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THE IMPLICATIONS OF KNOWLEDGE-BASED HRM PRACTICES ON OPEN INNOVATIONS FOR SMEs IN THE MANUFACTURING SECTOR

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ABSTRACT

Aim/Purpose	The main aim of this study was to investigate the impact of knowledge-based Human Resources Management (HRM) practices on inbound and outbound open innovation in Jordanian small and medium enterprises (SMEs).
Background	SMEs in Jordan lack tangible resources. This insufficiency can be remedied by using knowledge as a resource. According to the Knowledge-Based View (KBV) theory, which posits knowledge as the most valuable resource, SMEs can achieve open innovation by implementing knowledge-based HRM practices that enhance the utilization of knowledge and yield competitiveness.
Methodology	This study adopted the quantitative method employing descriptive and exploratory approaches. A total of 500 Jordanian manufacturing SMEs were selected from 2,310 manufacturing SMEs registered lists, according to the Jordan Social Security, by using random sampling. The study's instrument was a questionnaire that was applied to these SMEs. There were 335 responses that were deemed useful for analysis after filtering out the replies with missing values; this corresponded to a response rate of 67%. The paper utilized structural equation modeling and cross-sectional design to test hypotheses in the proposed research model.

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Contribution	This study advocates the assumption of the role of KBV in improving innovation practices. This study contributes to the existing strategic HRM research by extending the understanding of knowledge-based HRM practices in the context of SMEs. Thus, this study contributes to the understanding of innovation management by demonstrating the role of knowledge-based HRM practices in boosting inbound and outbound OI practices, thereby enhancing innovation as an essential component of firm competitiveness.
Findings	The findings revealed the positive impact of four knowledge-based HRM practices on inbound and outbound open innovation in Jordanian manufacturing SMEs. These practices were knowledge-based recruitment and selection, knowledge-based training and development, knowledge-based compensation and reward, as well as knowledge-based performance assessment.
Recommendations for Practitioners	This study is expected to help the stakeholders of SMEs to re-shape the traditional HRM practices into knowledge-based practices which improve managerial skills, innovation practices, and the level of the firm's competitiveness.
Recommendations for Researchers	This study serves as a significant contribution to the research field of innovation practices by building a new association between knowledge-based HRM practices and inbound and outbound open innovation.
Impact on Society	The study emphasizes the vital role of knowledge-based HRM practices in enhancing the knowledge and social skills of the human capital in SMEs in Jordan, thus improving the country's social and economic development.
Future Research	Future research could build on this study to include service SMEs. It could also employ a longitudinal study over the long run which would allow for a deeper analysis of the relationships of causality, offering a more comprehensive view of the effect of knowledge-based HRM on open innovation. Furthermore, future research could examine the sample of investigation before and after implementing the knowledge-based HRM practices to provide stronger evidence of their influence on inbound and outbound innovation.
Keywords	knowledge-based HRM practices, open innovation, inbound open innovation, outbound open innovation

INTRODUCTION

SMEs are the backbone of economic growth in the global economy and make a sizable contribution to it (Gherghina et al., 2020). However, in today's hyper-competitive market environment, SMEs face various challenges in maintaining and sustaining competitiveness (Prasanna et al., 2019). The rapid changes in technology and customer demands due to globalization result in more difficulties for SMEs to compete with large companies and sometimes even to survive (Dušana & Olgicab, 2020).

The challenges faced by SMEs in Jordan are similar to those faced by SMEs worldwide, particularly in developing nations (Al Tal & Emeagwali, 2019). These challenges include a severe reduction in competitiveness due to a lack of resources, management competence, innovation, and market access (Al-Weshah et al., 2022). Despite SMEs occupying about 98% of the total manufacturing sector in Jordan, the level of innovation and competitiveness of Jordanian SMEs remains low (Al-Hyari, 2021). According to the Global Competitiveness Index (GCI), Jordan's economy ranks 70th among 141 economies (World Economic Forum, 2019). This low competitiveness of Jordanian SMEs can be easily identified by insufficient contribution to the Gross Domestic Product (Alzeaideen, 2020).

Researchers have recently pointed out the role of innovation in gaining competitive advantage through knowledge (Chong & Yuen, 2022; Gonzalez & De Melo, 2018; Sabando-Vera et al., 2022). Innovation is crucial for SMEs to increase competitiveness for better profitability, sales, and market share (Kiveu et al., 2019). The traditional or close innovation model was beneficial to large organizations which could afford in-house research and development (R&D). Nowadays, this close innovation is no longer effective, particularly in the context of SMEs because of their limited resources and low capacity for R&D (Arvaniti et al., 2022).

Srisathan et al. (2022) suggested that open innovation plays a vital role in enhancing competitiveness, particularly in SMEs. Open innovation can be defined as the process by which an enterprise imports knowledge from its surrounding environment and shares its own knowledge in the form of research and expertise. Open innovation, therefore, is dynamic with two dimensions: inbound and outbound. Inbound open innovation involves the processes by which a firm utilizes the imported knowledge that is obtained from external sources, while outbound open innovation can be defined as the processes through which a firm shares the knowledge generated internally.

The practices of inbound and outbound open innovation allow maximum utilization of knowledge through the effective management of knowledge inflow and outflow, and in turn, SMEs can promote innovation performance (Popa et al., 2017). The idea behind open innovation stems from the fact that firms cannot innovate alone as they need to collaborate with a variety of partners to obtain new ideas and resources in order to sustain competitiveness (Leitão et al., 2020). Furthermore, making the development and improvement of the quality of human resources is an essential prerequisite for building open innovation in firms (Engelsberger et al., 2022). Contemporary firms need to adopt new HRM practices that enable and facilitate organizational innovation and competitiveness (Waheed et al., 2019). Ling and Nasurdin (2010) adopted a bundle of HRM practices (performance appraisal, career management, training, reward system, and recruitment) to examine the level of organizational innovation. This bundle was found to significantly affect organizational innovation.

López-Cabrales et al. (2009) and Minbaeva (2013) introduced knowledge-based HRM practices that were designed to enhance the management of knowledge across organizational boundaries. Further, Kianto et al. (2017) indicated that knowledge-based HRM practices can promote innovation performance in firms. Inkinen et al. (2015) indicated the effect of knowledge-based HRM through such practices as recruiting, training, and motivating talented employees in the innovation process. Similarly, Al Tal and Emeagwali (2019) indicated that knowledge-based HRM practices can boost procedures and product innovation.

In terms of research, specific gaps have been identified in previous research on inbound and outbound open innovation. Hong et al. (2019) suggested that the relationship between HRM practices and inbound and outbound open innovation has not been well examined. Also, there have been limited empirical studies on open innovation in the SME context (Baggio et al., 2018; Grama-Vigouroux et al., 2020; Hinteregger et al., 2019; Park, 2018). According to Annamalah et al. (2018), many researchers have limited their focus to inbound and outbound open innovation practices in large and high-technology companies.

Further research gaps can be identified. Hermano and Martín-Cruz (2020) contended that HRM practices could substantially enhance a firm's capability to manage knowledge to drive intended innovation. However, the HRM practices considered by the aforementioned authors were not knowledge-based. Moreover, most of these studies on open innovation practices (Costa & Matias, 2020; Greco et al., 2016; Lenart-Gansiniec & Sulkowski, 2020; Popa et al., 2017) have been conducted in developed countries, i.e., Western countries. Hossain and Kauranen (2016) highlighted the scarcity of open innovation studies in developing countries.

The discussion above establishes the novelty and value of this study. In terms of the research problem, this study investigates the low competitiveness in Jordanian SMEs, possibly due to gaps in innovation practices, coupled with the absence of a research framework that links open innovation with

knowledge-based HRM practice. It examines the effect of knowledge-based HRM practices on inbound and outbound open innovation in SMEs in developing countries with Jordanian SMEs being the focus of the study. Four HRM practices were chosen, namely: knowledge-based recruitment and selection; knowledge-based training and development; knowledge-based compensation and reward; and knowledge-based performance assessment.

The next section provides a chronological review of the literature on open innovation with a specific focus on KBV theory and the four practices of knowledge-based HRM, ending with the development of the research hypotheses. Next, the methods and tools used in this study to collect and analyze data are presented, leading to the results, discussion, implications, and conclusions.

LITERATURE REVIEW

OPEN INNOVATION (OI)

According to Heimstädt and Reischauer (2019), innovation is a “continuum between closed forms and opened forms of innovation.” Innovation is a critical component of any business’s success (Gómez et al., 2017). However, organizations could range from close to open innovation with varying degrees of openness (Huizingh, 2011). Over the past three decades, the views underlying closed innovation have come under scrutiny due to changes in the socio-technical environment, such as increased labor mobility, decreased transportation costs, intensified technological development and dissemination processes, as well as growing globalization (Grama-Vigouroux et al., 2020). In addition, new challenges face SMEs such as the emergence of industry 4.0 and the recent pandemic which have affected SMEs’ competitiveness and even survival. Accordingly, strategic management in SMEs should adopt and adapt to “open innovation” strategies to overcome these challenges and foster SMEs innovation and competitiveness (Anshari & Almunawar, 2022; Rumanti et al., 2022). Open innovation practices may be the most effective way to advance innovation in SMEs and increase their competitiveness (Sabando-Vera et al., 2022).

Open innovation (OI) is regarded as a more advanced and sophisticated form of innovation that provides potential advantages by exploiting the external and internal knowledge of the firm. OI has become a unique topic of study to improve the innovation performance of many different types of organizations since Chesbrough introduced the notion in 2003 (Chesbrough & Bogers, 2014; Popa et al., 2017; Randhawa et al., 2016; West & Bogers, 2014). Furthermore, open innovation is closely connected to “absorptive capacity” (Cohen & Levinthal, 1990) and “technology transfer” (Bozeman, 2000). In addition, “licensing” (Grindley & Teece, 1997), and “external technology/knowledge acquisition” (Veugelers & Cassiman, 1999), the above-mentioned studies contribute to comprehending the concept of open innovation, which is primarily linked to intra- and inter-organizational knowledge flows (Chesbrough & Bogers, 2014).

OI based on purposefully managed knowledge flows across organizational boundaries which aid organizations in establishing a synergistic interaction between internal and external sources of new knowledge (Chesbrough & Bogers, 2014; Randhawa et al., 2016). Moreover, OI practices reflect the development of innovation because they enable organizations to obtain innovation from the environment through collaborating with other organizations to acquire external knowledge (Stanislowski, 2020). This collaboration with the surrounding sources enables SMEs to overcome their limited resources in terms of R&D and other tangible resources (e.g., the firm’s property, plant, and equipment). The majority of the existing open innovation research focused on technology sourcing or inbound upstream open innovation. It also pointed out that organizations can internalize, outsource, “buy-in”, “sell-out”, and collaborate with “external actors” along with “downstream activities” (Filioiu, 2020). Among the majority of scholars (e.g., Chesbrough & Bogers, 2014; Gassmann, 2006; Popa et al., 2017; Stanko et al., 2017), open innovation was divided into two main dimensions: inbound open innovation, and outbound open innovation, as per the following subsections.

Inbound open innovation

Inbound OI is viewed as the process where firms internally use the knowledge obtained from external sources such as consumers, suppliers, competitors, governments, consultants, universities, or research organizations (Santoro et al., 2019). It also refers to internalizing thoughts, expertise, and technologies that complement and supplement an organization's knowledge base which involves external actors and organizations at a comparative advantage (Leitão et al., 2020). In other words, inbound OI can be conceptualized in terms of the breadth of the search for new sources of knowledge and the breadth of collaboration with different types of external partners.

Outbound open innovation

Outbound OI can be defined as the processes where firms externally use the knowledge generated internally such as licensing, patenting, and contractual agreement (Santoro et al., 2019). It encourages internal innovation to collaborate with external stakeholders with the goal of having a positive influence on society and the environment. In other words, outbound OI is the strategy to shift the internal knowledge outside the firm's boundaries, which means creating profits via out-licensing IP and "technology, joint ventures and alliances, agreement contracts, spin-outs, corporate venture capital and corporate incubators" (Chesbrough & Bogers, 2014).

KNOWLEDGE BASED VIEW THEORY

The theory of Knowledge Based View (KBV) considers knowledge as the crucial resource of an organization because of its inimitability (Choi et al., 2016). KBV is viewed as an extension of the Resource Based View (RBV) theory and the main driver of competitive advantage by integrating innovation from external sources (Walliser & Mignon, 2015). Thus, it facilitates and supports open innovation in firms (Chesbrough, 2006; Chesbrough & Bogers, 2014; Najar et al., 2020). This theory considers knowledge to be the main strategic advantage in an organization (Grant, 1996; Spender, 1996). Development and expansion of that internal knowledge in firms are the essential strategic resource of competitive advantage (Conner, 1991; Grant, 1996; Spender, 1996). KBV argues that a combination of various types of specialized knowledge is required for value production in firms (Grant, 1996; Kogut & Zander, 1993). KBV not only adds up to the existing knowledge in the organization but also is the key resource for the potential knowledge and processing of knowledge management, which are the main factors of sustainable innovation and competitive advantage (Inkinen et al., 2015). HRM and knowledge management are two interdependent constructs that complement each other in organizations according to KBV. Therefore, KBV can explain how knowledge-based HRM practices affect OI and make predictions for the proposed research framework of the study. In this vein, Kuo (2011) pointed out that HRM practices have a positive impact on knowledge management processes, while Al Tal and Emeagwali (2019) indicate the effect of knowledge-based HRM practices on knowledge management processes and innovation. The following section discusses knowledge-based HRM practices in depth.

KNOWLEDGE-BASED HRM PRACTICES

In their empirical studies, Laursen and Foss (2003) indicated that HRM could foster firm innovativeness. Scholars (Al Tal & Emeagwali, 2019; Hong et al., 2019; Kianto et al., 2017) suggested that modern practices of HRM are crucial for knowledge generation, sharing, and application. Knowledge-based HRM can be defined as those modern HRM practices which are purposefully designed to enhance knowledge processes within an organization (Al Tal & Emeagwali, 2019; Kianto et al., 2017). Drawing on KBV theory, organizations are born to generate, consolidate, and employ knowledge and that knowledge is the central resource in a firm. Not only it is the central source, but it is also the fuel of innovation (Bogers et al., 2019). Consequently, individual employees can develop their knowledge and social relationships through specific HRM (i.e., knowledge-based) practices thereby enhancing a firm's innovation (Al Tal & Emeagwali, 2019; Tay et al., 2021). Additionally, Bogers et al. (2019)

claimed that employee attributes and HRM can influence open innovation implementation in firms. Therefore, this study focuses on HRM practices that efficiently and effectively manage the inflow and outflow of a firm's knowledge. In this respect, knowledge-based HRM practices empower employees to create, share, and apply knowledge which boosts knowledge flows across the firm (Kianto et al., 2017). Knowledge inflows and outflows play a significant role in both inbound and outbound open innovation (Chesbrough & Bogers, 2014). Furthermore, Bogers et al. (2019) pointed out that strategic human resources management plays a crucial role in innovation. Therefore, strategic HRM, and in particular, knowledge-based practices, can contribute positively to the implementation of open innovation.

Podmetina et al. (2013) addressed the critical role of HRM practices in open innovation by demonstrating their influence on the internal and external openness of organizations. Further, Aagaard (2017) highlighted the role of specific HRM practices in boosting a firm's innovativeness. However, none of these researchers indicated the effect of knowledge-based HRM on open innovation practices. Other researchers considered the value of knowledge-based HRM. For example, Lepak and Snell (1999) suggested that enhancing inimitable knowledge can be done through a system of knowledge-based HRM practices that boost the internal development of human resources with specific recruitment, training, development, compensation, and performance assessment. Hong et al. (2019) claimed that collaborative HRM can reduce the barriers to open innovation practices while Popa et al. (2017) indicated the positive effect of commitment-based HRM practices on open innovation. Some studies highlighted the effect of knowledge-based HRM practices on innovation or innovative performance (Al Tal & Emeagwali, 2019; Kianto et al., 2017; Minbaeva, 2013), however, they did not differentiate between open innovation and closed innovation as this study does. Based on the above-mentioned studies, the following hypotheses are proposed. Figure 1 also depicts the research framework which stems from these hypotheses.

H1a: Knowledge-based HRM practices have a positive effect on inbound open innovation.

H1b: Knowledge-based HRM practices have a positive effect on outbound open innovation.

According to previous studies (Al Tal & Emeagwali, 2019; Inkinen et al., 2015; Kianto et al., 2017), four main knowledge-based HRM practices are crucial for a firm's innovation. They are: (1) knowledge-based recruitment and selection, (2) knowledge-based training and development, (3) knowledge-based compensation and reward, and (4) knowledge-based performance assessment. The next four sections provide a brief summary of each dimension and its relationship with inbound and outbound innovation.

Knowledge-based recruitment and selection

Knowledge-based recruitment and selection can be defined as the process of recruiting and selecting employees based on their level of knowledge, learning ability, potential expertise, and social skills (Al Tal & Emeagwali, 2019). The process of recruitment and selection is dynamic and complex because today's knowledge economy is very much dependent on the value created by this practice to both employers and employees (Rozario et al., 2019). Knowledge-based recruitment and selection influence knowledge utilization as it decides the knowledge brought into the firm (De Winne & Sels, 2010). Furthermore, organizational innovation relies on the company's "knowledge base", which results from hiring of talented workforce who contributes to intellectual capital and allover performance of the firm (Gupta, 2022). The firm's knowledge foundation, which is in-grained in the hiring of employees who can share and apply knowledge, is what drives innovation (Jiang et al., 2012; Subramaniam & Youndt, 2005).

In this vein, Engelsberger et al. (2022) contend that managers can foster the emergence of open innovation activities by instilling knowledge-based recruiting and selecting systems in SMEs. Recruiting and selecting people who have a high ability to learn and collaborate can boost generating of

knowledge from external resources which enables inbound open innovation while recruiting and selecting people who can share and apply the acquired knowledge enables outbound open innovation. Therefore, the following hypotheses are concluded:

H2a: Knowledge-based recruitment and selection have a significant impact on inbound open innovation.

H2b: Knowledge-based recruitment and selection have a significant impact on outbound open innovation.

Knowledge-based training and development

According to Robbins et al. (2010), competent workers are rarely able to maintain their competence indefinitely since skills frequently deteriorate over time. Training and development are essential for organizations to bridge the gap between the skills and knowledge which employees are required to possess and what they presently have (Cabello-Medina et al., 2011). Knowledge-based training and development involve regular activities for developing staff skills and knowledge. It is centered on individualized training that fits employees' distinctive demands to ensure continuous improvement of human capital and innovation practices (Al Tal & Emeagwali, 2019). Knowledge-based training and development are vital for motivating human skills (Kianto et al., 2017). According to Abrar et al. (2021), knowledge-based training and development boost human capital, which enhances employees' absorptive capacity and ultimately has a favorable effect on employees' innovative behavior. Knowledge-based training can also include courses that motivate employees to generate and share knowledge which can enhance inbound open innovation activities. In addition, knowledge-based training and development can improve competencies to utilize internal and external knowledge (Enkel et al., 2017), and in turn, boost outbound open innovation activities in the organization. According to this argument, the following hypotheses are proposed:

H3a: Knowledge-based training and development have a significant impact on inbound open innovation.

H3b: Knowledge-based training and development have a significant impact on outbound open innovation.

Knowledge-based compensation and reward

Knowledge-based compensation and reward refer to actions related to rewarding employees according to their contributions to the key knowledge processes in the firm (Al Tal & Emeagwali, 2019). Hee and Jing (2018) pointed out that compensation could be in different forms such as monetary rewards, leaves, recognition packages, and medical insurance. Furthermore, Ghayas and Hussain (2015), Mangkunegara (2011), and Setyorini et al. (2018) indicated that compensation given to employees would significantly affect the level of motivation, job satisfaction, and employee performance. In the context of a knowledge-based economy, knowledge is the precious asset by which firms achieve competitiveness. Therefore, the system of knowledge-based compensation and reward upholds those employees trying to create, share and apply new knowledge. This practice, as a result, encourages and improves innovation in organizations (Valmohammadi et al., 2019). Traditionally, rewards and incentives are given to those promoted employees or those who achieve higher sales and profit. In a knowledge-based compensation system, employees are rewarded according to their contribution to knowledge generation and sharing, which in turn, encourages inbound open innovation activities. Further, knowledge-based compensation and reward encourage employees to learn new skills, and thus, facilitate knowledge application, thereby enhancing outbound open innovation in the firm. Hence, it is proposed that:

H4a: Knowledge-based compensation and reward have a significant impact on inbound open innovation.

H4b: Knowledge-based compensation and reward have a significant impact on outbound open innovation.

Knowledge-based performance assessment

Knowledge-based performance assessment focuses solely on how the employee acts in terms of knowledge management (Inkinen et al., 2015; Lepak & Snell, 1999). Accordingly, Alavi and Leidner (2001) and Al Tal and Emeagwali (2019) viewed knowledge-based performance assessment as the procedure of evaluating workers based on their participation in the firm’s knowledge processes, namely knowledge generation, knowledge sharing, and knowledge application. The assessment of employee activities assists in discovering gaps between performance and goals, which encourages workers to think innovatively (Shipton et al., 2006). According to Curzi et al. (2019), a more contemporary HRM practice of performance assessment that places an emphasis on acquiring new knowledge and skill may have a favorable impact on employees’ innovative behavior. In this regard, Jiang et al. (2012) contend that the performance assessment that focuses on knowledge creation and sharing will help employees to better learn and utilize knowledge.

According to a recent study by Kianto et al. (2017), an efficient system of performance assessment that encourages and supports knowledge generation, sharing, storing, and application can improve the firm’s performance in terms of innovation. To sum up, adopting knowledge-based performance assessment can enhance employees’ ability to learn and apply new knowledge (Al Tal & Emeagwali, 2019), thereby enhancing inbound and outbound open innovation in the firm. Hence, it is proposed that:

H5a: Knowledge-based performance assessments have a significant impact on inbound open innovation.

H5b: Knowledge-based performance assessments have a significant impact on outbound open innovation.

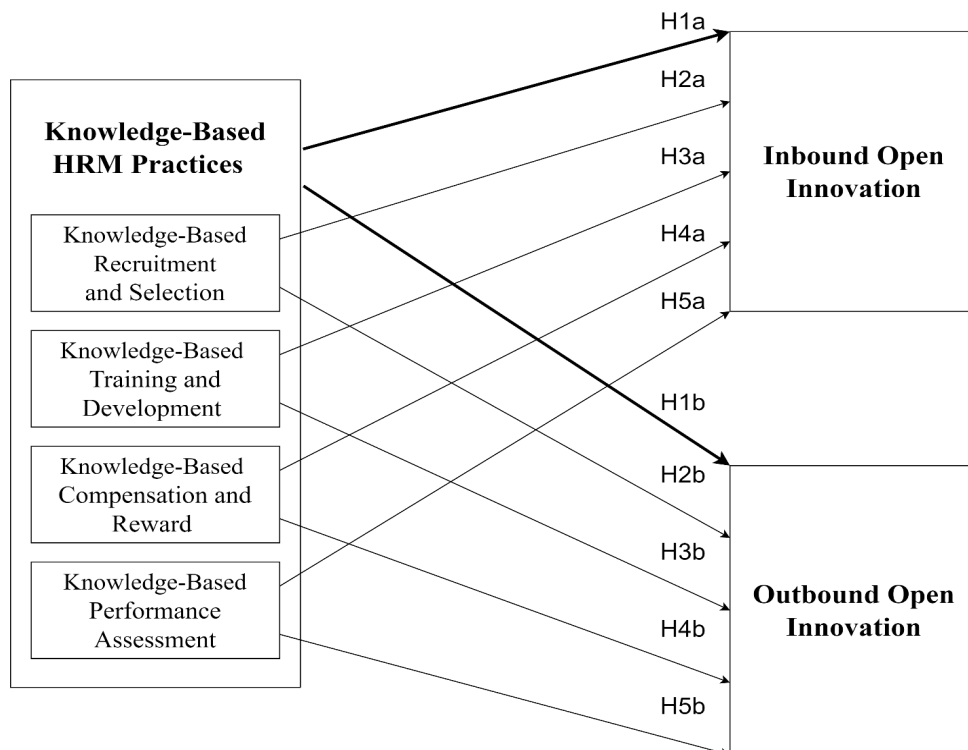


Figure 1. Research framework of the study

RESEARCH METHODOLOGY

This study adopted the quantitative method employing descriptive and exploratory approaches. Correlational-based hypothesis testing was also used in order to learn more about the relationship between knowledge-based HRM practices and their influence on open innovation practices. A cross-sectional method employing a questionnaire was used to obtain data. The tools of Statistical Package for Social Science (SPSS), in addition to Structural Equation Modeling (SEM) with the Analysis of Moment Structure (AMOS), were implemented for the study's statistical analysis. Prior to that, the entered data was shifted to Microsoft Excel and then exported to SPSS software for statistical analysis. The initial descriptive "statistical analysis" was conducted through SPSS version 12 to perform data screening and to check on data distribution. Descriptive statistics of the demographic profile of participating SMEs were obtained to ensure the sample homogeneity, the research scope, and the unit of analysis were in place which would serve the study's objectives and enable generalizations of the results. The data were checked to ensure uncompleted responses or missing values; thus, all of the responses are useful to serve the study objectives. The next subsections describe the research instrument, sample, data collection, and the demographic profile of the participants.

RESEARCH INSTRUMENT

The instrument used for this study is a questionnaire which consists of three sections. The first section comprises the demographic profiles of organizational characteristics (Table 1). For the second and third sections, the 7-point scale (1-Strongly disagree, 7-Strongly agree) was used to provide a wider range of possibilities, increasing the likelihood of meeting people's objective realities, and thus, invoke specifically the "faculty of reason" of the participants (Joshi et al., 2015).

The second section consists of 13 items that measure "knowledge-based HRM practices" as a bundle which was adopted from Kianto et al. (2017): the first three items for knowledge-based recruitment and selection, four items for knowledge-based training and development, three items for knowledge-based compensation and reward, and the last three items for knowledge-based performance assessment. Finally, the third section comprises seven items to measure inbound and outbound open innovation practices in the company. These seven items were adopted from Cheng and Shiu (2015), four items of these to measure inbound open innovation, and the other three items to measure outbound open innovation.

Throughout the pilot study, thirteen SMEs located in the cities of Zarqa and Amman were visited between February 8 and February 27, 2022. The pre-tested questionnaire was shown and reviewed with supervisors, directors, head managers, and HR managers, in addition to owners of these enterprises. The discussion was very informative and assisted to constitute the final form of the questionnaire. The participants were found to be familiar with the terminology of the questionnaire. In sum, the majority of the pilot study participants (12 out of 13) recommended the questionnaire for the purpose of the study.

SAMPLE

The scope of the current study limits the number of participants for manufacturing SMEs to meet the purposes for which the study was capped to. As a result, service SMEs were excluded. Further, micro-enterprises were excluded in spite of their large share of the market (89%), as they have been found to lack the structure and technological ability to accommodate OI practices (Hameed et al., 2018). Further, Hellman et al. (2020) claimed that top management or owners are at the center of SMEs' strategic direction. Accordingly, the top management or owners of Jordanian manufacturing SMEs were chosen as the study's participants. Furthermore, the SMEs that were chosen for this study were those that had been functioning and active for more than two years to ensure the stability of policies and procedures of the firm, thereby effectively orienting the firm's strategies and performance (Alzeaiden, 2020; Chong & Yuen, 2022).

A list of a registered 2,310 manufacturing SMEs in Jordan was provided by the Social Security Department; 500 SMEs were randomly selected from this list. Around 70% of SMEs were concentrated in the cities of Amman, Zarqa, and Irbid. The population of the study (Registered SMEs List) is homogenous as it represents the manufacturing SMEs in Jordan which are very similar in size, resources, and level of technology. Thus, random sampling is considered best in the sample design as all information about the population (2,310 SMEs) is available in an Excel spreadsheet. Random sampling was applied by creating a random value for each record of SMEs in a row, each row contains a random number and a sort; finally, the first 500 records out of 2,310 were chosen to generate the sample.

DATA COLLECTION

An online method was implemented to collect the data. A link to the survey website was emailed and responses were collected. Emails were used and phone calls were made to these top managers and owners of SMEs to follow up on the completion of the questionnaires. The data was collected between March and August 2022. Only 374 (74.8%) questionnaires were completed and returned. Of those, 335 responses were deemed useful for analysis after filtering out the replies with missing values; this corresponded to a response rate of 67%.

THE DEMOGRAPHIC PROFILE OF THE PARTICIPANTS

The majority of the SMEs (42.4%) had been in business for 11-15 years. Also, the majority of these SMEs were from the chemicals industry (27.8%) followed by the industry of food and beverages (22.4%). According to Al-Gobor et al. (2020), the Ministry of Trade classified SMEs in Jordan in accordance with number of employees: the small enterprises employed 10-49 full-time employees while medium enterprises employed 50-249 full-time employees. In this study, 56.7% of the SMEs sample were medium enterprises while 43.3% were small enterprises. Table 1 shows the demographic profile for the Jordanian manufacturing SMEs sample in this study.

Table 1. Profile of participating SMEs

No.	Variables	Categorization	Frequency	Percent %
1	Age of the company?	Less than 2 years	0	0
		2-5 years	29	8.6
		6-10 years	83	24.8
		11-15 years	142	42.4
		More than 15 Years	81	24.2
	Total	335	100.0	Total
2	Which of the following categories best describes your company's industry?	Chemicals	93	27.8
		Fabricated Materials	16	4.7
		Food and Beverages	75	22.4
		Metal	22	6.6
		Petroleum	0	0
		Plastic	36	10.7
		Rubber	19	5.7
		Tobacco	0	0
		Other	74	22.1
	Total	335	100.0	Total

No.	Variables	Categorization	Frequency	Percent %
3	Which of the following categories best describes the number of employees in your company?	Less than 10 employees	0	0
		Full-time employees from 10 to less than 50	145	43.3
		Full-time employees from 50 to less than 250	190	56.7
		More than 250 employees	0	0
	Total	335	100.0	

DATA ANALYSIS AND RESULTS

RELIABILITY OF MEASUREMENTS

Tables 2 and 3 display the reliability test's findings. The internal consistency of the instrument was evaluated using Cronbach's Alpha. All values of consistency coefficients for independent and dependent variables were high as shown in Tables 2 and 3. The findings showed that all Cronbach's Alpha percentages were acceptable since they exceeded the minimum limit of 0.70. As a result, the use of the instrument was appropriate for achieving the study's objectives.

Table 2. Reliability test (Cronbach's Alpha for independent variable)

No.	Dimensions	No.	Cronbach's Alpha (Alpha Value (α))
1	Independent Variable (Measurement of Knowledge-based HRM practices)	13	0.960
1.1	Knowledge-based Recruitment and Selection	3	0.860
1.2	Knowledge-based Training and Development	4	0.924
1.3	Knowledge-based Compensation and Reward	3	0.874
1.4	Knowledge-based Performance Assessment	3	0.903

Table 3. Reliability test (Cronbach's Alpha for dependent variable)

No	Dimension	No of times	Cronbach's Alpha
1	Open Innovation	7	0.936
1,1	Inbound OI	4	0.948
1,2	Outbound OI	3	0.871

VALIDITY

The questionnaire's content validity was verified during the pre-test period by senior academics and subject matter experts. The draft of the questionnaire was sent to some governmental offices in the Jordan Chamber of Industry, and Ministry of Industry and Trade to provide comments on the "content validity" of the questionnaire. In sum, the questionnaire was pre-tested by three senior academics and two experts in the field and agreed on the appropriateness, readability, and comprehensiveness of the questionnaire for the study's purpose.

Exploratory Factor Analysis (EFA) is conducted to estimate the factor loading of variables to assess the construct validity of the variables. Table 4 shows the results of the EFA for the study tool of Independent Variable (Knowledge-Based HRM practices). It was noted from the results as per Table 4

that all Eigenvalues were greater than 1. All KMO values were greater than 0.50. All values of Bartlett’s test of Sphericity were statistically significant at the level of statistical significance ($\alpha = 0.05$). Finally, all values of the factors were loaded on one factor and their values exceeded 0.40. These results of the exploratory factor analysis indicate a high degree of construct validity for the independent variable (knowledge-based HRM practices).

Table 4. Loadings matrix of the independent variable (knowledge-based HRM practices)

Construct	Item	Factor Loading	KMO	Bartlett’s Test of Sphericity	Eigenvalues	Sig
Knowledge-based recruitment and selection	RS1	0.830	0.694	525.203	2.359	0.00**
	RS2	0.902				
	RS3	0.925				
Knowledge-based training and development	TD1	0.907	0.856	1017.195	3.258	0.00**
	TD2	0.919				
	TD3	0.908				
	TD4	0.875				
Knowledge-based compensation and reward	CR1	0.868	0.729	529.009	2.404	0.00**
	CR2	0.916				
	CR3	0.901				
Knowledge-based performance assessment	PA1	0.908	0.741	653.183	2.517	0.00**
	PA2	0.936				
	PA3	0.903				

Table 5 shows the results of the exploratory factor analysis of the study tool of dependent variable (inbound open innovation, outbound open innovation). The results show that all values of Eigenvalues were greater than 1, all KMO values were greater than 0.50, all values of Bartlett’s test of Sphericity were statistically significant at the level of statistical significance ($\alpha = 0.05$), and all values of the factors were loaded on one factor and their values exceeded 0.40. Therefore, the results of the exploratory factor analysis indicate a high degree of construct validity for the dependent variable.

Table 5. Loading matrix of dependent variable (open innovation)

Construct	Item	Factor Loading	KMO	Bartlett’s Test of Sphericity	Eigenvalue	Sig
Inbound open Innovation	IB1	0.935	0.870	1308.217	3.464	0.00**
	IB2	0.931				
	IB3	0.931				
	IB4	0.925				
Outbound open innovation	OB1	0.872	0.721	520.002	2.392	0.00**
	OB2	0.921				
	OB3	0.884				

MEASUREMENT MODEL ANALYSIS

SEM through AMOS V.23 program was used to measure the model fit indicators related to the independent variable (Knowledge-based HRM practices) and dependent variable (OI). Confirmatory Factor Analysis (CFA) was employed to test the proposed hypotheses with regard to the relationships among knowledge-based HRM practices, inbound OI, and outbound OI. Table 6 shows the indicators of goodness-of-fit to test the measurement model of the data. The results show low RMESA and RMR values ≤ 0.07 , while the values of GFI, TLI, CFI and NFI are high (>0.90) at the level of statistical significance (Sig = 0.00) which indicates a better fit of the study's data. The results denote the fit of the measurement model to the survey data. Figures 2 and 3 also depict the measurement model for independent and dependent variables in order.

Table 6. Indicators of model fit of the independent and dependent variables

Indicator	RMSE A	RMR	Chi-Square	DF	Sig	GFI	TLI	CFI	NFI
Knowledge-based HRM practices	0.07	0.05	329.934	59	0.00	0.900	0.915	0.936	0.923
Open innovation	0.07	0.07	37.879	13	0.00	0.988	0.981	0.988	0.982

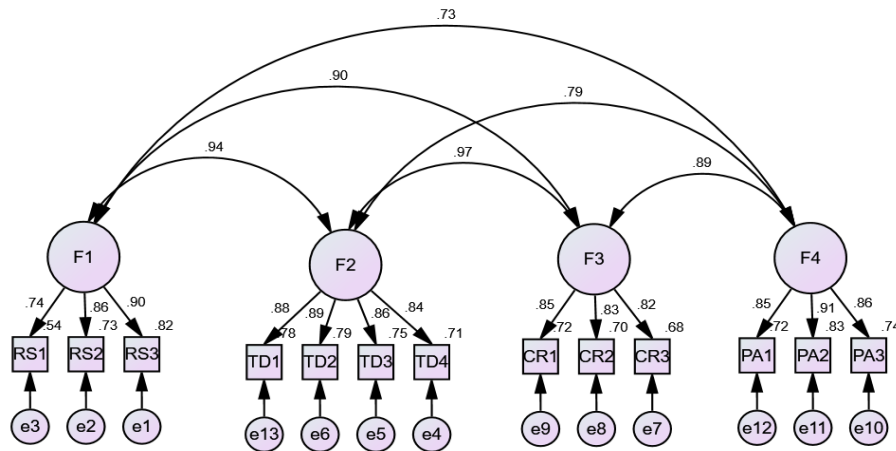


Figure 2. Specified knowledge -based HRM practices measurement model

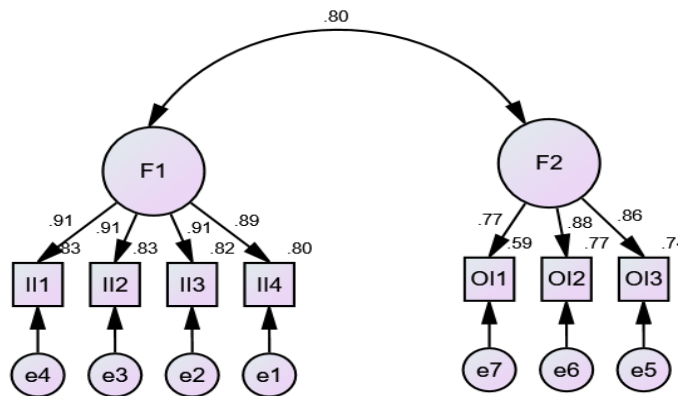


Figure 3. Specified open innovation measurement model

TESTING HYPOTHESES RESULTS

H1a: Knowledge-based HRM practices have a positive effect on inbound OI

To test the first hypothesis of the study, SEM is used to investigate the relationship between knowledge-based HRM (knowledge-based recruitment and selection, knowledge-based training and development, knowledge-based compensation and reward, and knowledge-based performance assessment) and inbound open innovation practices. AMOS V.23 software was used to test the above hypothesis. The structural model estimates are shown in Table 7, including the direct relationship between the independent and dependent variables. The first proposed hypothesis proposes that knowledge-based HRM is positively related to inbound open innovation. The results in Table 7 indicate a significant positive relationship exists between these two variables ($\beta = 0.77$, $t = 21.831$, $p < 0.05$). Table 7 also shows the proportion of variation in the knowledge-based HRM practices that can be attributed to inbound innovation ($R^2, 58.7\%$).

The findings of testing H2a, H3a, H4a, and H5a reveal the significant positive association between knowledge-based recruitment and selection, knowledge-based training and development, knowledge-based compensation and reward, knowledge-based performance assessment) and inbound open innovation. Table 8 shows that each practice of knowledge-based HRM and inbound open innovation had favorable relationships, knowledge-based recruitment and selection ($\beta = 0.624$, $t = 14.570$, $p < 0.05$), knowledge-based training and development ($\beta = 0.674$, $t = 16.645$, $p < 0.05$), knowledge-based compensation and reward ($\beta = 0.745$, $t = 20.403$, $p < 0.05$) and knowledge-based performance assessment ($\beta = 0.774$, $t = 22.314$, $p < 0.05$).

Table 7. Result of testing the first hypothesis

Direction			β	t	Sig.	R2	Adjusted R2
Knowledge-based HRM practices	<---	Inbound Open Innovation	0.77	21.831	0.00**	0.588	0.587

Table 8. The effect of knowledge-based dimensions on inbound OI

Direction			β	t	Sig.	R ²	Adjusted R ²
Knowledge-based recruitment and selection	<---	Inbound OI	0.624	14.570	0.00**	0.389	0.387
Knowledge-based training and development	<---	Inbound OI	0.674	16.645	0.00**	0.454	0.452
Knowledge-based compensation and reward	<---	Inbound OI	0.745	20.403	0.00**	0.556	0.554
Knowledge-based performance assessment	<---	Inbound OI	0.774	22.314	0.00**	0.599	0.598

H1b: Knowledge-based HRM practices have a positive effect on outbound OI

To test H1b, SEM is also applied to investigate the relationship between Knowledge-based HRM practices and outbound OI practices. AMOS V.23 software was also used to test this hypothesis. The structural model estimates shown in Table 9 demonstrate the direct relationship between knowledge-based HRM practices and outbound innovation. H1b proposes that knowledge-based HRM is positively related to outbound open innovation. The results in Table 9 indicate a significant positive relationship exists between these two variables ($\beta = 0.74$, $t = 20.247$, $p < 0.05$). Table 9 also shows the

proportion of variation in the knowledge-based HRM practices that can be attributed to outbound innovation ($R^2, 55.1\%$).

The results of testing H2b, H3b, H4b, and H5b reveal the positive association between all dimensions of knowledge-based HRM practices and outbound open innovation. Table 10 shows the significant positive effect of knowledge-based recruitment and selection ($\beta = 0.622$, $t = 14.514$, $p < 0.05$), knowledge-based training and development ($\beta = 0.696$, $t = 17.709$, $p < 0.05$), knowledge-based compensation and reward ($\beta = 0.717$, $t = 18.744$, $p < 0.05$) and knowledge-based performance assessment ($\beta = 0.681$, $t = 16.987$, $p < 0.05$) on outbound OI.

Table 9. Result of testing the second hypothesis

Direction			B	t	Sig.	R ²	Adjusted R ²
Knowledge-based HRM practices	<---	Outbound Innovation	0.74	20.247	0.00**	0.551	0.550

Table 10. The effect of knowledge-based dimensions on outbound OI

Direction			B	t	Sig.	R ²	Adjusted R ²
Knowledge-based recruitment and selection	<---	Outbound OI	0.622	14.514	0.00**	0.387	0.386
Knowledge-based training and development	<---	Outbound OI	0.696	17.709	0.00**	0.485	0.483
Knowledge-based compensation and reward	<---	Outbound OI	0.717	18.744	0.00**	0.513	0.512
Knowledge-based performance assessment	<---	Outbound OI	0.681	16.987	0.00**	0.464	0.463

DISCUSSION

This study is among the first that focuses on knowledge-based HRM practices as a bundle of antecedents to inbound and outbound open innovation, particularly in the Jordanian Manufacturing Sector. This paper combines a research framework that includes the best practices of HRM (i.e., knowledge-based recruitment and selection, knowledge-based training and development, knowledge-based compensation and reward, and knowledge-based performance assessment) to enhance inbound OI and outbound OI. This paper provides empirical knowledge on the relationship between knowledge-based HRM practices and OI.

Theoretically, this study encourages the use of the KBV theory to improve innovation activities. KBV indicates that organizational growth relies on heterogeneous knowledge flows in addition to fit knowledge integration processes to boost market response capabilities and this heterogeneity should be marinated to continuously stimulate knowledge management processes (Alam, 2019). Therefore, Knowledge cannot be ruled as tangible resources, but organizations can release the potential of their value-creation through knowledge-based HRM practices which facilitate an environment for knowledge management, thereby advancing their innovation level.

According to Kianto et al. (2017), there is still a lack of literature on HRM from a knowledge perspective. Thus, by highlighting the significance of knowledge-based HRM practices in fostering open innovation practices, this work is considered an important contribution to the research in the field of

innovation as it broadens the understanding of innovation management (Beugelsdijk, 2008; Laursen, 2002; Shipton et al., 2006).

Moreover, the study supports Armstrong and Taylor's (2015) recommendation that new HRM practices should replace traditional HRM practices in order to generate and boost knowledge in firms. Hussinki et al. (2017) and Inkinen et al. (2015) have further examined the relationship between HRM practices and innovation practices in organizations and found a positive association with this relation. This is also consistent with suggestions made by other researchers (Chen & Huang, 2009; Dimitrios et al., 2016) that modern HRM aids in instilling motivation and incentives in workers, leading to better innovation outputs. The findings revealed that in the context of Jordanian SMEs, knowledge-based HRM practices had a positive impact on both inbound and outbound open innovation. The results are built on earlier research (Al Tal & Emeagwali, 2019; Kianto et al., 2017), which demonstrated that knowledge-based HRM practices had a significant impact on innovation performance.

The findings of this study are consistent with previous research on the relationship between strategic HRM and open innovation as many scholars highlighted the positive impact of strategic HRM on open innovation and innovation performance. In this respect, Bogers et al. (2019) suggested that strategies enhance open innovation practices in organizations. The findings of this study are also in agreement with Hong et al. (2019) who contended that collaboration-oriented HRM practices can support open innovation by reducing the barriers to that. Furthermore, Popa et al. (2017) claimed that commitment-HRM practices had a positive impact on inbound and outbound open innovation in SMEs by improving the innovation climate in these enterprises.

Although various studies (Al Tal & Emeagwali, 2019; Inkinen et al., 2015; Kianto et al., 2017) have recognized the importance of knowledge-based HRM in fostering innovation, there is a shortage of research addressing significant issues in the context of open innovation. In addition, Engelsberger et al. (2022) noted that while there has been some research indicating that strategic HRM can support open innovation practices, there hasn't been any that explicitly linked the two. In other words, little research has been done on knowledge-based HRM as a precursor to open innovation. The empirically verified positive impact of knowledge-based HRM practices on inbound and outbound open innovation, as described in the following subsections, is the study's noteworthy finding.

KNOWLEDGE-BASED RECRUITMENT AND SELECTION AND OI

According to this study, taking into consideration the knowledge and social skills of candidates during the hiring process is quite important. Knowledge-based hiring gives businesses access to knowledgeable workers who can handle demanding knowledge-based jobs (Chen & Huang, 2009; Scarborough, 2003). The findings of this investigation showed that knowledge-based recruitment and selection had a statistically positive impact on both inbound and outbound open innovation. This positive impact of knowledge-based recruitment and selection was relatively similar on both inbound and outbound open innovation. The results were consistent with those of other studies which revealed the importance of hiring individuals with specialized knowledge for improving open innovation processes (Popa et al., 2017). The results also corroborated past research that showed how recruiting staff with strong collaborative and learning skills can significantly improve open innovation practices in the workplace (Hong et al., 2019; Volberda et al., 2010).

KNOWLEDGE-BASED TRAINING AND DEVELOPMENT AND OI

The results also unveiled that knowledge-based training and development had a similar positive impact on both inbound and outbound open innovation. The findings were consistent with past studies (Inkinen et al., 2015) which indicate that continuous training for workers to fit between their current and requisite knowledge is essential to improve innovation performance. The results were also in keeping with other studies on the value of knowledge-based training and development for fostering

long-term growth and creating an innovative environment that facilitates the adoption of open innovation (Collins & Smith, 2006; Popa et al., 2017). Similarly, the results support the notion that training and development can improve open innovation practices by tailoring instruction to fit employees' unique goals, skills, and ongoing growth (Al Tal & Emeagwali, 2019).

KNOWLEDGE-BASED COMPENSATION AND REWARD AND OI

The results indicated that knowledge-based compensation and reward had a significant and positive influence on both inbound and outbound open innovation. According to the results, knowledge-based compensation and reward had a larger impact on both inbound and outbound open innovation than knowledge-based recruitment and selection and knowledge-based training and development. This could be explained by the fact that recruitment and selection processes place more emphasis on how well candidates fit the company, and training is focused on improving day-to-day work. Compensation and reward systems, however, emphasize motivation and long-term success (Camelo-Ordaz et al., 2011). Additionally, these results were consistent with Chen and Huang (2009), who contended that compensation systems are critical in encouraging workers to share their experiences and generate new knowledge, both of which are essential for open innovation.

KNOWLEDGE-BASED PERFORMANCE ASSESSMENT AND OI

Knowledge-based performance assessment was revealed to have the highest influence on inbound open innovation of all the knowledge-based HRM practices while it had less of an impact on outbound open innovation. These results were in accordance with those reached by Kianto et al. (2017) and Inkinen et al. (2015) who both highlighted the considerable impact of knowledge-based performance assessment on innovation performance. This was also in line with the assertion made by Inkinen et al. (2015), that employee performance is more likely to be innovative when it is assessed based on their contribution to knowledge production and utilization. The findings supported Al Tal and Emeagwali (2019) who argued that knowledge-based innovation strategies in a company were no longer supported by traditional employee performance assessment.

IMPLICATIONS

This study highlights the importance of open innovation practices in SMEs. Unlike earlier research that did not distinguish between open innovation and closed innovation (Perdomo-Ortiz et al., 2009; Wang & Wang, 2012), the findings indicate the hypotheses that knowledge-based HRM practices have a positive significant effect on inbound and outbound OI practices in Jordanian SMEs. Other studies have examined the effect of different bundles of HRM practices on open innovation practices. For example, Popa et al. (2017) indicated that commitment-based HRM practices (i.e., recruitment and selection, training and development, incentives, and performance appraisals) could enhance open innovation practices in SMEs. In addition, Hong et al. (2019) found that collaborative-based HRM practices (i.e., rotational job design, team-based recruitment, team-based training, team-based reward, and team-based appraisals) could enhance open innovation practices. This study, on the other hand, targeted a specific bundle of HRM practices, i.e., knowledge-based practices, to investigate their effect on open innovation practices.

Practically, the results of the study contribute to providing solutions that have a significant impact on the performance of SMEs globally. SMEs face challenges in terms of the lack of resources, innovation, managerial skills, and market access which weaken their competitiveness of SMEs (Al-Hyari, 2020; Al Tal & Emeagwali, 2019; Al-Weshah et al., 2022; Al Zuod et al., 2019; Prasanna et al., 2019). This study, therefore, suggests that implementing open innovation strategy through knowledge-based HRM practices in SMEs allows for more opportunities to acquire and exploit knowledge, which is crucial for innovation and, in turn, increases the competitiveness level of a firm.

Additionally, the provided research methodology offers stakeholders of SMEs a conceptual framework of tools that they may use to benefit from inbound and outbound open innovation procedures. The study's results also show how knowledge-based HRM strengthens productive networks and collaboration, which are crucial for boosting innovative performance and introducing new goods and services. The research framework of this study can therefore be a key to improving innovative performance. In other words, managers who pursue open innovation practices via knowledge-based HRM practices are more likely to overcome the lack of resources and the limited capacity for R&D in manufacturing SMEs (Al-Weshah et al., 2022).

Finally, stakeholders of Jordanian SMEs could implement policies that encourage knowledge-based HRM to facilitate knowledge generation, knowledge sharing, and knowledge application that ultimately enhances open innovation practices which are essential for SMEs' competitiveness. Additionally, the owners and managers of SMEs should invest in their staff members because they are the true asset that can turn knowledge and other intangible resources into tangible resources to spur innovation and boost the company's competitiveness.

CONCLUSIONS AND LIMITATIONS

This research primarily examined the previously overlooked effect antecedents of knowledge-based HRM practices on OI practices in the SME context. The substantial conclusion derived from the findings of this paper refers to the significant role exerted by knowledge-based HRM practices in the promotion of inbound and outbound open innovation practices in manufacturing SMEs. The findings revealed that the main dimensions of knowledge-based HRM practices (knowledge-based recruitment and selection, knowledge-based training and development, knowledge-based compensation and reward, and knowledge-based performance assessment) are positive determinants for inbound and outbound OI.

The original concept of OI in the study considered conceptually related dimensions, namely inbound and outbound open innovation. Through the literature, a review of the mentioned antecedents and underlying theories synthesized the hypotheses to examine the influence of these antecedents that are relevant to dimensions of the OI construct. In other words, the theoretical framework has empirically proved the impact relationships between knowledge-based HRM and OI using data collected from a cross-sectional survey of manufacturing SMEs in Jordan. Further, this study presented a conceptual framework for understanding the relationship between knowledge-based HRM practices and open innovation practices.

However, there were certain limitations to this study. First, the use of a cross-sectional sample restricted the ability to explain the proposed links between knowledge-based HRM practices and open innovation practices. Face-to-face interviews would reveal more specific data regarding the study's topic. Second, this study was an exploratory investigation of the extent to which HRM practices were implemented and the effect they had on open innovation practices. However, explanatory studies can be undertaken to examine the sample before and after implementing knowledge-based HRM practices to provide stronger evidence of their effect on open innovation.

Future research can discuss additional antecedents aligned with knowledge-based HRM practices such as knowledge management processes which could contribute more to the enhancement of open innovation practices in SMEs. Future research could also examine the sample of investigation before and after implementing the knowledge-based HRM practices to provide stronger evidence of their effect on OI practices. Finally, future research is encouraged to view the conceptual model of this study in other organizational settings (i.e., micro, and large enterprises, high-tech, Industry.04, and services industry). The results of such research may provide empirical support and aid in the model's acceptability and generalizability in different organizational settings.

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