion Digital Transformation: Innovating Business Models toward Circular Economy and Sustainability	(Magrini et al., 2021)	2023	The research subject of the paper is the intersection of the circular economy and the strategy literature.

4.2 Advancing the smart circular economy paradigm: Move the focus from single organizations to the entire ecosystem of stakeholders.

This research agenda covers various aspects of human resource management in the context of the smart circular economy, including skills and competencies, talent acquisition, learning and development, change management, and collaboration and partnerships. The research questions aim to address the challenges and opportunities posed by the circular economy transition, while the research methods suggest a combination of qualitative and quantitative approaches, including literature reviews, interviews, surveys, case studies, pilot programs, and experiments.

The potential sources listed provide a starting point for researchers to explore relevant literature, reports, case studies, and industry insights from various organizations, academic journals, and practitioner publications. By leveraging these sources and conducting further research, organizations and researchers can gain valuable insights and develop strategies to build a skilled and adaptable workforce capable of thriving in the smart circular economy of the digital age.

Therefore, we encourage future research to examine more closely how human resources in digitalization provide a higher level of transparency through data exchange between organizations, leading to communication of performance and sustainability benefits. organizations, leading to the communication of performance and sustainability benefits.

Research Area	Research Questions	Research Methods	Potential Sources
Skills and Competencies	- What are the key skills and competencies required for a circular economy workforce in the digital age - How can these skills be effectively identified, assessed, and developed? - What role can digital technologies play in upskilling and reskilling programs?	- Literature reviews- Job analysis- Competency mapping- Interviews with industry experts- Surveys with organizations- Case studies of best practices	- Reports from organizations like the Ellen MacArthur Foundation, World Economic Forum, and the European Commission- Academic journals like the Journal of Cleaner Production, Resources, Conservation & Recycling, and the International Journal of Human Resource Management

Talent Acquisition	- How can recruitment and selection processes be adapted to attract and hire individuals with circular economy mindsets and capabilities?- What strategies can be employed to source and assess candidates with relevant skills and knowledge?- How can job descriptions and employer branding be aligned with circular economy principles?	- Analysis of job descriptions and recruitment processes- Interviews with HR professionals and hiring managers- Surveys with job candidates- Experiments and pilot programs for new recruitment methods	- HR practitioner journals like Harvard Business Review, MIT Sloan Management Review, and the Journal of Corporate Recruiting Leadership- Industry reports from consulting firms like McKinsey, Deloitte, and PwC- Case studies from companies leading in circular economy practices
Learning and Development	- What are the most effective training and development programs for building a circular economy workforce?- How can digital technologies be leveraged to deliver immersive and personalized learning experiences?- How can organizations foster a culture of continuous learning and knowledge sharing?	- Design and evaluation of training programs- Pilot studies of digital learning solutions- Surveys and focus groups with learners- Observation and analysis of organizational learning practices	- Learning and development journals like the Journal of Workplace Learning and the European Journal of Training and Development- Reports from organizations like the Association for Talent Development (ATD) and the eLearning Industry- Case studies from companies with successful learning initiatives
Change Management	- What are the key barriers and enablers for successful organizational transformation towards a circular economy model?- How can HR practices support and drive cultural change towards a circular mindset?- What role can leaders and change agents play in fostering a circular economy culture?	- Case studies of organizational change initiatives- Interviews with change leaders and HR professionals- Surveys and focus groups with employees- Longitudinal studies of culture change programs	- Change management journals like the Journal of Change Management and the Journal of Organizational Change Management- Books and reports on organizational culture and change leadership- Case studies from companies that have undergone successful circular economy transformations

| Collaboration and Partnerships | - How can organizations collaborate with educational institutions, industry associations, and other stakeholders to develop a circular economy talent pipeline?- What are the best practices for fostering cross-sector partnerships and knowledge sharing?- How can digital platforms and tools facilitate collaboration and co-creation of circular economy solutions? | - Stakeholder analysis and mapping- Case studies of successful partnerships- Interviews with partners and collaborators- Pilot projects and experiments with digital collaboration platforms | - Reports from organizations like the World Business Council for Sustainable Development (WBCSD) and the United Nations Environment Programme (UNEP)- Academic journals on sustainability education and industry-academia collaboration- Case studies from successful cross-sector partnerships and digital collaboration initiatives |

5. Conclusion

The transition towards a smart circular economy in the digital age presents both challenges and opportunities for organizations and their workforce. As businesses strive to adopt more sustainable and resource-efficient models, it is crucial to equip employees with the necessary skills and competencies to thrive in this new paradigm. Reskilling and upskilling initiatives play a pivotal role in unlocking the potential of the circular economy and enabling organizations to capitalize on emerging opportunities.

To enhance knowledge on human resources in smart circular economy paradigm, researchers and practitioners are advised to: (i) Skills and Competencies, (ii) Learning and Development (iii) Learning and Development (iv) Change Management

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