HR 5.0

INTEGRATION



Unleashing the Potential of the Digital Twin Revolution

Edited by

CHANNI SACHDEVA, VEENA GROVER, BALAMURUGAN BALUSAMY, VEER P. GANGWAR, & PARDEEP KUMAR

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INVESTOR IN PEOPLE

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Foreword

The dawn of the Fourth Industrial Revolution has ushered in an unprecedented technological disruption, fundamentally transforming how organizations operate, compete, and innovate. As we stand at the precipice of HR 5.0 – a new paradigm where human capital strategy converges with hyper-automation, artificial intelligence, and cyber-physical systems – the integration of digital twin technology emerges as a game-changer in workforce optimization, talent management, and organizational agility.

This groundbreaking volume, *HR 5.0 Integration: Unleashing the Potential of the Digital Twin Revolution*, meticulously examines how digital twins – virtual replicas of physical employees, processes, and workplaces – are redefining human resource (HR)'s strategic capabilities. From predictive workforce analytics to immersive learning simulations and AI-driven talent ecosystems, this book presents a visionary yet pragmatic roadmap for HR leaders, technologists, and organizational strategists navigating this transformative landscape.

As Jane Thompson, Chief Human Resources Officer (CHRO) of a Fortune 100 tech firm, aptly observes:

> Deploying digital twins for workforce planning allowed us to simulate attrition risks, optimize hybrid work policies, and even pretest leadership development interventions – before rolling them out in the real world. The ROI wasn't just in efficiency; it was in radically reimagining how HR anticipates human behaviour.

This book bridges cutting-edge research with actionable insights, featuring contributions from leading scholars, industry practitioners, and digital transformation pioneers. Whether you are an academic exploring the future of work or an executive steering HR's digital evolution, this compilation will equip you with the frameworks, case studies, and ethical considerations essential for harnessing the digital twin revolution responsibly.

The future of HR is not just digital – it is "physical," predictive, and perpetually adaptive. Let this book be your guide to mastering that future.

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Chapter 1

Digital Twin Technologies Contributing Toward the Advancement of HR 5.0: A Bibliometric Analysis

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Abstract

Digital twin (DT) technology possesses the competency to provide real-time insight and extends its acceptance beyond product development, engineering and optimizing business processes across all functions and vertices of companies. DT minimizes the efforts of a company by assisting in data-driven decisions, increasing operational efficacy and achieving a competitive edge. It acts as a driving force in terms of innovation, new product development, and process optimizer and enhances overall business performance. Organizations need to develop and nurture the skill set of their employees along with managing physical and mental health to create long-term sustainability; hence, human-centric approaches need to be matched with technological advancements. DT in human resource 5.0 (HR 5.0) provides innovative solutions by way of resource planning and allocation of employees. DT also shares inputs by acquiring the best minds managing them and upskilling desired skill sets to cater for the demands of multiple projects. This study will unveil the recent trends and collaboration of DT concerning HR 5.0 and its contribution in terms of employee recruitment, engagement to retention, etc. Primarily, the research entails a deductive approach using preferred reporting items for systematic reviews

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and meta-analysis (PRISMA) followed by bibliometric analysis using R software and VOSviewer. Finally, network analysis and bibliometric coupling in the study will showcase the collaboration in terms of authors, country, keywords, and sources contributed to the literature.

Keywords: Digital twin; HR 5.0; PRISMA; network analysis; package; VOSviewer; bibliometric coupling

1.1. Introduction

The DT was initiated in 2003 in the domain of aerospace, and later, the three fundamental concepts were formalized for a better adaption. These components are composed of real space with physical evidence; virtual space with cybernetic representation of physical evidence and bidirectionally connecting, synchronizing and converging both the evidence. Eventually, no best definition can explain or translate perfectly the digital linkage among the two entities (Grieves, 2015; Lee et al., 2013; Rosen et al., 2015; Tao et al., 2018). The adaption of technology has dynamically linked both the digital and physical world using a virtual model to attain specific goals. The replica model empowers consistent and collaborating association among the two evidences, leading to the development of an in-depth understanding, evaluation, and optimization of the absolute life cycle. This is designed using an algorithmic model that is based on historical and real-time data utilizing prediction, verification simulation, and controlling techniques (Rasheed et al., 2020; Wagg et al., 2020). Subsequently, DTs have been increasingly used in multiple domains like industry, manufacturing, cities, and other functional domains with the advent of simulation technologies (Lv et al., 2022).

A technology created for imbibing and replicating the features of physical evidence and real-time data using DT has gained success and attention under Industry 4.0 (Sharotry et al., 2020). The ongoing disruption and growing challenges of innovation in information technology (IT) and computerization have uplifted the use of DT. In the past few years, DT applications have consistently moved their focus from aerospace and military to touch daily life globally (Qi et al., 2021). In the process of promoting urbanization, more investments are made in terms of research and development in the field of DT and developing intelligent cities. Internet of things (IoT), artificial intelligence (AI) work together to serve as the problem solver of multifarious problems faced by smart cities. IoT serves as a problem solver not only for smart cities but also assists companies in managing their various functional areas. DT, AI, and IoT together could help HR 5.0 in dealing with the growing problems of managing teams and people effectively to attain organizational goals.

The reshaping of the HR market is easy to predict due to growing technological development, globalization, and the advent of IT tools (IoT and AI), which have made it possible to match the demand of a dynamic market (Djumalieva & Sleeman, 2018; OECD, 2018). Innovation and changes in technology ensures the

employees' participation at all the levels and considers employees as stakeholders and an integral part of technological development and its implementation. It could also ease and facilitate decision-making of employees quicker and faster (Myers et al., 2021). According to Bakhshi et al. (2017), digitalization of HR may lead to structural changes from higher-order cognitive shift and interpersonal skills to freelancers and e-employee's platforms (Möhlmann et al., 2021). Similarly, DT technology has huge innovative potential toward facilitating and easing the work potential of HR. First, for an efficient data-driven decision, it provides a trustworthy database, and second, for multiple employees in the organization, it makes the work easier to design a work and growth progression path for their overall development.

DT can be understood as the comprehensive digital representation of employee's knowledge, attributes, experience, and skills based upon the objective database rather than subjective nature. These data sets pertaining to employees are acquired, accumulated, arranged, and authenticated from multiple sources like certification institutions, past employers, and social media websites (Facebook, LinkedIn). Hence, DT is more authentic and elaborative as compared to traditional profiling due to its integration of multiple sources (Furini et al., 2022). This comprehensive skill profile is developed over a prolonged period from learning to working of employees, and it makes easy to take decision and dynamically update the profile on a consistent basis (Enders & Hoßbach, 2019; Glaessgen & Stargel, 2012). DT in HR can be useful for record keeping that includes learning, hiring, developing, and maintaining career progression of employees. DT provides a comprehensive and objective assessment of employee's skill that facilitates organizations to recognize, hire, and place a suitable talent and make him understand and develop his own skills. DT helps in predicting a path for potential employees and assigning them a specific skill-based task by combining solutions to training, automation, and developing detailed insights into employee performance. DT can provide inputs and predictions by preparing algorithms that have competency to create training or material for development and improvement of employee performance (Liu et al., 2021).

In the process of attaining a perfect organizational culture globally, digital human resource management (HRM) practices and policies need to be implemented timely, and upgradations need to be carried out consistently (Ahmad, 2015). Fig. 1.1 explains the journey from traditional practices HR 1.0 to green HR using AI-enhanced HR, that is, HR 5.0, a phase-wise development. The ongoing environmental damage has generated concern and awareness among people to utilize and produce eco-friendly things, and in the process, the same companies are consciously following the concept of "green" (Almagtome et al., 2020). In the process of developing green products, it is observed that green creativity has taken over the green business. Presently, green creativity in behavior is an integral part of enhancing organizational efficacy as organizations require human interaction in terms of efforts and cohesive and collective thinking. Thus, DT technology has become essential to be lined with HR 5.0 for the success of business and a novel conception for saving power (Jiang et al., 2021). Due to a digital transformation in business, different terminologies have emerged in HRM

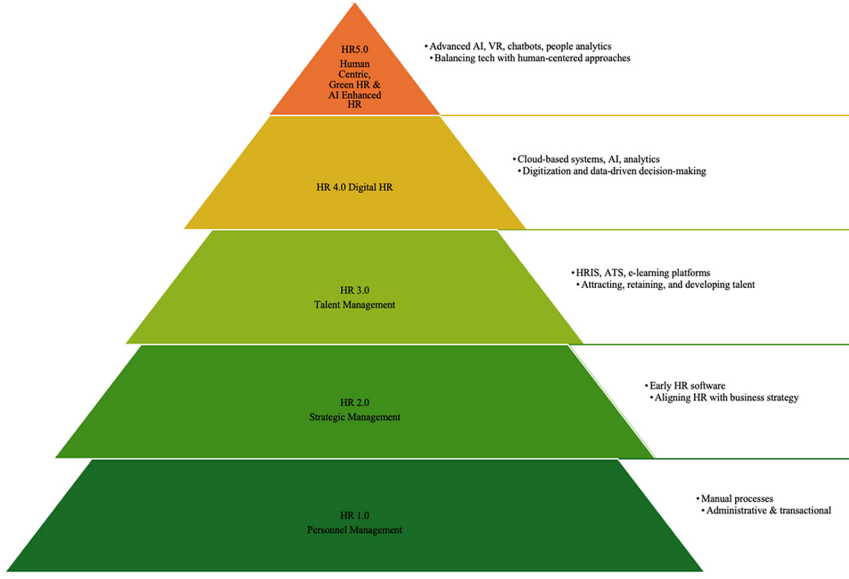


Fig. 1.1. Authors' Creation of Historical HR Process from 1.0 to 5.0. *Source*: Authors' creation.

like green HR, digital disruption, AI-enhanced HR, and people analytics (Westerman et al., 2014).

The various dimensions to which HR 5.0 is likely to contribute are recruitments, training and development, performance appraisal, compensation, green creativity, green creative motivation, green creative thinking, green creative behavior, and green creative outcome. This reliance refers to a dynamic dependence on technology and the consequential noteworthy transformations in shaping HR 5.0. Innovative HRM models and their implementation need to be adapted by corporate strategy makers to cater to the challenges of dynamic digital economy. This is a high time to recognize the HR processes which today are no longer subjective driven, and DT solutions presented in this chapter aligning HR 5.0 will access the literature contribution. This chapter will undertake a bibliometric synthesis of the authors, documents, keywords, countries, and co-authorship using R package and VOSviewer software as shown in the study flowchart of Fig. 1.2.

1.2. Design and Methodology

This chapter explores the DT contribution to the advancement of HR 5.0, and it has become extremely critical in contemporary business practices where companies are under immense pressure to adapt green revolution. Companies need to reduce their carbon footprints, and to do so, they need to find all possible solutions and find the way out toward sustainability. In this process, does DT provide a solution toward the success of HR 5.0, and what are the various determinants or key drivers that possess the competency to make it successful? The study is

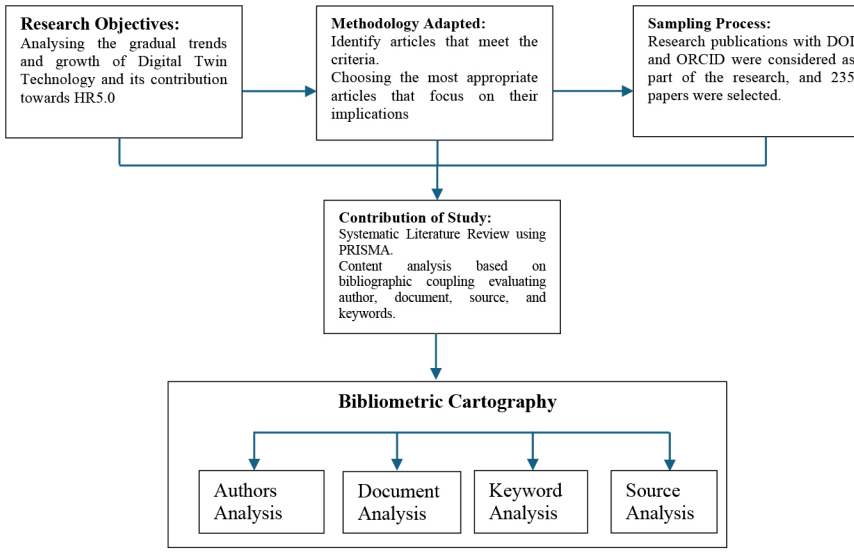


Fig. 1.2. Authors' Creation Flowchart of Research. *Source*: Authors' creation.

proposed to address several research questions that will further pave the direction using the existing body of literature. The key research questions explored in this study, as derived from prior investigations and the tools considering bibliometric synthesis (Behera & Sood, 2024; Kumar et al., 2022; Mukherjee et al., 2023), include the following:

- Which articles have been the most influential in shaping the discourse on DT's contribution to the advancement of HR 5.0?
- What are the dominant themes and topics explored within the context of DT's contribution to the advancement of HR 5.0?
- Which journals provide the most significant insight into DT's contribution to the advancement of HR 5.0?
- What are the future research directions that will shape the further development of DT's contribution to the advancement of HR 5.0?

Primarily, the study entails PRISMA that are meant to be meticulously used to reduce the number of research papers in the field of study. It is a step-down approach in terms of analyzing the research literature and making it justifiable to be included in the study (Ahmad et al., 2020; de Freitas Netto et al., 2020). In the process of predetermining the eligibility criteria of research, a systematic literature review (SLR) was adapted primarily in practices such as health care and clinical studies (Moher et al., 2009) and then across multiple disciplines to enhance the creditworthiness of the study. The study includes threefolds: first, it involves identifying the core research questions and their relevance with the studies in terms of literature review; second, it ensures a full-text review of the selected

studies and finally, screening process based upon the relevance of each study by the research questions.

The studies were also evaluated based on specific inclusion and exclusion criteria. Finally, it met the eligibility criteria that include SLR; the data extracted from these studies formed the foundation for the findings and conclusions presented in the report and allowed the researchers to systematically analyze the selected studies and draw meaningful conclusions from the existing literature. The PRISMA analysis applied in the study to follow and satisfy all three stages was carried out using 328 papers. Only 235 met the threshold criteria of future research, as shown in Fig. 1.3. Table 1.1 explains the research contribution using the R package. The study period ranges from 2017 to 2024 the annual growth rate is 91%, and the document citations are 13.53, which is much less; this reveals that more quality work is expected across the globe by researchers to make the research more

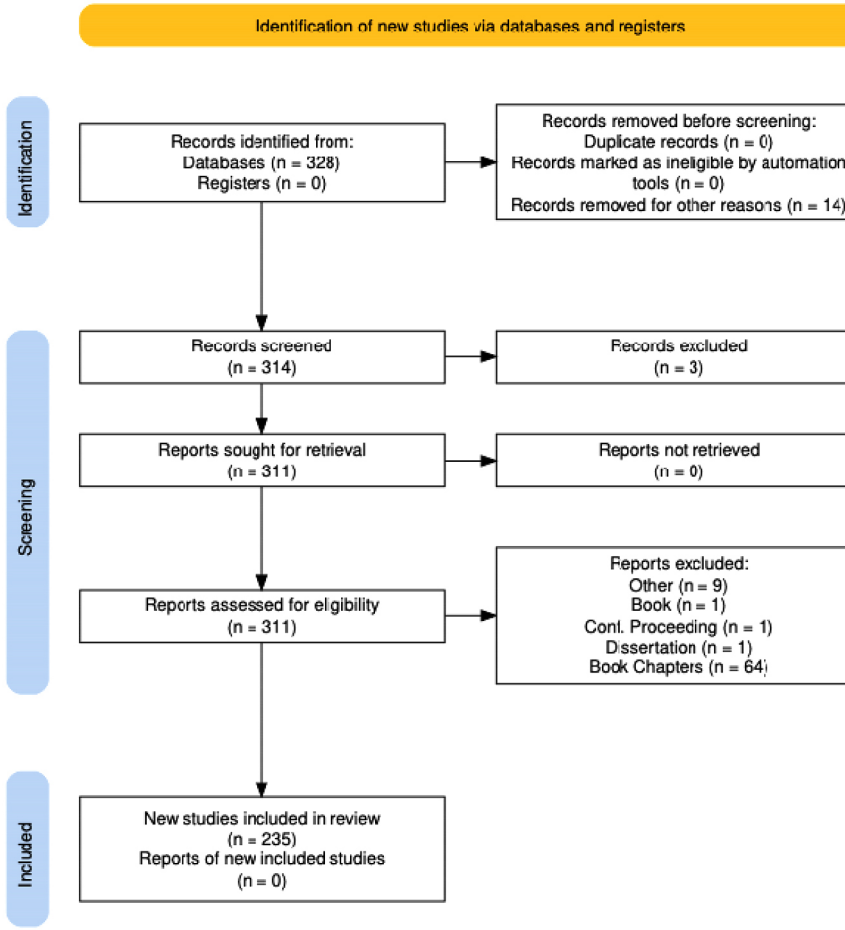


Fig. 1.3. Authors' Creation of PRISMA Analysis. *Source*: Authors' creation.

Table 1.1. Main Information Table Using the R Software.

Description	Results
Main information about data	
Timespan	2017:2024
Sources (journals, books, etc.)	165
Documents	235
Annual growth rate %	91.66
Document average age	0.966
Average citations per doc	13.53
References	6,576
Document contents	
Keywords plus (ID)	109
Author's keywords (DE)	109
Authors	
Authors	837
Authors of single-authored docs	24
Authors collaboration	
Single-authored docs	25
Co-authors per doc	4.34
International co-authorships %	0
Document types	
Conference proceedings article	44
Journal article	191

Source: Authors' creation.

communicable to large segments. The research is contributed in collaboration instead of individual authors, meaning that cohesiveness and joint contribution enhance the competency of research publications.

1.3. Bibliometric Results, Discussion, and Visualization

The study uses bibliometric analysis performed by a VOSviewer and bibliometric R package (biblioshiny). These tools imbibe dynamic visualization based on networks, including keyword clusters, author collaborations, country contributions, and bibliographic coupling networks (Baker et al., 2020). By utilizing these tools, the research was able to map the background of literature on DT technology that contributes to HR 5.0. The bibliometric R package also allowed for a detailed textual and source analysis and a graphical representation of key findings. The

study in Table 1.2 revealed consistent growth in the research contribution from 2020 to 2024, meaning that in the last five years. Fig. 1.4 indicates the graphical growth pattern of articles from 3 to 95. This is quite significant, but checking the author's *h*-index, countries' *h*-index, keywords, contributing company, documents, and citation analysis is a key determinant of the upcoming study.

1.3.1. Lotka's Law

Lotka's Law is a test of reliability using the R package, as shown in Table 1.3, which uses the strata as a social order that contributes to the production and reputation of researchers and limits itself to the studied social group. This law entails both qualitative and quantitative data in extending the study, and its quantitative value should be more than 61%. The study revealed that the maximum number of authors, that is, 706, falls in the category of 0.843, meaning that 84.3% of authors are found to fit to be further analyzed under the study. Fig. 1.5 denoted the steep decline for 131 authors, and their reliability is very low using the biblioshiny application.

Table 1.2. Year-wise Articles Published.

Year	Articles
2017	1
2018	0
2019	1
2020	3
2021	13
2022	42
2023	79
2024	95

Source: Authors' creation.

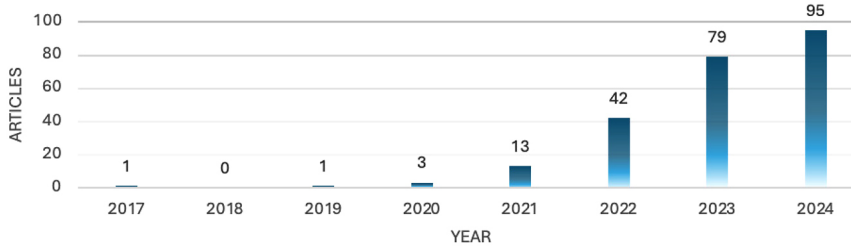


Fig. 1.4. Year-wise Publication Using Excel. *Source*: Authors' Creation.