

Article

The Role of Smart Human Resource Management in the Relationship between Technology Application and Innovation Performance

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Abstract: This study investigates the intricate relationships between technology application, smart human resource management (SHRM), and innovation performance within the Jordanian telecom industry. Employing a quantitative research methodology, data were collected from employees of telecommunications firms in Jordan. The results illuminate significant positive associations between technology application, SHRM, and innovation performance, elucidating the pivotal roles of technology and HRM strategies in fostering innovation and bolstering organizational success. Practical implications of the findings advocate for substantial investments in cutting-edge technologies, the integration of intelligent HRM practices, and the prioritization of continuous learning and development initiatives to nurture an innovative workforce. This research contributes to a deeper comprehension of innovation dynamics within the telecommunications sector and furnishes valuable insights for practitioners striving to elevate innovation capabilities within their respective organizations.

Keywords: technology application; smart human resource management; innovation performance; organizational growth; telecom industry



Citation: Al-Faouri, E.H.; Abu Huson, Y.; Aljawarneh, N.M.; Alqmool, T.J. The Role of Smart Human Resource Management in the Relationship between Technology Application and Innovation Performance. *Sustainability* **2024**, *16*, 4747. <https://doi.org/10.3390/su16114747>

Academic Editors: Grigorios L. Kyriakopoulos and Jun (Justin) Li

Received: 24 April 2024

Revised: 18 May 2024

Accepted: 27 May 2024

Published: 2 June 2024



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1. Introduction

In today's fast-paced landscape of technological progress, organizations increasingly rely on technology to fuel innovation and gain a competitive edge [1,2]. The infusion of technology into various facets of business management has revolutionized traditional approaches, particularly in the domain of human resource management (HRM) [3,4]. As businesses navigate the complexities of the digital age, the role of HRM emerges as a pivotal factor in their ability to effectively leverage technology for innovation [5,6].

The integration of technology into HRM practices has transformed talent acquisition, development, and retention processes [7,8]. From automated recruitment systems to data-driven performance evaluations, technology-driven HRM methodologies have streamlined operations and provided strategic insights [9]. Furthermore, advancements in artificial intelligence (AI), machine learning, and big data analytics empower HR professionals to derive actionable insights from vast datasets, facilitating informed decision-making and optimizing HRM processes [10–12].

Nevertheless, amidst the surge in technological solutions in HRM, the significance of human capital remains paramount [13]. While technology can automate routine tasks and boost productivity, human intervention remains crucial for fostering creativity, collaboration, and innovation within organizations [14,15]. Thus, the concept of smart human resource management (SHRM) emerges as a critical framework for leveraging technology to optimize human capital and drive innovation [16–18].

SHRM embodies a strategic approach to HRM that underscores the alignment of HR practices with organizational objectives and values [19]. It entails integrating technology into HRM processes to enhance adaptability, agility, and responsiveness to dynamic market conditions [20]. Through the adoption of technology-enabled HRM practices, organizations can refine talent management strategies, foster continuous learning and development, and cultivate an environment conducive to innovation [21,22].

While existing research has examined the impact of technology applications on SHRM and explored the relationship between SHRM and innovation performance, there exists a notable gap concerning how SHRM acts as a mediator between technology application and innovation performance.

This paper aims to delve into the intricate dynamics among technology application, SHRM, and innovation performance within organizational settings. Specifically, it seeks to answer the question:

How does SHRM mediate the relationship between technology application and innovation performance amidst technological advancements? By thoroughly examining this nexus, the study endeavors to enhance our understanding of how SHRM practices influence innovation amidst technological advancements.

Highlighting the pivotal role of SHRM practices in leveraging technology to drive innovation and enhance organizational performance, this paper aims to illuminate the interplay between technology application, SHRM strategies, and innovation outcomes. Ultimately, the study aims to offer actionable insights for practitioners and policymakers keen on harnessing technology to foster innovation and sustainable growth within organizations.

The remainder of the manuscript is organized as follows: the Section 2 presents an exhaustive review of the existing literature and formulates hypotheses based on the literature. Following that, the Section 3 outlines the methodology employed in the study. In the Section 4, the research findings are presented and analyzed, covering various topics and discoveries. The Section 5 serves as the discussion, where implications and insights drawn from the findings are explored in detail. Finally, the Section 6 provides a comprehensive summary of the study, including its limitations, and offers recommendations for future research endeavors.

2. Literature Review and Hypothesis Development

The intricate interplay between technology application, HRM, and innovation performance holds a central position within contemporary organizational research. This section embarks on an exhaustive exploration of existing literature to expound upon the conceptual foundations of smart human resource management (SHRM), technology application, and innovation performance. While a plethora of studies have scrutinized these variables across diverse sectors like banking, as evidenced by Rasool et al. (2019) [23], there remains a conspicuous gap in the literature pertaining to the communications sector. The omission of the communications sector from scholarly discourse is particularly noteworthy given the profound technological advancements, notably in the Middle East. This underscores the imperative for further investigation within this realm to comprehend the unique dynamics at play in the communications sector amidst rapid technological evolution.

2.1. *The Relationship between Technology Application and Innovation Performance*

Technology application denotes the integration of technological tools and systems into various organizational processes and functions [24]. This encompasses a broad spectrum of innovations, including artificial intelligence (AI), machine learning, big data analytics, and automation [25]. Within the domain of HRM, technology application has revolutionized traditional practices such as recruitment, training, performance evaluation, and employee engagement, as emphasized by Kambur and Yildirim (2023) [19].

Organizations leverage technology to streamline operations, enhance efficiency, and derive insights for data-driven decision-making [26]. Moreover, technology application

fosters the development of agile and adaptable work environments, enabling organizations to respond promptly to market changes and disruptions [5,26].

Innovation, initially introduced by Joseph Schumpeter, is a cornerstone in economics, promoting development and competitiveness. The term “innovation” has replaced various management concepts like “re-engineering”, “Six Sigma”, “kaizen”, and “out-sourcing”, encompassing all their functionalities [27]. Innovation performance refers to an organization’s ability to generate, implement, and commercialize new ideas, products, processes, or services that create value for stakeholders [28].

Innovation performance is pivotal for organizational growth, competitiveness, and long-term sustainability [29]. Organizations with high levels of innovation performance are better equipped to adapt to changing market dynamics, meet customer needs, and outperform competitors, especially in light of technological developments and the shift towards a digital business environment [28]. Maxamadumarovich et al. (2012) [27] emphasized that innovation is essential for economic growth and sustainability and that companies must adapt to rapidly changing environments to survive and thrive through innovation. In the context of HRM, innovation performance is influenced by factors such as organizational culture, leadership style, employee empowerment, and the effective utilization of technology [30].

The integration of technology into organizational processes has become imperative for driving innovation performance in today’s dynamic business environment [2,31]. Technology application encompasses the adoption and utilization of various digital tools, platforms, and systems to enhance operational efficiency, facilitate collaboration, and stimulate creativity within organizations [32]. A plethora of research supports the premise that technology application positively influences innovation performance by providing organizations with the capabilities to innovate across product development, process optimization, and business model innovation [33,34].

Empirical findings consistently suggest a strong positive relationship between technology application and innovation performance. Studies by Jabbouri et al. (2016) [35] and Kolluru and Mukhopadhyaya (2017) [36] reveal that organizations investing in advanced technologies such as AI, IoT, and blockchain achieve higher levels of innovation output and competitiveness compared to their counterparts. These technologies empower organizations to gather, analyze, and leverage vast amounts of data to identify market trends, customer preferences, and emerging opportunities, thereby fueling the innovation process [37,38].

Furthermore, technology application facilitates collaboration and knowledge sharing among employees, enabling cross-functional teams to work seamlessly irrespective of geographical boundaries [39,40]. Platforms such as cloud computing, project management software, and virtual collaboration tools empower employees to share ideas, brainstorm solutions, and co-create innovative solutions, thereby enhancing innovation performance [41].

Drawing from the literature, the following hypothesis is formulated:

H1. *There is a positive relationship between technology application and innovation performance.*

2.2. The Relationship between Technology Application and Smart HRM

Smart HRM embodies a strategic approach to HRM that underscores the integration of technology to optimize human capital and enhance organizational performance [20]. Diverging from conventional HRM, which often centers on administrative tasks and regulatory compliance, SHRM adopts a proactive and data-driven stance. It involves aligning HR practices with organizational objectives and values while leveraging technology to bolster recruitment, talent development, performance management, and employee engagement [42]. Recognizing the critical role of human capital in fostering innovation and competitiveness, SHRM acknowledges the transformative potential of technology in refining HRM practices [43].

The infusion of technology into HRM practices has revolutionized talent management within organizations [7]. SHRM entails the strategic deployment of technology to optimize HR processes, enrich employee experiences, and synchronize HR strategies with organizational goals [19,44]. By harnessing technologies such as AI, machine learning, and data analytics, organizations can streamline recruitment processes, tailor learning and development initiatives, and enhance employee engagement, thereby fostering organizational performance [45].

Research underscores the positive nexus between technology application and smart HRM practices. For instance, studies by Pillai and Srivastava (2023) [46] and Kambur and Yildirim (2023) [19] demonstrate that organizations leveraging HR technologies exhibit higher levels of employee satisfaction, productivity, and retention compared to those relying on traditional HR methods. These technologies enable organizations to automate routine administrative tasks, such as payroll processing and performance evaluations, liberating HR professionals to concentrate on strategic endeavors like talent development and succession planning [47,48].

Moreover, smart HRM practices contribute to innovation performance by nurturing an organizational culture valuing creativity, collaboration, and continuous learning [49]. Technologies such as learning management systems, gamified training modules, and virtual mentoring platforms empower organizations to furnish employees with personalized development opportunities, cultivating a workforce adept at generating and implementing innovative ideas [50,51].

Building upon the literature, the following hypothesis is posited:

H2. *There is a positive relationship between technology application and SHRM.*

2.3. *The Relationship between Smart HRM and Innovation Performance*

Smart HRM practices play a crucial role in cultivating an organizational culture conducive to innovation by empowering employees, fostering knowledge exchange, and facilitating cross-functional collaboration [52,53]. By aligning HR strategies with innovation objectives and furnishing employees with requisite support, resources, and incentives, organizations can augment their innovation capacity and propel sustainable growth [54,55].

A multitude of studies have underscored the positive influence of smart HRM practices on innovation performance. For instance, research by Donate et al. (2016) [56] revealed that organizations fostering strong learning cultures and innovative HR practices demonstrated heightened levels of innovation capability and performance compared to their counterparts. Similarly, Kwon and Kim (2020) [57] and Chowhan (2016) [54] documented a positive correlation between employee engagement and innovation outcomes, emphasizing the pivotal role of HR practices in fueling innovation within organizations.

SHRM practices contribute to innovation performance by cultivating an engaged, empowered workforce equipped with the requisite skills and knowledge for effective innovation [43,58]. Through investments in initiatives such as skill development programs, innovation training workshops, and cross-functional teams, organizations create an environment conducive to creativity, experimentation, and risk-taking, thereby fostering innovation across all organizational levels [53,59].

Given the empirical evidence, the following hypothesis is posited:

H3. *There is a positive relationship between SHRM and innovation performance.*

2.4. *The Mediating Role of Smart HRM*

Expanding on the relationships established in the preceding hypotheses, it is posited that smart HRM serves as a mediator in the relationship between technology application and innovation performance within organizations. Jebali and Meschitti (2021) [60], as well as Khan and Talib (2023) [61], have affirmed that smart HRM acts as a pivotal intermediary mechanism, translating technological investments into tangible innovation outcomes by

optimizing the utilization of human capital and fostering an environment conducive to innovation.

Through technology-enabled HRM practices, organizations can bolster employee engagement, cultivate a culture of continuous learning and knowledge sharing, and align HR strategies with innovation objectives [21,22,62]. Consequently, SHRM assumes a critical role in unlocking the inherent innovation potential of technological advancements, thereby driving organizational success and competitiveness [45,63].

Empirical studies have lent support to the mediating role of SHRM in the relationship between technology application and innovation performance. For instance, Iqbal et al. (2021) [64] and Waheed et al. (2020) [65] observed that organizations with advanced HR technology capabilities demonstrated higher levels of innovation performance, with SHRM practices mediating this relationship. Similarly, Diaz-Fernandez et al. (2015) [66] reported that HRM practices such as employee training and development mediated the relationship between technology adoption and innovation outcomes in a sample of high-tech firms.

Based on this conceptual framework, the following hypothesis is formulated:

H4. *Smart HRM mediates the relationship between technology application and innovation performance.*

3. Methodology

3.1. Research Design

This study employs a quantitative research methodology to investigate the intricate relationships between technology application, SHRM, and innovation performance within Jordanian telecom companies. Quantitative research is chosen for its capacity to empirically explore connections between variables and measure their impacts, thereby offering valuable insights into organizational processes [67].

3.2. Population and Sampling

The study focuses on employees within the main branches of Jordanian telecom companies—Orange, Zain, and Umniah—during the year 2024. A total of 268 questionnaires were distributed to the study population by sharing the questionnaire link with employees. Over the data collection period, we received 200 responses. Additionally, 20 questionnaires were distributed outside the study population for data validation purposes, but these responses were excluded from the analysis. The sampling technique employed was systematic random sampling, selecting employees with odd ID numbers across various departments, including Management, Information Technology, Human Resources, Accounting, Marketing, and Research and Development.

3.3. Data Collection

Data collection primarily relies on utilizing a questionnaire as the primary instrument for gathering empirical evidence [68,69] (Johnson and Turner, 2003; Kareem, 2019). The questionnaire is carefully designed to solicit responses related to technology application, SHRM practices, and innovation performance. To ensure the reliability and validity of the questionnaire, items are adapted from well-established studies in the field.

Questions pertaining to SHRM practices draw from the research of Strohmeier (2020) [70] (questions 1, 3, and 4), Hussein and Abdullah (2023) [71] (questions 2, 5, and 6), and Pillai and Srivastava (2024) [20] (questions 7 and 8), ensuring that the questionnaire captures the latest insights and best practices in HRM. Similarly, questions addressing technology application are derived from Ogbeibu et al. (2024) [72] (questions 1, 3, and 10), Mishra and Akman (2010) [73] (questions 4, 6, and 7), and Turulja and Bajgoric (2018) [74] (questions 2, 5, 8, and 9), reflecting the diverse technological landscape within organizations. Furthermore, questions focusing on innovation performance are adapted from studies by Riana et al. (2020) [75] (questions 2, 3, and 8), Singh (2018) [58] (questions 1, 5, 6, and 9), and Diaz-Fernandez et al. (2015) [66] (questions 4 and 7), encompassing various dimensions of innovation (see Appendix A).

The questionnaire is disseminated electronically to the study sample using Google Forms. Electronic dissemination offers numerous benefits, such as streamlined administration, efficient data collection, and cost reduction. The methodology employed in the study involved the assessment of the questionnaire with the participation of specialized academics from both public and private universities in Jordan. This meticulous evaluation process ensured the surveys' reliability and validity, with all suggestions meticulously reviewed to enhance the questionnaire's quality. Clear instructions for completing the questionnaire are provided to participants, and efforts are made to ensure a high response rate through reminders and follow-up communications. The research strictly adheres to ethical principles throughout the entire process, with participants receiving informed consent outlining the study's objectives, voluntary participation, confidentiality assurances, and data usage policies. Moreover, the study adheres to ethical guidelines and regulations governing research involving human subjects.

3.4. Demographic Characteristics

The demographic composition of the participants is outlined in Table 1, covering various essential attributes including gender distribution, age demographics, educational attainment, field of specialization, positions within telecom companies, and years of professional experience.

Table 1. Overview of the participant demographics.

Characteristics		Count	Percentage
Gender	Male	162	0.81
	Female	38	0.19
Age	<30	87	0.43
	30–40	60	0.30
	41–50	38	0.19
	>50	15	0.07
Educational qualifications	Diploma	8	0.04
	Bachelor	157	0.78
	Master	34	0.17
	PhD	1	0.005
Specialization	Management	47	0.23
	Information Technology	71	0.35
	Accounting	53	0.26
	Marketing	11	0.05
	Others	18	0.09
Position	Top management	14	0.07
	Head of Department	19	0.09
	Trainee	32	0.16
	Others	135	0.67
Years of experience	<5	85	0.42
	5–10	52	0.26
	11–20	40	0.20
	>20	23	0.11

The gender breakdown among participants reveals a significant contrast between the proportions of male and female respondents. Notably, 162 male participants, comprising

approximately 81% of the total respondents, were recorded, whereas 38 female participants represented approximately 19% of the total. This gender gap may be ascribed to several factors. Firstly, it aligns with industry norms, where the telecom sector historically exhibits a higher representation of male employees compared to females. This trend may be influenced by societal norms, historical biases in recruitment practices favoring males, or the predominant nature of job roles within the industry. Additionally, career preferences may play a role, as certain sectors like technology and telecommunications have traditionally attracted more male workers, resulting in fewer women pursuing careers in these fields. Further investigation in future research endeavors could delve into the underlying causes of gender imbalances in the telecom industry, informing targeted interventions aimed at fostering gender equality and diversity.

In terms of specialization, the highest percentage is attributed to information technology, underscoring the diverse range of skills and roles within the telecom sector.

4. Data Analysis and Results

To investigate and estimate the interrelationships among the model variables, a causal-predictive structural equation modeling (SEM) approach was employed using PLS 4 software. Unlike covariance-based SEM (CB-SEM), which relies on the indeterminacy of item scores [76,77], PLS-SEM operates on fixed latent scores and prioritizes the maximization of predictive power for endogenous components over model fit [78]. PLS-SEM is particularly adept at handling complex structural models, including second-order models, and is robust to small sample sizes while not being overly stringent regarding data normality. This approach allows for a comprehensive analysis of the relationships between technology application, smart human resource management (SHRM), and innovation performance within the context of Jordanian telecom companies.

Figure 1 displays the loadings of items from various scales, accompanied by the significance of the R^2 for each variable within the inner model. Here, TA represents technology application, SHRM represents smart human resource management, and IP represents innovation performance.

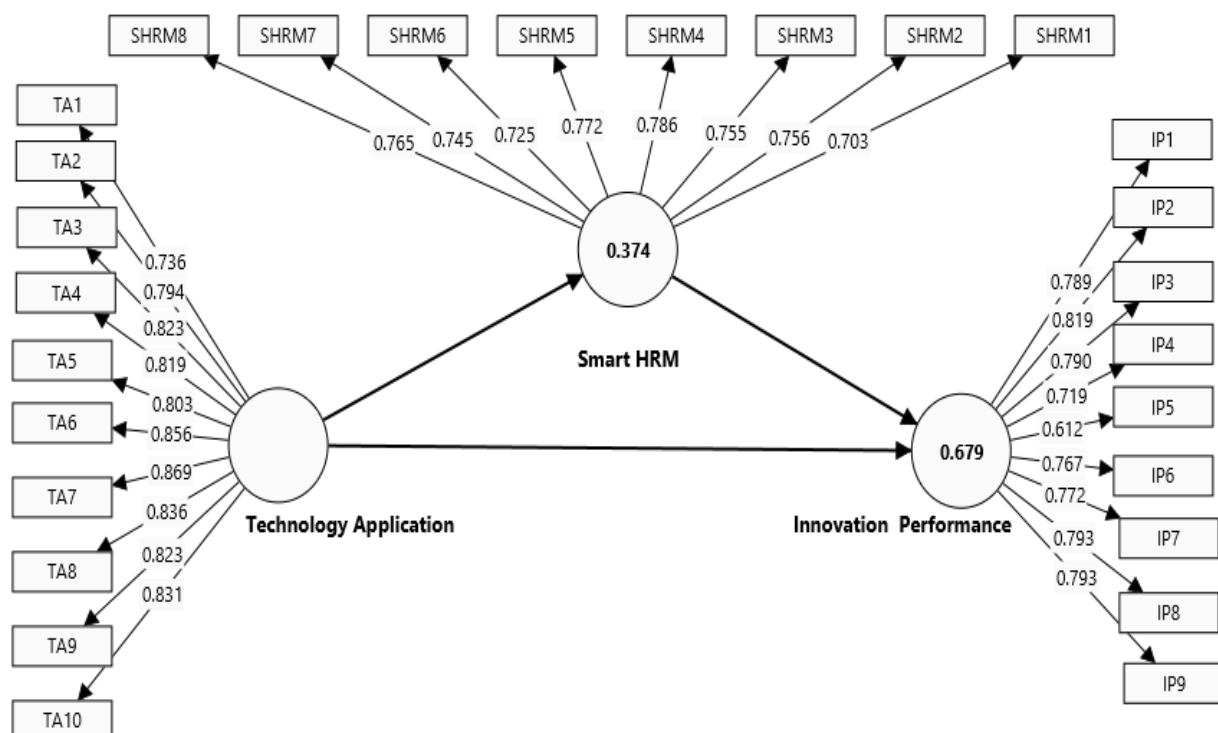


Figure 1. Measurement model.

Figure 2 illustrates the significance levels of the scale items in the outer model, as well as the relationships between variables within the inner model. This diagram provides insights into the statistical significance of the relationships between the variables under investigation.

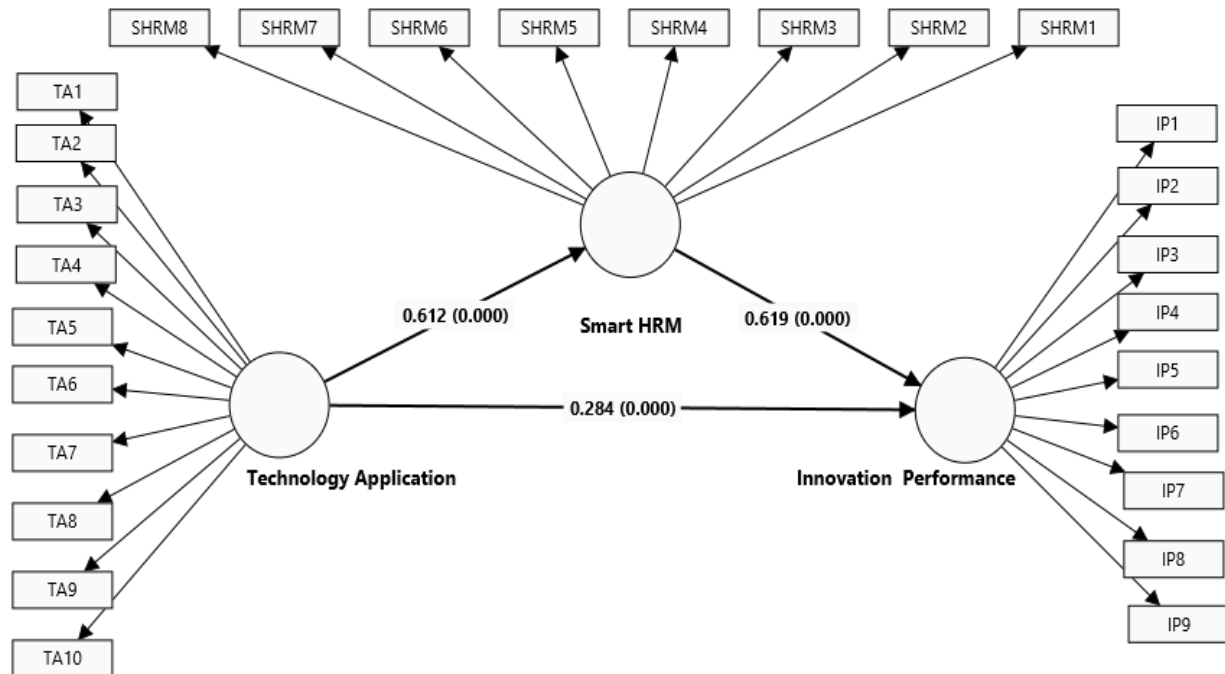


Figure 2. Significance level.

Table 2 presents the mean and standard deviation (SD) for the measured variables. The measures include innovation performance, smart HRM, and technology application, with their respective mean values and standard deviations provided.

Table 2. Mean and standard deviation (SD).

Measures	Mean	SD
Innovation Performance	4.03	0.745
Smart HRM	4.40	0.350
Technology Application	4.06	0.520

The loadings observed in the outer model, as illustrated in Figure 1, predominantly surpassed the threshold of 0.7, indicating strong relationships between the latent variables and their indicators. These loadings, alongside their corresponding B-values, play a pivotal role in understanding the significance levels depicted in Figure 2.

Table 3 presents the reliability and convergent validity measures for the instruments utilized in the study. Cronbach's alpha (α) values exceeding 0.70 ensure internal consistency, while composite reliability (CR) values surpassing 0.70 indicate the reliability of the measurement model. Additionally, average variance extracted (AVE) values exceeding 0.50 suggest convergent validity.

Table 3. Reliability and convergent validity.

Instruments	α	CR	rho	AVE	R ²
Innovation Performance	0.910	0.915	0.926	0.584	0.679
Smart HRM	0.890	0.891	0.912	0.565	0.374
Technology Application	0.946	0.948	0.953	0.672	

Table 4 demonstrates the fulfillment of the Fornell–Larcker criterion, a widely accepted method for assessing divergent validity. The criterion is met when the square of each variable’s AVE exceeds the inter-correlations between variables, indicating discriminant validity among the constructs.

Table 4. Divergent validity based on the Fornell–Larcker approach.

Measures	1	2	3
Innovation Performance	0.793		
Smart HRM	0.751	0.764	
Technology Application	0.663	0.612	0.820

Table 5 presents variance inflation factor (VIF) values for the inner model, a crucial step in assessing multicollinearity within a structural model. In this case, the VIF values for smart HRM, technology application, and innovation performance are generally below the commonly accepted threshold of 3.3 [79], indicating a low level of multicollinearity among the indicators within each latent construct.

Table 5. VIF values.

Measures	VIF
Smart HRM -> Innovation Performance	1.599
Technology Application -> Innovation Performance	1.599
Technology Application -> Smart HRM	1.000

Table 6 reports coefficient estimations for the structural model, illustrating the direct and indirect effects of smart HRM and technology application on innovation performance. The observed direct impact of technology application on innovation performance is both positive and significant ($\beta = 0.248$, $p = 0.000$), while the direct effect of smart HRM on innovation performance is also positive and significant ($\beta = 0.619$, $p = 0.000$). Additionally, the direct effect of technology application on smart HRM is positive and significant ($\beta = 0.612$, $p = 0.000$). The mediating impact of smart HRM on the association between technology application and innovation performance is also positive and significant ($\beta = 0.379$, $p = 0.000$). Furthermore, the variance explained by the model R^2 is 0.679, indicating that 67.9% of the variance in innovation performance is accounted for (see Table 2). Falk and Miller (1992) proposed a benchmark for R^2 values, suggesting that the lowest recommended level should be 0.10. The R^2 value in our study indicates a large effect size.

Table 6. Direct and indirect effects.

Relationships	β	T	ρ
Smart HRM -> Innovation Performance	0.619	8.431	0.000
Technology Application -> Innovation Performance	0.284	3.727	0.000
Technology Application -> Smart HRM	0.612	11.886	0.000
Technology Application -> Smart HRM-> Innovation Performance	0.379	7.847	0.000

Note: β , beta value; ρ , ρ -value; T, T-value.

5. Discussion

The findings of this study offer insightful observations regarding the intricate dynamics between technology application, SHRM, and innovation performance within the framework of Jordanian telecom companies. This discussion segment seeks to synthesize these findings, interpret their implications, and furnish actionable recommendations for stakeholders in both practical and policy realms.

5.1. Analyzing the Findings

The study's outcomes reveal a notable positive correlation between technology application and innovation performance, aligning with prior research (Jabbouri et al., 2016; Kolluru and Mukhopadhyaya, 2017) [35,36]. This underscores technology's pivotal role in propelling innovation within organizational contexts. Through investments in advanced technologies like AI, IoT, and blockchain, telecom enterprises can bolster their innovation prowess, elevate competitiveness, and adeptly respond to swiftly evolving market dynamics. The affirmative influence of technology application underscores the imperative of continual technological progression and integration in the telecom sector.

Moreover, the study underscores a robust positive relationship between SHRM and innovation performance, echoing existing research (Donate et al., 2016; Kwon and Kim, 2020) [56,57]. Smart HRM practices, encompassing employee engagement, talent nurturing, and innovative HR strategies, substantially contribute to nurturing a culture of innovation within organizations. By aligning HR strategies with innovation imperatives and furnishing employees with requisite support and resources, telecom entities can augment their innovation potential and foster sustainable growth. This underscores the strategic significance of human capital in steering innovation and organizational triumph.

Furthermore, the study validates SHRM's mediating role in the nexus between technology application and innovation performance. This suggests that smart HRM practices serve as pivotal intermediaries in translating technological investments into tangible innovation outcomes. By optimizing human capital utilization and nurturing an environment conducive to innovation, SHRM serves as a catalyst for innovation within organizations. This finding accentuates the synergistic rapport between technology and human capital in steering innovation and organizational efficacy.

5.2. Implications for Practice

The study's implications for the Jordanian telecom industry are profound. Firstly, telecom organizations should prioritize investments in advanced technologies to fortify their innovation prowess. By embracing cutting-edge technologies such as AI, IoT, and blockchain, telecom firms can enhance operational efficiency, streamline processes, and foster innovation across their operational spectrum.

Furthermore, it is imperative for telecom entities to espouse smart HRM practices to cultivate an innovation-centric culture among their workforces. This entails implementing initiatives like employee engagement endeavors, talent development schemes, and innovative HR strategies. By investing in employees and aligning HR practices with innovation goals, organizations can empower their workforce to drive innovation and attain organizational triumph.

Moreover, the integration of technology into HRM practices is indispensable for telecom companies aiming to optimize human capital and spur innovation. Leveraging HR technologies like AI, machine learning, and data analytics empowers organizations to refine recruitment processes, tailor learning and development initiatives, and augment employee engagement. This amalgamation empowers organizations to harness the full potential of their human capital and propel innovation proficiently across all operational dimensions.

Additionally, prioritizing continual learning and development initiatives is pivotal for telecom firms aspiring to cultivate an innovative workforce. By offering employees access to training programs, workshops, and learning resources, organizations can instill a culture of continuous learning and innovation. This equips employees to stay abreast of emerging technologies and industry trends, thereby catalyzing innovation and fortifying organizational efficacy within the dynamic telecom landscape.

6. Conclusions

In conclusion, this study provides valuable insights into the interplay between technology application, smart human resource management (SHRM), and innovation performance within the Jordanian telecom industry. The findings underscore the significant positive

relationships between these variables, highlighting the pivotal role of technology and HRM practices in driving innovation and organizational success. By investing in advanced technologies and embracing smart HRM practices, telecom companies can enhance their innovation capabilities, foster a culture of innovation among employees, and drive sustainable growth.

6.1. Limitations

Despite the contributions of this study, several limitations warrant acknowledgment. Firstly, the study's focus on the Jordanian telecom industry may limit the generalizability of the findings to other contexts. Additionally, the use of a quantitative research approach may overlook nuanced qualitative insights into the phenomenon under investigation. Furthermore, the reliance on self-reported data through questionnaires may introduce response biases and social desirability effects, potentially influencing the study outcomes.

6.2. Future Research Directions

To address the identified limitations and further advance our understanding in this area, future research endeavors could adopt a mixed-methods approach, combining quantitative analyses with qualitative interviews or case studies to gain a comprehensive understanding of the complexities involved. Additionally, expanding the study scope to encompass diverse industries and geographical regions would facilitate broader generalizability of the findings.

Furthermore, longitudinal studies could be conducted to explore the long-term effects of technology adoption and SHRM practices on innovation performance over time. Additionally, investigating the moderating effects of contextual factors such as the organizational culture, leadership style, and regulatory environment could provide deeper insights into the relationships examined in this study.

Moreover, exploring the role of emerging technologies such as augmented reality, virtual reality, and the Internet of things in driving innovation within the telecom sector could uncover new avenues for research and practical applications. Finally, examining the influence of external factors such as market competition, industry disruption, and technological convergence on innovation performance could offer valuable insights for practitioners and policymakers alike.

Author Contributions: Conceptualization, E.H.A.-F.; Methodology, Y.A.H. and N.M.A.; Software, N.M.A.; Formal analysis, N.M.A.; Investigation, Y.A.H.; Resources, E.H.A.-F. and Y.A.H.; Data curation, N.M.A.; Writing – original draft, E.H.A.-F. and T.j.A.; Writing—review & editing, Y.A.H.; Supervision, E.H.A.-F. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Data Availability Statement: No new data were created or analyzed in this study. Data sharing is not applicable to this article.

Conflicts of Interest: Author Yazan Abu Huson was employed by National Electric Power Company, Jordan. The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Appendix A. The Questionnaire

Assessment Scale	☹ Strongly Disagree	Disagree	☺ Indifferent	Agree	☺ Strongly Agree
Please read each statement carefully and indicate your response by placing a circle or tick	1	2	3	4	5

Technology Application		☹		☺		☺
1	The company allocates sufficient funds and resources to use technology applications in its operations.	1	2	3	4	5
2	The company uses technology applications in its operations, which leads to increased productivity.	1	2	3	4	5
3	The company invests in training employees on the optimal use of technology applications.	1	2	3	4	5
4	The company keeps pace with the latest technology applications and invests in them	1	2	3	4	5
5	The company uses technology applications to improve the type of work through automation and remote control.	1	2	3	4	5
6	Technology applications help the company innovate and develop new products or services.	1	2	3	4	5
7	The company uses technology applications in marketing and expansion.	1	2	3	4	5
8	The company is interested in training workers to use technology applications.	1	2	3	4	5
9	The company uses technology applications to communicate effectively with customers, employees, and partners anywhere in the world.	1	2	3	4	5
10	The company uses technology applications to protect its data and information security.	1	2	3	4	5
Smart Human Resource Management		☹		☺		☺
1	SHRM provides easy-to-understand data for the target audience.	1	2	3	4	5
2	SHRM delivers data that is free from bias, and error.	1	2	3	4	5
3	SHRM continuously delivers new data.	1	2	3	4	5
4	SHRM provides data that aligns with users' needs and habits.	1	2	3	4	5
5	SHRM processes and delivers data without delay.	1	2	3	4	5
6	SHRM data reduce business operations and service delivery costs.	1	2	3	4	5
7	The decision-making process is well established and known to stakeholders.	1	2	3	4	5
8	Information provided by SHRM is used to make changes to organization strategies and plans.	1	2	3	4	5
Innovation Performance		☹		☺		☺
1	The organization is expanding the range of products within the main product area with products that are technically new compared to our competitors.	1	2	3	4	5
2	The organization develops environmentally friendly products compared to our competitors.	1	2	3	4	5
3	The organization has a better and faster average time to develop innovation projects compared to our competitors.	1	2	3	4	5
4	The organization has an average number of hours working on innovation projects more than our competitors.	1	2	3	4	5
5	The organization is characterized by a higher average amount of spending on research and development compared to its competitors.	1	2	3	4	5
6	Sales of the organization are constantly increasing.	1	2	3	4	5
7	The market share of the organization is constantly increasing.	1	2	3	4	5
8	Modern technologies are available within the organization.	1	2	3	4	5
9	Research and development activities are available in the organization.	1	2	3	4	5

Demographics—Kindly place a tick (✓) in the appropriate alternatives.

Your gender?

Male ☐ Female ☐

How old are you?

<30 ☐ 30–40 ☐ 41–50 ☐ >50 ☐

What is your level of education?

Diploma ☐ Bachelor ☐ Master ☐ PhD ☐

What is your specialty?

Management ☐ Information Technology ☐ Accounting ☐ Marketing ☐ Others ☐

Position?

Top management ☐ Head of Department ☐ Trainee ☐ others ☐

Years of experience?

<5 [] 5–10 [] 11–20 [] >20 []

Thank you for your time!!!

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