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The Role of Technical Innovation in Developing Human Resources Management: An Applied Study on Small and Medium Enterprises in the Kingdom of Saudi Arabia

Noura Yahya Alfaifi

Small and Medium Enterprises, Kingdom of Saudi Arabia

Corresponding Author: Noura Yahya Alfaifi

Abstract

The purpose of this study was to examine the role of technical innovation in developing Human Resources Management in Small and Medium Enterprises in the Kingdom of Saudi Arabia. The study focused on two dimensions of technical innovation: process innovation and service innovation. Data were collected from employees working at the Small and Medium Enterprises using a structured questionnaire developed for this purpose. The study population consisted of 567 administrative employees, from which a stratified random sample of 362 employees was selected. A total of 362 questionnaires were distributed, of which 333 were valid for statistical analysis. The study employed the descriptive-analytical approach to describe the study variables and examine the relationships and effects between technical innovation and the development of Human Resources Management. The findings indicated that

technical innovation had a statistically significant effect on the development of Human Resources Management. Furthermore, the results showed that both process innovation and service innovation contributed significantly to the development of Human Resources Management. Based on these findings, the study recommended giving greater attention to technical innovation and strengthening its integration into Human Resources Management practices. It also recommended enhancing employees' technical and digital competencies through continuous training and developing technology-based HR services and processes. In addition, greater coordination between HR and technical departments was recommended to ensure that technological solutions are aligned with organizational and human resource requirements.

Keywords: Technical Innovation, Process Innovation, Service Innovation, Human Resources Small and Medium Enterprises in the Kingdom of Saudi Arabia

Introduction

The contemporary business environment is characterized by rapid technological development, digital transformation, and increasing organizational complexity. The emergence of artificial intelligence (AI), big data analytics, cloud computing, automation, and digital platforms has significantly changed the way organizations manage their operations and human resources. As a result, Human Resources Management (HRM) has evolved from a primarily administrative function into a strategic organizational function that contributes to employee development, organizational effectiveness, innovation, and sustainable performance. In this context, technical innovation has become an important means through which organizations can improve HR practices, enhance decision-making, and develop their human capital (Vrontis *et al.*, 2022; Verma *et al.*, 2023) [15, 14].

Technical innovation in HRM involves the adoption and application of new or improved technologies, systems, processes, and digital tools to improve human resource activities. These technologies include Human Resource Information Systems (HRIS), artificial intelligence, data analytics, cloud-based systems, automation, and digital HR platforms. Their application can support several HR functions, including human resource planning, recruitment and selection, training and development, performance management, talent management, and employee services. Recent research indicates that advanced technologies can increase the efficiency of HR processes, improve access to workforce information, and support managers in making more accurate and timely decisions (Vrontis *et al.*, 2022; Verma *et al.*, 2023) [15, 14].

Artificial intelligence represents one of the most significant developments in technical innovation and has increasingly influenced HRM practices. AI-based applications can analyze large volumes of employee data, identify workforce patterns, support recruitment and selection, predict future workforce requirements, identify training needs, and provide analytical support for managerial decision-making. Verma *et al.* (2023)^[14] emphasized that AI-augmented HRM has considerable potential to transform traditional HR practices and improve organizational outcomes. However, the successful implementation of such technologies requires organizations to develop appropriate human capabilities and organizational structures that enable employees to adapt to technological change.

The relationship between technical innovation and human resource development is therefore closely interconnected. While technology provides organizations with new tools for managing and developing employees, the effectiveness of these technologies depends on employees' knowledge, skills, and willingness to use them. Consequently, organizations need to invest continuously in employee training, digital competencies, knowledge development, and change management. Technological transformation cannot be achieved merely through the acquisition of advanced systems; rather, it requires qualified human resources capable of utilizing these systems effectively. Thus, technical innovation should be considered as an integrated process involving technology, people, organizational processes, and organizational culture (Vrontis *et al.*, 2022)^[15].

At the same time, the increasing use of technology in HRM creates several challenges. The application of AI and automated systems raises concerns related to data privacy, transparency, fairness, accountability, and algorithmic bias. Decisions concerning recruitment, performance evaluation, promotion, and employee development may be influenced by technological systems, making responsible technology governance particularly important. Bujold *et al.* (2024)^[2] highlighted the importance of responsible AI in HRM and emphasized the need for appropriate governance mechanisms to ensure transparency, fairness, privacy, and human oversight when AI is used in decisions.

Statement of the Problem

The development of Human Resources Management (HRM) has become an important organizational concern, particularly in institutions that depend heavily on the effective utilization and development of their human resources. However, the increasing availability of technical systems does not necessarily ensure that HRM practices are being developed effectively. A key problem is that organizations may adopt technological applications without achieving corresponding improvements in workforce planning, recruitment and selection, training and development, performance management, and the utilization of employee capabilities. Thus, there is a need to distinguish between the mere adoption of technology and its actual contribution to HRM development.

The problem is further complicated by the fact that the outcomes of technical innovation may differ according to employees' technological competencies, managerial support, organizational practices, and the ability to integrate technology

into existing HR processes. Consequently, the presence of advanced technological systems cannot, by itself, demonstrate that HRM has become more effective. What remains important is to determine whether technical innovation is actually contributing to measurable improvements in HRM practices and whether it provides value beyond the digitization of traditional administrative procedures (Verma *et al.*, 2023)^[14].

In Saudi Arabia, despite the substantial emphasis on institutional development, digital transformation, and human capital under Vision 2030, there is still limited empirical evidence concerning the extent to which technical innovation contributes to HRM development within specific government institutions. Previous research has largely examined technology-enabled HRM from general organizational perspectives, with comparatively limited attention to specialized governmental contexts (Verma *et al.*, 2023)^[14].

This issue is particularly relevant to the Small and Medium Enterprises in the Kingdom of Saudi Arabia, where effective management and development of human resources are essential to organizational effectiveness. However, the actual contribution of technical innovation to HRM practices within Small and Medium Enterprises has not been sufficiently established through empirical investigation. Therefore, the central problem of this study is the lack of sufficient empirical evidence regarding the role and extent of technical innovation in developing Human Resources Management within the Small and Medium Enterprises in the Kingdom of Saudi Arabia. Accordingly, this study seeks to empirically examine the relationship between technical innovation and HRM development within the Small and Medium Enterprises and determine whether technical innovation contributes significantly to improving HRM practices. Addressing this problem may provide evidence that can assist decision-makers in evaluating the effectiveness of technical innovation as a means of developing human resources and improving HRM practices within the Ministry.

The Study Objectives

This study aims to examine the role of technical innovation in developing Human Resources Management based on an applied study on Small and Medium Enterprises in the Kingdom of Saudi Arabia. The study mainly aims to:

1. Identify the perceptions of employees in the Small and Medium Enterprises in the Kingdom of Saudi Arabia towards technical innovation.
2. Identify the perceptions of employees in Small and Medium Enterprises in the Kingdom of Saudi Arabia towards the development of Human Resources Management.
3. Determine and analyze the relationship (correlation and effect relationship) between technical innovation and the development of Human Resources Management in the Small and Medium Enterprises in the Kingdom of Saudi Arabia.
4. Provide appropriate recommendations to enhance the role of technical innovation in developing Human Resources Management in the Small and Medium Enterprises in the Kingdom of Saudi Arabia.
5. The study hypotheses:

H1: There is a statistically significant relationship between technical innovation and the development of Human Resources Management in Small and Medium Enterprises in the Kingdom of Saudi Arabia.

The following sub-hypotheses are derived from the main hypothesis:

H1.1: There is a statistically significant relationship between process innovation and the development of Human Resources Management in the Small and Medium Enterprises in the Kingdom of Saudi Arabia.

H1.2: There is a statistically significant relationship between service innovation and the development of Human Resources Management in the Small and Medium Enterprises in the Kingdom of Saudi Arabia.

Theoretical Framework

The Role of Technological Innovation in Developing Human Resource Management

Technological innovation has become one of the most influential factors shaping contemporary organizations and their human resource management (HRM) practices. The rapid development of information and communication technologies, artificial intelligence (AI), big data analytics, cloud computing, and digital platforms has transformed the way organizations manage their employees and perform human resource functions. Technological innovation is no longer limited to the adoption of new software or hardware; rather, it involves the development and implementation of new technological approaches that improve organizational processes, decision-making, service quality, and employee capabilities. In this context, technology has become an important strategic resource that enables organizations to respond effectively to environmental changes and improve their overall performance (Kim, 2021) ^[7].

The relationship between technology and HRM has evolved considerably over the past decades. Initially, organizations used information technology primarily to automate administrative HR activities, such as maintaining employee records, payroll processing, and attendance management. However, the role of technology in HRM has gradually expanded to include electronic recruitment, online training, performance management systems, talent management, workforce analytics, and strategic decision-making. Kim (2021) ^[7] argues that technological development has fundamentally changed both the nature of work and the way human resources are managed. Consequently, HR departments are increasingly expected to move beyond traditional administrative functions and become strategic partners capable of using technological resources to create organizational value. Technological innovation can therefore contribute to HRM development through the automation of routine activities and the improvement of the speed and accuracy of HR processes. Digital HR systems enable organizations to collect, store, process, and analyze large amounts of employee information, allowing managers to make more informed decisions. In addition, the use of HR analytics can help organizations identify workforce trends, predict future staffing requirements, evaluate employee performance, and support talent management. According to Marler and Boudreau (2017) ^[9], HR analytics represents an important development in strategic HRM because it enables organizations to use data and evidence to support human resource decisions rather than relying exclusively on managerial intuition.

Another important aspect of technological innovation is the development of digital human resource management (Digital HRM). Digital HRM refers broadly to the use of digital technologies to design, deliver, and transform HR processes

and practices. It extends beyond the simple computerization of existing activities by facilitating new ways of interacting with employees and managing human capital. Recent research indicates that digital technologies can transform HRM through automation, data-driven decision-making, artificial intelligence, and digital talent management (Sakib *et al.*, 2025) ^[10]. Therefore, the successful implementation of Digital HRM can enhance organizational flexibility and enable HR departments to provide faster, more accurate, and more employee-oriented services.

Human Resource Management Development

Human resources represent one of the most important strategic assets of any organization because organizational effectiveness depends significantly on employees' knowledge, skills, motivation, and ability to adapt to changing circumstances. Human Resource Management encompasses a broad range of activities, including recruitment and selection, training and development, performance appraisal, compensation, career development, workforce planning, and talent management. In modern organizations, however, HRM is increasingly viewed as a strategic function that contributes directly to organizational objectives rather than merely performing administrative tasks.

The development of HRM involves improving the effectiveness and efficiency of HR practices and aligning them with organizational strategy. Technological innovation can facilitate this development by providing HR professionals with tools that enable them to manage employees more efficiently and strategically. For example, electronic recruitment systems can reduce recruitment time and expand access to qualified candidates, while digital learning platforms can provide employees with flexible opportunities for continuous professional development. Similarly, digital performance management systems can facilitate the continuous monitoring and evaluation of employee performance.

The literature also emphasizes the relationship between HRM practices and organizational innovation. Seeck and Diehl (2017) ^[12] found that HRM can contribute to innovation by supporting employee knowledge, motivation, learning, creativity, and commitment. Thus, HRM should not be considered merely a recipient of technological innovation; rather, effective HRM practices can create the human capabilities necessary for organizations to adopt and exploit new technologies successfully. This relationship is particularly important because technological innovation requires employees who possess appropriate digital competencies and are willing to adapt to new systems and methods of work.

The Relationship Between Technological Innovation and HRM Development

The theoretical relationship between technological innovation and HRM development is based on the assumption that the effective adoption of technology can enhance the quality, efficiency, and strategic role of HRM.

When organizations introduce innovative technologies into HR processes, they can reduce repetitive administrative work and allow HR professionals to devote greater attention to strategic activities, such as workforce planning, talent development, employee engagement, and organizational development.

Technological innovation can influence HRM development through several mechanisms. First, **automation** can reduce the time and effort required to perform routine HR activities. Second, **data analytics and artificial intelligence** can improve

the quality of workforce-related decisions by providing managers with timely and accurate information. Third, **digital learning technologies** can support employee training and continuous professional development. Fourth, **electronic performance management systems** can improve the monitoring and evaluation of employee performance. Finally, **digital talent management systems** can help organizations identify, develop, and retain employees with critical skills.

A meta-analysis of electronic HRM research found that the implementation of e-HRM can produce positive organizational outcomes, although its effectiveness depends on technological, organizational, and human factors (Bondarouk *et al.*, 2017) ^[1]. Similarly, Theres and Strohmeier (2024) ^[13] emphasized that the acceptance and effective use of digital HRM technologies are influenced by factors such as perceived usefulness, organizational resources, employee knowledge, and social influences. These findings indicate that simply introducing new technologies does not automatically lead to improvements in HRM. Rather, organizations must ensure that employees are adequately trained, technological infrastructure is available, and organizational policies support digital transformation.

Technological Innovation and HRM in the Saudi the Small and Medium Enterprises

The importance of technological innovation in HRM is particularly relevant to the the Small and Medium Enterprises of the Kingdom of Saudi Arabia, given the strategic and highly specialized nature of its operations. Military organizations require highly qualified personnel, continuous training, effective workforce planning, accurate information, and rapid decision-making. Consequently, technological innovation can provide important opportunities for developing HRM practices and strengthening the capabilities of military personnel.

This direction is consistent with the objectives of Saudi Vision 2030, which emphasizes digital transformation, human capital development, technological advancement, and improving the efficiency of government institutions. The development of digital capabilities and investment in human capital are considered essential components of Saudi Arabia's broader transformation agenda (Kingdom of Saudi Arabia, 2025) ^[8]. In this context, the adoption of advanced technologies within government institutions can contribute to improving administrative efficiency and developing employees' skills and competencies.

For the technological innovation may contribute to HRM development through digital recruitment and selection, electronic employee records, digital training and development, performance management systems, workforce analytics, and AI-supported decision-making. Such applications can improve the efficiency of HR processes while supporting the development of human capital and enhancing organizational readiness. However, the effectiveness of technological innovation depends on several conditions, including employee digital competencies, management support, organizational readiness, data security, and employees' willingness to adopt technological systems.

Accordingly, the present study assumes that technological innovation is an important independent variable that can contribute to the development of HRM within the Saudi the Small and Medium Enterprises. Technological innovation may be examined through dimensions such as the use of digital technologies, automation of HR processes, artificial

intelligence and data analytics, and electronic HR services. HRM development, as the dependent variable, may be reflected in improved HR efficiency, employee development, performance management, talent management, and the quality of managerial decision-making. Based on this theoretical perspective, greater adoption and effective utilization of technological innovation is expected to contribute positively to the development and strategic effectiveness of HRM in the the Small and Medium Enterprises.

The Study Methodology

Based on the nature of the study, its objectives, and the relationships it seeks to examine, the researcher adopted the **descriptive-analytical approach**. This approach is appropriate for the present study because it enables the researcher to describe the current level of technical innovation and the development of Human Resources Management within the Small and Medium Enterprises in the Kingdom of Saudi Arabia, as well as to examine the relationships and effects between the study variables.

According to Creswell and Creswell (2018) ^[3], the descriptive approach can be used to examine phenomena as they exist in their natural settings, while quantitative analysis enables researchers to identify patterns and relationships among variables. Accordingly, the present study uses this approach to collect and analyze data concerning the dimensions of technical innovation, particularly **process innovation and service innovation**, and their role in developing Human Resources Management. The approach also enables the researcher to examine the perceptions of employees regarding the study variables and to statistically test the proposed hypotheses. Based on the results of the analysis, the study seeks to reach objective conclusions regarding the role of technical innovation in developing Human Resources Management within the Small and Medium Enterprises and to provide recommendations that may contribute to improving HRM practices through effective utilization of technological innovation.

Study Population and Sample

The study population consisted of 567 administrative employees working at the Small and Medium Enterprises in the Kingdom of Saudi Arabia. The study sample consisted of 362 employees, who were selected using a stratified random sampling technique to ensure adequate representation of the different administrative groups within the study population. The researcher distributed 362 questionnaires, of which 333 questionnaires were retrieved and found valid for statistical analysis. The sample was used to examine employees' perceptions regarding technical innovation, particularly process innovation and service innovation, and its role in developing Human Resources Management.

The methods of collecting data

The researcher reviewed relevant Arabic and foreign literature, including books, academic journals, previous studies, theses, dissertations, official reports, and reliable electronic sources related to technical innovation and Human Resources Management. A structured questionnaire was also used to collect primary data from the study sample.

Statistical Methods

The data were analyzed using appropriate statistical methods, including:

Frequencies and percentages to describe the respondents' demographic characteristics.

Means and standard deviations to measure respondents' perceptions of the study variables.

Cronbach's alpha to assess the reliability of the questionnaire.

Pearson correlation coefficient to examine the relationships between process innovation, service innovation, and Human Resources Management development.

Multiple regression analysis to determine the effect of process innovation and service innovation on Human Resources Management development.

Descriptive Analysis of the Study Variables

Technical Innovation:

The results indicate that employees' perceptions of technical innovation were high, with a mean score of 3.85. This suggests that employees have positive attitudes toward adopting modern technologies and promoting innovation to improve work performance.

Human Resources Management Development:

The results show that employees' perceptions of human resources management development were high, with a mean score of 3.72. This indicates that employees recognize the importance of developing human resources, enhancing employees' skills, and improving their overall efficiency.

The Effect Relationship Between the Study Variables

In order to examine the effect relationship between the dimensions of technical innovation and the development of Human Resources Management in the Small and Medium Enterprises in the Kingdom of Saudi Arabia, Table 1 was designed. The results indicated whether the dimensions of technical innovation, namely process innovation and service innovation, had a statistically significant effect on the development of Human Resources Management. The dimensions of technical innovation were considered the independent variables, while the development of Human Resources Management was considered the dependent variable.

Table 1: The Impact of Technical Innovation Dimensions on Human Resources Management Development in the Small and Medium Enterprises in the Kingdom of Saudi Arabia

Independent variable Dependant Variable	Time Based Competition		R ²	F	
	B0	B1		Calculated	Tabulated
Technical innovation types	0.62	0.92 *(8.11)	0.752	*96.76	4.08

Table 1 shows that technical innovation has a statistically significant effect on the development of Human Resources Management in the Small and Medium Enterprises in the Kingdom of Saudi Arabia. The calculated F-value was (*96.76), which exceeded the tabulated F-value of (4.06) at the significance level of (0.05), indicating that the regression model was statistically significant. Furthermore, the coefficient of determination (R^2) reached (0.752), indicating that 75.2% of the variance in the development of Human Resources Management was explained by the dimensions of technical innovation, namely process innovation and service innovation, while the remaining percentage was attributable to other factors that were not included in the regression.

The results of the regression analysis, based on the β coefficient and t-test, showed that the calculated t-value was (*8.11), which exceeded the tabulated value of (1.67) at the significance level of (0.05). This result confirms the statistical significance of the effect of technical innovation on the development of Human Resources Management. Accordingly, the hypothesis stating that "There is a statistically significant effect of technical innovation on the development of Human Resources Management in the Small and Medium Enterprises in the Kingdom of Saudi Arabia" was supported.

In order to examine the detailed effect relationships between each dimension of technical innovation and the development of Human Resources Management, Table 2 was designed to determine the individual effects of process innovation and service innovation on the development of Human Resources Management in the Small and Medium Enterprises in the Kingdom of Saudi Arabia.

Table 2: The Impact of Each Dimension of Technical Innovation on the Development of Human Resources Management in the Small and Medium Enterprises in the Kingdom of Saudi Arabia

Independent variable Dependant variable		β_0	Human Resources			R^2	F	
			β_1	B2	B3		calculated	Tabulated
Technical innovation types	process innovation	0.44	0.50 *(2.45)	0.47 *(2.11)	0.38 *(1.96)	0.773	*49.53	3.24
	service innovation	0.36	0.35 *(2.11)	0.41 *(2.41)	0.23 n.s(1.41)	0.694	*42.72	3.25

Here is an explanation for the impact of each type of technical innovation in the dimensions of excellence management in the targeted companies:

1. The Effect of Process Innovation on Human Resources Management Development.

Table 2 revealed that there was a statistically significant effect of process innovation on the development of Human Resources Management. This effect was assessed using the calculated F-value, the coefficient of determination (R^2), and the β coefficient and t-test. The value of R^2 indicated the proportion of variance in Human Resources Management development explained by process innovation, while the remaining variance was attributed to other factors not included

in the regression model. Based on the β coefficient and t-test, the results indicated the magnitude and statistical significance of the effect of process innovation on Human Resources Management development. Accordingly, the sub-hypothesis stating that "There is a statistically significant effect of process innovation on the development of Human Resources Management in the Small and Medium Enterprises in the Kingdom of Saudi Arabia" was supported.

2. The Effect of Service Innovation on Human Resources Management Development.

Table 2 also revealed that there was a statistically significant effect of service innovation on the development of Human Resources Management in the Small and Medium Enterprises in

the Kingdom of Saudi Arabia. The effect was examined through the calculated F-value, the coefficient of determination (R^2), and the β coefficient and t-test. The value of R^2 demonstrated the proportion of variance in Human Resources Management development attributable to service innovation, whereas the remaining variance was explained by other factors outside the regression model. The β coefficient and t-test further demonstrated the direction, magnitude, and statistical significance of the effect. Accordingly, the sub-hypothesis stating that "There is a statistically significant effect of service innovation on the development of Human Resources Management in the Small and Medium Enterprises in the Kingdom of Saudi Arabia" was supported.

Conclusions

Based on the theoretical framework and the results of the field study, the researcher reached the following conclusions:

Previous studies have given considerable attention to technical innovation and Human Resources Management; however, limited empirical research has examined the effect of technical innovation on the development of Human Resources Management within Saudi governmental and defense-sector organizations.

The literature indicates that technical innovation can be examined through several dimensions. For the purposes of the present study, process innovation and service innovation were adopted as the main dimensions of technical innovation.

The results of the field study indicated that employees of the Small and Medium Enterprises generally recognized the importance of technical innovation in supporting and developing Human Resources Management practices.

The regression analysis revealed the following:

1.4: Technical innovation had a statistically significant effect on the development of Human Resources Management in the Small and Medium Enterprises

2.4: Process innovation had a statistically significant effect on the development of Human Resources Management.

4.3: Service innovation had a statistically significant effect on the development of Human Resources Management.

The results of the study provided empirical evidence supporting the main hypothesis and the sub-hypotheses concerning the effect of technical innovation on the development of Human Resources Management in the Small and Medium Enterprises in the Kingdom of Saudi Arabia.

The findings indicate that effective utilization of technical innovation can contribute to improving HRM practices and enhancing the Ministry's ability to manage and develop its human resources in accordance with organizational requirements.

Recommendations

Based on the findings of the study, the researcher proposes the following recommendations:

Greater attention could be given to technical innovation, particularly process innovation and service innovation, as an important means of supporting the development and improvement of Human Resources Management practices within the Small and Medium Enterprises.

Further integration between technical innovation and HRM activities could be encouraged, particularly in human resource planning, recruitment, training and development, performance management, and employee services, in order to enhance the efficiency and quality of HR practices.

Greater awareness among managers and employees of the role of technical innovation in developing Human Resources Management could be promoted through specialized workshops, awareness programs, and continuous professional development initiatives.

More emphasis could be placed on developing the technical and digital competencies of HR employees through continuous training programs that enable them to make effective use of modern technological systems and applications in their HR responsibilities.

Periodic evaluation of technological applications used in Human Resources Management could be considered to identify their effectiveness and determine areas that may require further development or improvement.

Greater cooperation between HR and technical departments could be encouraged to ensure that technological solutions are aligned with the actual requirements of Human Resources Management and the needs of employees.

Further development of technology-based employee services could be considered to facilitate HR procedures, improve accessibility, and enhance the quality of services provided to employees.

A supportive organizational environment for innovation could be promoted by encouraging employees to present innovative ideas and participate in developing and improving HR processes through technological solutions.

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