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HIGH-PERFORMANCE WORK SYSTEMS, ENTREPRENEURIAL ORIENTATION, AND INNOVATION STRATEGY IN DEVELOPING COUNTRIES

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Innovation strategy has become an important recent challenge in today's competitive conditions of developing countries. In this paper, the impact of high-performance work systems (HPWSs) on innovation strategy of knowledge-based enterprises is examined, considering the mediating role of entrepreneurial orientation. The statistical sample of study includes 180 managers and employees of Iranian knowledge-based companies. Data were collected using standard questionnaire, and the structural equation method was used for data analysis. The results showed that HPWSs have a positive and significant impact on innovation strategy of knowledge-based companies and about 75% of the total effect of the HPWS on innovation strategy is explained indirectly by the mediating variable of entrepreneurial orientation.

Keywords: High-performance work systems; innovation strategy; entrepreneurial orientation; knowledge-based companies; developing countries.

Introduction

Nowadays, traditional sources of organisations' competitive advantage, such as franchises and cost management, have lost their effectiveness due to globalisation and other environmental changes (Anning-Dorson, 2018). So, new approaches to achieve competitive advantage must be commensurate with today's rapid pace of change. Each business must adapt to changing customer and strategic needs by

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establishing internal structures and processes that influence its members to create organisation-specific competencies. So, employees become a critical resource for sustainable competitive advantage (De Mel, 2002). Retaining talented, skilled, and flexible staff as an alternative to traditional resources of competitive advantage can help to grow the organisation's core competencies (Michaelis *et al*., 2015). It is noteworthy that today's traditional human resource management (HRM) practices cannot meet the needs of employees (Bashir *et al*., 2012). Nowadays, managers do not emphasise the various components of HRM such as recruitment, training, employment, and salary payment system separately, but all of these activities are integrated into a coherent system aimed at enhancing employee performance and partnership (Ripley, 2003). This has led to the emergence of high-performance work systems (HPWSs) (Macky and Boxall, 2007). HPWS is defined as a set of HR practices that provide employees the necessary skills, knowledge, and motivation to aid an organisation in achieving sustainable competitive advantage (Datta *et al*., 2005). These systems can enhance the productivity and efficiency of organisations by fostering their learning capabilities (Jyoti and Rani, 2017). In other words, it is people who develop and implement ideas, so new ideas and innovation will depend on effective HRM (Afshari and Nasab, 2021). It will also depend on knowledge, because any innovation indicates the development of new knowledge as an input (e.g., new ideas, prototypes, etc.) and an outcome (i.e., the novelty produced). Thus, both HRM and knowledge are key enablers of innovation in firms (Lei *et al*., 2021). Studies have shown that HPWSs improve innovative knowledge, skills, and abilities of employees through developing their expertise (Shahriari *et al*., 2017). In other words, with recruitment and selection of the right people, training them, clarification their job, giving them more resources for experimentation, participation, and decision making, they can facilitate cooperative, interdependent, and long-term-oriented behaviours, which are critical elements for new products and service development (Kundu *et al*., 2020).

In a knowledge-based economy, the economic environment changes rapidly. To be successful, organisations must be proactive, anticipate, and be directed towards continuous learning and permanent development. The main resource of a knowledge-based company is knowledge. This company is focused on knowledge creation, acquisition, learning, use, sharing, integration, exploitation, and protection in order to achieve economic and social performance (Singh *et al*., 2021). From these considerations, it is clear that the knowledge-based company is the learning organisation that develops over time due to commitment and management processes applied and constantly pursued (Dorinela, 2011). On the other hand, the management of the people who work in these companies is different from other companies and requires special conditions. Human resources, if strategically managed, can increase the company's productivity by up to 20% (Combs *et al*., 2006).

In this regard, HPWSs with the design of dimensions related to human resources that have high internal coordination can meet the human resource needs of these types of companies. It is also assumed that the implementation of HPWS can improve the level of innovation and organisational commitment; and thus enhancing entrepreneurial orientation (Zhu *et al*., 2018). Innovation, risk-taking and proactiveness, make companies more compliant to expand markets, launch new products and make decisions ahead of competitors, thus improving corporate performance (Messersmith and Wales, 2013; Ahmad Arshad *et al*., 2015). The entrepreneurial orientation literature has established the consistent result that high levels of innovation are associated with greater proactiveness, and risk-taking (Pérez-Luño *et al*., 2011). In fact, increasing risk-taking, proactiveness, and innovativeness with learning capabilities in knowledge-based companies lead to a set of structured activities that are developed to maintain and support the future growth of the organisation, which supports the organisation's innovation strategy. Therefore, the extant literature suggests that entrepreneurial orientation can bridge HPWS and innovation strategy in these enterprises.

Although the impact of HPWSs on innovation and innovation performance has been studied in various studies, the effect of these systems on innovation strategy in knowledge-based companies has not been studied so far. This issue is even more important in knowledge-based companies in developing countries such as Iran, where the educational infrastructure is not on par with countries with knowledge-based economies. In developing countries, challenges arise within companies due to a lack of processed technological information, external influential factors, economic development, and low power of HRM department. In these countries, there are inadequate training capabilities at technical and vocational education training (TVET) centers, lack of access to financial and other resources and absence of consultancy support, investment restrictions, internal labor markets and various industry legislations. These factors may affect the working conditions as well as employee performance and job satisfaction. Furthermore, hiring suitable employees which fit to the company's culture, providing them with the proper training to meet the company's goals, ensuring their welfare, and building solid relationships are challenges due to social and economic development, as well as the low power of HRM in these countries (Zupan and Kaše, 2005). The ability of a country to sustain rapid economic growth, in the long run, depends on the effectiveness with which its institutions and policies support the knowledge generation, technological transformation, and innovativeness of its enterprises. In developing countries, innovation is crucial for enterprises in increasing competitiveness, creating a value, determining the long-term survival, and raising productivity (Daksa *et al*., 2018). Because the HRM functions can play an important role in enhancing innovation capabilities and forming the innovation strategy (Donate *et al*., 2016), it

is vital to implement a kind of HRM system that minimise such mentioned challenges and strengthen the organisation's innovation power in order to achieve its goals. This research innovatively seeks to study the impact of HPWSs, as a proper kind of HRM system on the innovation strategy of knowledge-based companies and examine the mediating role of entrepreneurial orientation in this regard. This can be useful for knowledge-based companies in finding appropriate human resource solutions to enhance sustainable competitive advantage. The continuation of this research is organised into four sections: First, the literature review of the research topic is summarised, and the hypotheses and conceptual model of the study are defined. Then the research method is described. Afterwards, the data analysis is presented, and finally, the arguments, discussions, and conclusions are mentioned.

Research Background

Knowledge-based companies

A knowledge-based company utilises knowledge, expert workforce, and a dynamic organisational structure for the production and provision of services with capabilities including innovation and wealth creation (Singh *et al*., 2021). In this definition, production or service delivery and also knowledge production and knowledge acquisition are considered as essential issues. Because the promotion of knowledge in the specialised domain of a knowledge-based company is an innovation in that company and its results include the creation of a differentiated product/service at the target market level, as well as the promotion of native knowledge and improvement of the development level (Yaghoubi *et al*., 2017). Knowledge-based corporations are law firms and institutions formed by creating knowledge-based businesses in order to sustainably transform knowledge into wealth, and their economic activities are based on and along with R&D activities in new and advanced technologies and contributes to the development of a knowledge-based economy in the society (Mahdavi *et al*., 2011).

HPWSs

HPWS are defined as "a set of separate but interrelated human resource practices designed to improve employee skills and effort" (Takeuchi *et al*., 2007). In fact, these systems use a different management approach. The purpose of this approach is to increase the level of performance of the organisation through more staff participation and involvement (Shahriari and Allameh, 2020). Although HRM scholars have had little emphasis on the characteristics of different management systems and approaches, in the Human Equation book (1998), Pfeffer considers the core

idea of HPWS to create an organisation, instead of relying on control, is based on involvement, commitment, and empowerment of employees. In high involvement organisations, employees feel accountable for their actions and contribute to organisational success. They know more, participate more, and are more involved. Therefore, they receive the power, knowledge, and rewards to perform at the highest level (Dell'Aringa *et al*., 2003).

Various studies of HPWSs in recent years have defined different dimensions for measuring these types of work systems. Chuang and Liao (2010) defined HPWSs in six dimensions: Recruitment, training, involvement/participation, performance evaluation, service/reward compensation, and observation. Gitel *et al*. (2010) also defined six dimensions for these systems that differ from Chuang and Liao's dimensions: Selection, conflict resolution, performance measurement, rewards, meetings, and boundary regulators. Similarly, other researchers have defined different dimensions for measuring HPWSs, each depending on the field in which they operate. Shahriari *et al*. (2018) examined the impact of HPWSs on fundamental innovation in knowledge-based companies with the moderating role of innovation capabilities. They used the Mihail and Kloutsiniotis (2016) approach to model HPWS and showed that the dimensions of staff independence, staff training and development, decision-making, job security, and performance management significantly impact knowledge-based enterprise innovation and security dimensions, while job security and job transparency dimensions do not affect innovation.

In this study, the dimensions that Shahriari *et al*. (2018) used to measure HPWS in their study are utilised. The dimensions include "recruitment and selection", "staff independence", "training and development", "job security", "participation in decision making", "performance management", and "job transparency".

Innovation strategy

Innovation strategy in organisations has been one of the central issues in recent years and is crucial for organisational adaptation and restructuring and its competitive advantage. The term innovation strategy encompasses various components such as innovation creation, innovation acceptance, and diffusion of innovation (Kim and Huarng, 2011; Parellada *et al*., 2011). An innovative organisation needs an innovation strategy because it will not be able to control the fundamental changes in the future without a clear innovation strategy, and having an innovation strategy will help organisations be able to cope with future changes in the competitive environment and adapt and maintain their position (Tamayo-Torres *et al*., 2003).

Before defining an innovation strategy, it is necessary to become familiar with its constituent components, i.e., strategy and innovation. From Mintzberg's (1987) perspective, strategies are patterns of the past and plans for the future.

In other words, strategy is a program that determines how companies, products, processes, and systems are configured to adapt to their environment for competitive advantage development (Ireland and Webb, 2007). On the other hand, innovation is the mechanism by which organisations produce new products, processes, and systems needed to cope with changes in markets, technologies, and competing practices (Lawson and Samson, 2001). Also, innovation from the perspective of applying new ideas is a mechanism by which organisations can maintain their place in the competition scene (Tamayo-Torres *et al*., 2010). It can be said that the link between strategy and innovation is essential for the effective management of innovation, and it is not possible without strategy, performance improvement, and other organisational successes (Akman and Yilmaz, 2008). So, innovation strategies are strategies that show companies to what extent and how to use innovation to develop their performance (Karabulut, 2015). In another study, innovation strategy is defined as a predetermined, applied, and incremental design to manage resource allocation to different types of innovation to achieve the overall strategic goals and decision-making framework in the organisation (Lendel and Varmus, 2011).

Malek Akhlagh *et al*. (2013) examined each type of innovation strategies (proactive, analyser, risk-taking, futurity, aggressive, and defensive) on the performance development of construction companies. Their research results show that both proactive and futuristic strategies have a significant impact on the development and performance diversification of construction companies. Ndubisi *et al*. (2015) examined the impact of innovation strategy on performance in international technology services with the moderating role of structural autonomy. They showed that there is a significant relationship between innovation strategy and performance. Innovation strategies also guide these companies to improve customer performance, internal business processes performance, and economic learning and development that have been studied in different studies (Jenssen and Aasheim, 2010). Another study by Karabolut (2015) measured the impact of innovation strategy on the performance of manufacturing enterprises in Turkey. The results of this study showed that innovation strategy has a positive effect on the financial performance. Also, the innovation strategy leads these firms to improve their customer performance, internal business processes performance, and learning and growth performance. In a recent study, Romanowska (2017) examined the strategic dimensions of innovation, especially the relation between an enterprise's innovation activities and its competitiveness, as well as the enterprise's history and development. The results of research made useful points for improving the conditions of enterprises' decisions to start innovation activities. As innovation, learning, and development in the knowledge-based economy are challenges for these firms (Campos and de Pablos, 2004), in this study, the integration of the two above-mentioned studies has

Table 1. The most important classifications of the innovation strategies dimensions.

Innovation strategy dimensions	Reference
Proactive, defensive, analyzer, and reactor	Miles and Snow (1978)
Opportunistic, aggressive, defensive, dependent or reliant, imitative, and traditional	Freeman (2013)
Defensive strategy, distinctive product strategy, technical aggressive strategy, risk-taking strategy, and conservative strategy	Dwyer and Mellor (1993)
Reactive innovation strategy and proactive innovation strategy	Gilbert (1994)
Pioneer in producing innovation, purchasing innovation, and combinational strategy	Veugelers and Cassiman (1999)
Proactive, defensive, analytical, reactive, and balanced	Parnell *et al*. (2000)
Pioneering, and imitational	Massini *et al*. (2005)
Aggressive, analytical, conservative, futuristic, and progressive and risk-taking	Ackman and Yilmaz (2008)
Proactive, imitative, defensive, and technology importer	Guan *et al*. (2009)
Aggressive, analytical, defensive, futuristic, risky, and proactive	Karabolut (2015)
Perspective, defensive, analytical, and reactive	Romanowska (2017)

been used to measure the innovation strategy variable due to the related results of their works.

So far, various classifications of innovation strategies dimensions have been proposed, which are presented in Table 1.

Entrepreneurial orientation

Entrepreneurial orientation is a strategic orientation at the firm level that incorporates the creation procedures for organisation strategies, management philosophy, and corporate behaviour with an entrepreneurial nature (Anderson *et al*., 2009). Past researches have identified entrepreneurial orientation as one of the vital predictors for business performance (Basso *et al*., 2009). Covin and Slevin (1998) used the term "entrepreneurial behaviour" to describe risk-taking, innovative behaviours, and proactiveness. The most well-known model in this area is the five-dimensional model of Lumpkin and Dess (1996). According to the two researchers, entrepreneurial orientation combines the decision-making aspects, procedures and practices of a company to determine the strategic orientation and performance of the company. The five dimensions of entrepreneurial orientation proposed by Lumpkin and Dess (1996) include risk-taking, innovativeness, proactiveness, aggressiveness, and independence, which affect business performance by

influencing environmental and organisational factors. Entrepreneurial orientation refers to the strategic orientation of the organisation and how to exploit knowledge resources to discover and exploit entrepreneurial opportunities (Teng, 2007). In fact, the characteristic of knowledge-based organisations, in pursuit of opportunities by creating an entrepreneurial environment, increases the value-added of knowledge resources for optimal organisational performance. Entrepreneurial-orientated organisations enhance organisational learning by applying organisational knowledge to achieve innovation (Basso *et al*., 2009).

Filser and Eggers (2014) examined the relationship between entrepreneurial orientation and company performance in a comparative study of Austria, Liechtenstein, and Switzerland. They have compared the impact of three dimensions of innovation, risk-taking, and entrepreneurial orientation on the performance of the companies under study. Their research showed that company performance was influenced by entrepreneurial orientation and innovation but risk-taking did not affect performance. These findings indicate that in different countries, the impact of entrepreneurial orientation dimensions on company performance is varied. Therefore, it can be said that the relationship between entrepreneurial orientation and company performance is influenced by environmental factors. Almeida *et al*. (2019) examined the role of entrepreneurial orientation in Junior Enterprises (JEs). They designed a measure of entrepreneurial orientation with dimensions of entrepreneurial behaviour, competitive focus, and job independence. They then used regression to test the impact of EO dimensions on JE performance. Their research results show that EO has a positive impact on the performance of JEs, which has an important role in the development of JEs and thus in student progress. In another research, Pett and Wolf (2016) examined the relationship between entrepreneurial orientation and organisational learning and considered the dimensions of proactiveness, risk-taking, and innovativeness for entrepreneurial orientation. Considering the positive results of this research about the effect of entrepreneurial orientation on learning and on the other hand its importance in knowledge-based enterprises, in this research, the three mentioned dimensions have been used to measure the entrepreneurial orientation in knowledge-based enterprises.

The hypotheses development and conceptual model of research

As mentioned, the impact of HPWSs on the innovation strategy of Iranian knowledge-based companies is discussed in this paper, considering the mediating role of entrepreneurial orientation. Therefore, the variables of this study include HPWSs, innovation strategy, and entrepreneurial orientation.

Innovation strategy requires the organisations to be the unique producer and develop new and improved ways of manufacturing products and services (Kundu

et al., 2020). This requires the organisations' employees to work differently with a high degree of independent, creative, innovative, and risk-taking behaviour, with a moderate concern for quality and quantity and a longer-term focus (Anderson *et al*., 2014). HPWS can fulfill these requirements. A high-performance organisation values its employees and views them as the most valuable asset of the organisation. It gives employees more discretion, exerts minimal controls, provides more resources for experimentation, teamwork support and fosters the exchange of ideas and risk-taking (Caniëls and Veld, 2019), thereby facilitating cooperative, interdependent and long-term-oriented behaviours which are vital elements for new product and service development (Kundu *et al*., 2020). In recent research, many researchers have emphasised the positive and significant relationship between HPWS and organisational innovation (Shahriari *et al*., 2017, 2018; Gittell *et al*., 2010). It is noteworthy that HPWS can play an important role in the emergence of innovative behaviour in knowledge-based companies. These companies need the motivation and ability of employees to generate creative ideas, develop innovative approaches and seize new opportunities to launch new products or services (Shahin *et al*., 2020, Pelagidis, 2008). HPWS can influence and modify employees' attitudes and behaviours to achieve organisational goals and play an essential role in fostering the conditions to lead people to develop innovative activities (Ahmadi *et al*., 2018). So, it can be concluded that HPWS can affect the definition and achievement of innovation strategies and goals in knowledge-based companies. Based on this result, the first hypothesis is proposed as follows:

Hypothesis 1: *HPWSs have a significant impact on the innovation strategy of knowledge-based companies*.

Entrepreneurial orientation can be considered as a mind pattern of an organisation that shows entrepreneurial attitudes and willingness when starting new businesses (Zhu *et al*., 2018). It is a critical element of organisational culture and can be reflected in activities such as daily operations and in decision-making processes. Whether an organisation has an entrepreneurial orientation or not lies in the entrepreneurial spirit of its employees. Therefore, it is essential for companies to encourage employees to build entrepreneurial spirit. Through systematic managerial practices such as skill training, information sharing, involvement in decision-making processes, and authorisation, companies affect entrepreneurial behaviours and thus enhance the level of organisational, entrepreneurial orientation (Zhu and Chen, 2014). So, if human resources are strategically managed, it can improve organisational, entrepreneurial orientation. HPWSs, as a type of strategic HRM, encourage the dimension of proactiveness because after gaining new knowledge by employees, they will hope to use the knowledge to keep pace with

current market trends. If they act ahead of competitors, they are more likely to reap the benefits of initial motivation, such as building customer relationships and establishing distribution channels (Hughes and Morgan, 2007). Therefore, HPWSs can accelerate proactive behaviours. Also, practices such as autonomy and participation in decision-making processes motivate employees to break through current problem-solving patterns, search for entrepreneurial opportunities and take risks to try new approaches to get higher returns (Li *et al*., 2008; Zhu and Chen, 2014). So, it can be concluded that these activities are useful for the promotion of knowledge and entrepreneurial orientation, especially in knowledge-based companies. Accumulated knowledge and willingness to take risks can interact with each other to facilitate entrepreneurial orientation. In the literature, few researchers, such as Zhu and Chen (2014) and Zhu *et al*. (2019), investigated the relationship between HPWS and entrepreneurial orientation. They argued that a strategic look at human resources could improve organisational, entrepreneurial orientation. Large-scale investment in employees can increase their specialised knowledge and skills, thus developing the organisation's human capital, which is the main source of entrepreneurial orientation and innovation. Hence, with the focus of HPWS, as an investment in human resources, the second research hypothesis is developed as follows:

Hypothesis 2: *HPWSs have a significant impact on the entrepreneurial orientation of knowledge-based companies*.

The importance of entrepreneurial orientation to the survival and performance of companies has been confirmed in the entrepreneurial literature (Hughes and Morgan, 2007). Lumpkin and Dess (1996) described EO as the process, practice, and decision-making activity that leads to new entry. Wiklund and Shepherd (2003) believed entrepreneurial attitudes and behaviours are critical for new ventures to facilitate the utilisation of new and existing knowledge to discover market opportunities. Entrepreneurial-oriented companies are firms with innovativeness which means a tendency to support new ideas and further increase the engagement in developing new products or processes (Lumpkin and Dess, 1996; Li *et al*., 2009). The development of new products and process involves extensive and intensive knowledge activities. Firms with entrepreneurial orientation tend to depend on employees' knowledge and skills as key inputs in the knowledge process (Lumpkin and Dess, 1996). As a result of this process, organisation's desire to engage and support new ideas, novelty, experimentation, and creative processes will increase which may lead to new products, services, or technological processes (Certo *et al*., 2009). Entrepreneurial-oriented companies also tend to participate in high-risk projects and managerial preferences for bold vs. cautious actions to achieve firm objectives (García-Granero *et al*., 2015). Involving in high-risk projects, and in other words, risk-taking increases

the organisation's willingness to support innovation and motivates managers to introduce new services to meet changing customer needs. Another dimension of entrepreneurial orientation is the process of anticipating and acting on future needs by looking for new opportunities which may be relevant to the current line of operations, introducing new products and brands ahead of the competition, strategically eliminating processes that are in the mature or declining stages of life cycle (Madhoushi *et al*., 2011). Previous research supports this view as these dimensions of entrepreneurial orientation have been found to encourage innovation, increase the competitiveness and effectiveness of a firm, and promote the launching of new ventures (Brock, 2003). So, entrepreneurial orientation can be considered as the processes, practices, philosophy, and decision-making activities that drive organisations to innovate. That is, firms with entrepreneurial orientation tend to pursue, identify, create, and launch new venture opportunities and strategic renewal to sustain competitive advantages (Huang and Wang, 2011). It has also been shown that entrepreneurial orientation influences the learning orientation of the organisation (Wang, 2008). Learning orientation, a kind of knowledge-based resource capability has been considered as a critical process that contributes to successful innovation, which determines and supports an organisation's success (Huang and Wang, 2011). So, it seems that entrepreneurial orientation in knowledge-based companies has a significant effect on innovation strategy. The direct relationship between entrepreneurial orientation and innovation strategy was not found in previous studies. But some studies mentioned entrepreneurial orientation increases a firm's autonomy, competitive aggressiveness, proactiveness, willingness to take risks, and innovativeness (Madhoushi *et al*., 2011; Lumpkin and Dess, 1996; Blumentritt *et al*., 2005; Freixanet *et al*., 2021). As the mentioned variables are the main components of innovation strategy, so it can be said entrepreneurial orientation can affect the organisational innovation strategy. Therefore, the third hypothesis is proposed as follows:

Hypothesis 3: *Entrepreneurial orientation has a significant impact on the innovation strategy of knowledge-based companies*.

Figure 1 shows the conceptual model of research based on the assumptions mentioned.

Research Method

This study is an applied research and a descriptive-analytical study in terms of type and nature. The statistical population of this study includes all employees and managers of Iranian knowledge-based companies in Isfahan province, out of which 180 were selected based on their work experience. Isfahan ranks second in

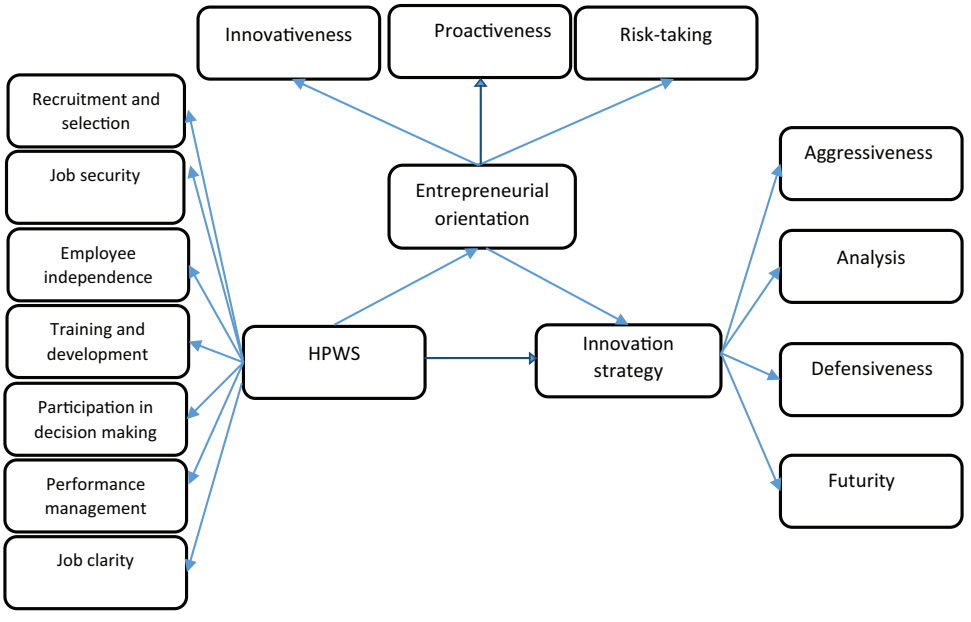

Fig. 1. Conceptual model of research.

the country with the activities of 520 knowledge-based companies and technology units. Science and Research Town, Technology Development Center, and Science and Technology Park in Isfahan have created the first official grounds for the formation of knowledge-based companies in Iran. Therefore, knowledge-based companies in this province have been selected as statistical population. In this case, simple random sampling was done. The total sample size was increased by 10% to adjust for incomplete questionnaires, and 198 questionnaires were finally collected from 48 knowledge-based companies. More demographic information about the sample is shown in Table 2. Data were collected using a 5-point Likert scale questionnaire that included measuring the dimensions of high-performance operating system variables, innovation strategy, and entrepreneurial orientation. In order to measure the effect of variables on each other, a questionnaire including 38 items was used. The questionnaire included seven items according to Shahriari *et al.* (2018) model, which used to evaluate the variable of HPWSs, 16 items according to Carabolut model (2015) and Romanowska (2017) to measure the innovation strategy variable, and finally, Brown (2010) questionnaire with 15 items was used to measure entrepreneurial orientation variable due to their comprehensiveness. The collected data were analysed to fit the research model and test the hypotheses in the SMART PLS software environment.

Table 2. Descriptive statistics

	Characteristics	Frequency	Percent (%)
Employees characteristics			
Age	18–25	38	19
	More than 25–40	91	46
	More than 40	69	35
Gender	Male	128	65
	Female	70	35
Education	Diploma & Under Diploma	5	3
	Associate	7	4
	Bachelor	89	45
	Master	73	37
	Ph.D.	24	12
Employee work experience	1–10	79	40
	More than 10–20	70	35
	More than 20	49	25
Companies characteristics			
Field of company	Machinery & equipment	5	10
	Power & electronics	10	20
	Metal & mineral	4	9
	Food & agriculture	5	10
	Medical & pharmaceutical	6	13
	Information technology	15	31
	Other	3	7
Company experience	1–5	7	15
	More than 5–10	13	27
	More than 10–20	22	46
	More than 20	6	12
Number of employment	1–10	6	13
	More than 10–100	23	48
	More than 100–500	12	25
	More than 500	7	14

Data Analysis

As mentioned, structural equation method was used in the present study to test research hypotheses. Convergent validity, diagnostic validity, and reliability of the construct, as well as Cronbach's alpha, were used to calculate the internal

consistency (reliability) of the questionnaire. After confirming the validity and reliability of the data collection tools, the research model was fitted to test the research hypotheses.

Validity and reliability of the questionnaire

As can be seen in Table 3, Cronbach's alpha value for all three variables is greater than 0.7, so the questions for each of these variables are reliable in terms of the value of this index and can be used for data collection and measurement of research variables. The mean of the extracted variances (average variance extracted (AVE)) is greater than 0.5 for all three variables, and the instrument for compiling the index is valid. The value of Rho_A index, which is equal to the mean of the AVE, is greater than 0.5 and indicates the diagnostic validity of the research variables. Also, the CR index value is greater than 0.7, indicating that the structure has combinational stability.

As mentioned above, to collect data, managers and employees of knowledge-based companies in Isfahan province were considered. At each company, it was tried to select from both levels of managers and employees to increase the validity of the data and results. As the model conceptualisation has been done at organisational level and data collected from individuals, to check the common method bias, Harman's Single Factor Test was performed by SPSS. All of the items explains less than 50% of the total variance of the variables, and the largest of which explains only 31% of the total variance of the variables. So, there is no common method bias in this research (MacKenzie and Podsakoff, 2012).

Testing research hypotheses

In the previous section, it was observed that four hypotheses were formulated in the present study to investigate the relationship between research variables. The fitted model has been shown in Fig. 2.

As can be seen, among the dimensions of HPWSs, the recruitment and selection dimension is most significant, weighing 0.857, and "job transparency" weighs

Table 3. Investigating the total reliability of the questionnaire.

Variable	Number of questions	Cronbach's alpha	Rho_A	CR	AVE
High- performance system	7	0.925	0.925	0.939	0.689
Entrepreneurial orientation	15	0.967	0.967	0.97	0.681
Innovation strategy	16	0.966	0.966	0.969	0.660

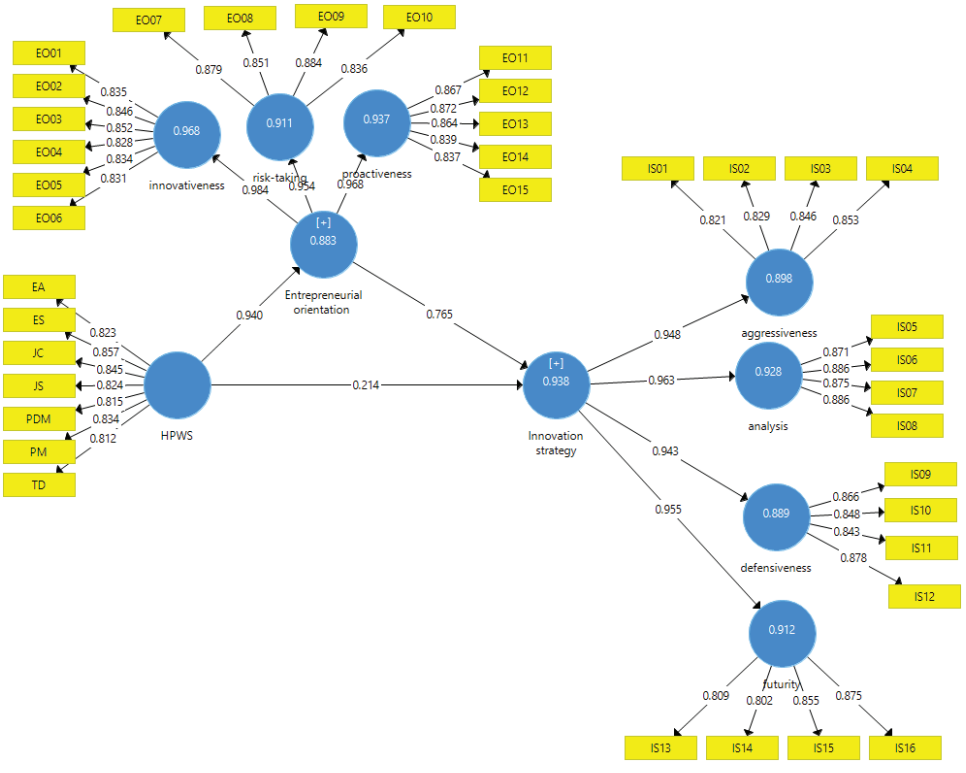

Fig. 2. Model fitness based on structural equation method.

Table 4. Goodness of fit of structural model.

Index	RMSEA	CFI	GFI	AGFI	NFI
Acceptable value	< 0.1	> 0.9	> 0.9	> 0.9	> 0.9
Calculated value	0.04	0.93	0.95	0.98	0.93

0.845 at second place, "performance management" weighs 0.834 at third place, job security is fourth with 0.824, employees' independence is fifth with 0.823, participation in decision making is sixth with 0.815, and education and development is seventh at 0.812.

The coefficient of determination R^2 is 0.882 for the "entrepreneurial orientation" variable and 0.937 for the innovation strategy variable, which indicates the appropriate fit of the model.

After fitting the model, the goodness of fit of the model is investigated (Table 4). As can be seen, the index values are in the permitted range, so it can be said that all the model fitness indices fit into the acceptable range.

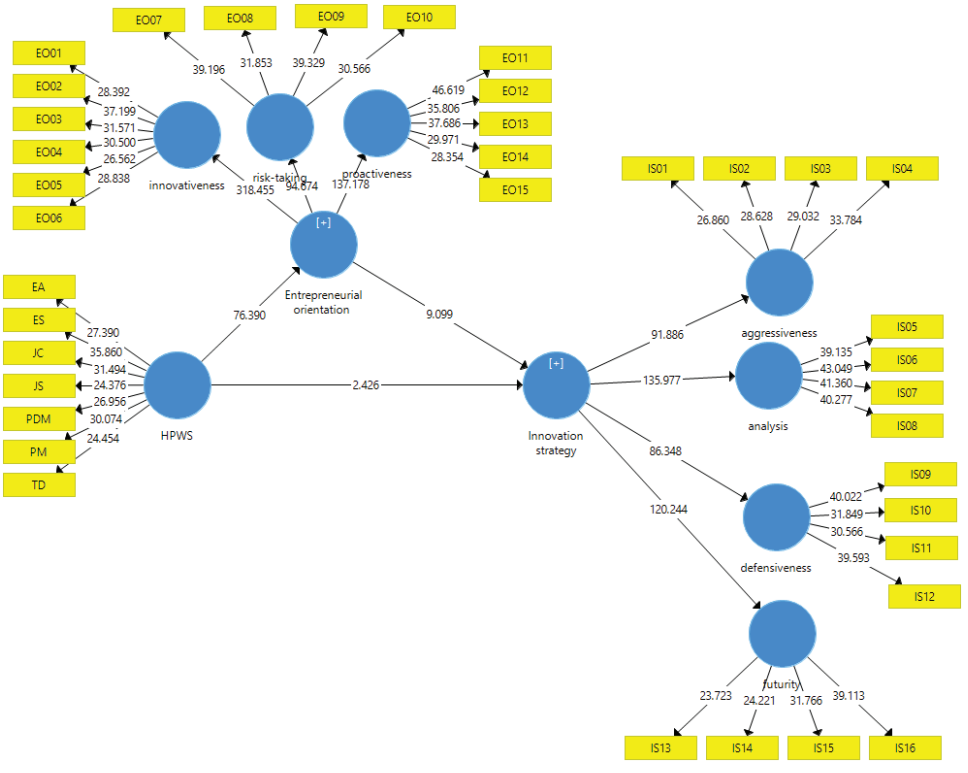

Fig. 3. Bootstrapping technique results.

In Fig. 3, the numbers on each path represent the value of *T* statistic. As can be seen, all the calculated values are greater than 1.96, so it can be concluded that the path coefficients in the fitted model are significant at the level of 0.05.

In the next step, to compare the mean of each of the Brunei hosts with the internal hosts, consider the standardised regression analysis of the individual hosts. This is a useful statement of the relative proportions of the proportions given in the model. This effect is visible in Fig. 2 and Table 5.

To determine the effect of exogenous variables on endogenous variables, standardised regression coefficients related to the paths of each hypothesis were investigated. These coefficients indicate to what extent the dependent variable changes are explained by the independent variables in the model. This impact is shown in Fig. 2 and Table 5. As can be seen in Table 5, the calculated *T* statistic for each path is greater than 1.96, and the path coefficients are significant at 0.05 error level. Therefore, the null hypothesis indicating there is no significant relationship or no significant influence between the variables in each path is rejected, and the first

Table 5. Results of model path investigation using structural equation method.

Hypothesis	Path	Path coefficients	Standard deviation	T-value	p-value	Test results
H1	HPWS— innovation strategy	0.214	0.067	9.381	0.000	Confirmation of hypothesis
H2	HPWS— entrepreneurial orientation	0.94	0.012	81.55	0.000	Confirmation of hypothesis
H3	Entrepreneurial orientation— innovation strategy	0.765	0.065	2.497	0.001	Confirmation of hypothesis

statistical hypothesis is accepted, indicating that there is a significant influence or relationship between the variables in the path. Therefore, three research hypotheses have been confirmed.

Hypothesis 1: *HPWSs have a significant impact on the innovation strategy of Iranian knowledge-based companies*.

As can be seen in the research structural equation model, the path coefficient of HPWSs—innovation strategy is 0.214. This means that there is a positive relationship between these two variables.

Hypothesis 2: *HPWSs have a significant impact on the entrepreneurial orientation of knowledge-based companies in Iran.*

As can be seen in the research model, the path coefficient of high-performance systems—entrepreneurial orientation is 0.94, indicating a strong impact of high-performance systems on entrepreneurial orientation.

Hypothesis 3: *Entrepreneurial orientation has a significant impact on the innovation strategy of Iranian knowledge-based companies*.

In the structural equation model of this study, it is observed that the path coefficient of entrepreneurial orientation—innovation strategy is 0.765, which indicates a positive relationship between entrepreneurial orientation and innovation strategy.

Now, to test the hypothesis on the mediating role of entrepreneurial orientation, given the confirmation of the relationship between paths 2 and 3, the existence of the mediating role is acceptable; therefore, the main hypothesis of the study is confirmed. But to explain the indirect effect of the high-performance independent operating system variable on the dependent variable, the innovation strategy is implemented through the entrepreneurial orientation as follows: To quantify the

indirect impact of the HPWS variable through entrepreneurial orientation, the coefficients of paths 2 and 3 are multiplied.

$$\text{effect in H} = 0.94 \times 0.765 = 0.72$$

Therefore, the impact of the entrepreneurial orientation variable on the relationship between the two variables of HPWSs and innovation strategy is 0.72. The variance accounted for (VAF) statistic is also used to determine the severity of the impact of the research mediator variable. The value is between 0 and 1, and the closer it is to 1, the stronger the impact.

$$\text{VAF} = \frac{a \times b}{(a \times b) + c} = \frac{0.94 \times 0.765}{(0.94 \times 0.765) + 0.214} = \frac{0.72}{0.72 + 0.214} = 0.77.$$

In the above relation, a, b and c are the coefficients of paths 2, 3, and 1, respectively. As can be seen, the resulting number is 0.77, i.e., about 77% of the total effect of the HPWS on the innovation strategy is indirectly explained by the mediating variable of entrepreneurial orientation.

Finally, to evaluate the overall fitness of the model, the GOF criterion is used as follows:

$$\text{GOF} = \sqrt{\text{Communalities} \times R^2}\ .$$

To calculate the fitness of the conceptual model, two indices of the mean cumulative index and average square of the correlation coefficients of endogenous structures are used (Table 6).

$$\text{GOF} = \sqrt{0.91 \times 0.785} = 0.85\ .$$

The test result for the model fit index is 0.85. Since the minimum acceptable value of this index is 0.36, it can be said that the research model has high and robust goodness of fit.

Table 6. Cumulative index and R squared values of variables.

Variable	Cumulative index	R squared
HPWS	—	—
Entrepreneurial orientation	0.780	0.882
Innovation strategy	0.791	0.937
Average	0.785	0.91

Discussion and Conclusion

In this paper, the impact of HPWSs on innovation strategy of knowledge-based Iranian companies was investigated with mediating role of entrepreneurial orientation. The structural equation method was used for data analysis. Although there have been several studies of the positive and significant relationship between HPWSs and innovation (Shahriari *et al*., 2017, 2018; Gittell *et al*., 2010), the impact of HPWS on innovation strategies in knowledge-based companies has not been explained based on previous studies. Moreover, an important contribution of this paper investigates the advantages of HPWS in promoting innovation strategy in developing countries. The first hypothesis of study was confirmed that the impact of HPWS on innovation strategies in developing countries is strongly emphasised. According to the previous researches, instead of emphasising particular HR activities, HPWS highlight the integration and coordination of HR practices aligned with organisational strategies (Shin and Konrad, 2017). Thus, HR practices are coordinated with innovation strategies as a subset of organisational strategies. In fact, HPWS can influence employees by viewing them as a valuable asset and fostering the exchange of ideas and risk-taking (Liu *et al*., 2009), so facilitating cooperative, interdependent, and long-term-oriented behaviours, which are vital elements for a new product or service development. These results are much more important for developing countries given their economic and social challenges and low power of HRM. In such countries, innovation strategies are more important for enterprises to become and remain competitive, to move to higher return activities, and to grow and graduate to a larger enterprise status, hence creating new employment and income opportunities. Therefore, given the statistical results of this study and the theoretical implications expressed, it can be claimed that HPWSs can influence a company's movement towards its innovation strategy in developing countries. The second hypothesis was confirmed that the impact of HPWS on entrepreneurial orientation in developing countries is strongly emphasised. Previous research showed that high-performance work organisations that increase their support for employees through teamwork and decentralised decision making perform better than other organisations by enhancing employees' entrepreneurial orientation. On the other hand, in HPWSs, the emphasis is on attracting creative and risky employees and talents as well asenhancing employee creativity by creating proper freedom of action and knowledge sharing platforms (Zhu and Chen, 2014). The presence of such employees creates a proactive and pioneering organisation and fosters organisational innovative and entrepreneurial behaviours (Zhu *et al*., 2019). Thus, according to the above and the results of Zhu *et al*. (2019), Naskar (2018), and Zhu and Chen (2014), it can be said that the result of the second hypothesis of this study on the impact of HPWSs on entrepreneurial orientation is consistent with the theoretical foundations and results of past

research. The third hypothesis of the studyshowed that entrepreneurial orientation has a significant and positive impact on innovation strategy of knowledge-based firms. The results show that risk-taking, along with other aspects of entrepreneurial orientation, i.e., innovative behaviours and proactiveness, lead to all other dimensions of innovative strategy. In fact, this results is consistent with the results of previous research that firms with entrepreneurial orientation tend to pursue, identify, create, and launch new venture opportunities and strategic renewal to sustain competitive advantages (Huang and Wang, 2011). As we have seen, HPWSs have a positive impact on innovation strategy as well as entrepreneurial orientation. Based on the results of the present study, the impact of entrepreneurial orientation on innovation strategy is mediating and indirect. The effect of entrepreneurial orientation variable on the relationship between HPWS and innovation strategy is 0.70, and about 75% of the total effect of HPWS on innovation strategy is indirectly explained by the mediating variable of entrepreneurial orientation.

Empirical Implications

The results of this study have relevant implications for managers, especially in knowledge-based enterprises. First of all, to properly establish HPWS, management must focus on developing creative abilities through extensive job training, performance-based reward systems, employee incentive systems, etc. These can motivate employees and encourage them to achieve higher levels of creativity, innovation, and performance (Miao *et al*., 2020). Management should also empower and motivate employees through decentralisation of power at the highest levels, participatory decision-making, and effective feedback systems. These measures will create a sense of belonging to the organisation in employees. They will also lead to producing novel ideas to develop new products, services, and, in other words the innovation strategy (Haneda and Ito, 2018). Innovation strategy for the knowledge economy is intended for managers who have implemented the quality management and re-engineering techniques and are ready to transform their organisations with the systematic concepts of knowledge creation and application. Gradual promotion of the culture of knowledge also helps organisations increase their employees' competencies (Abubakar *et al*., 2019). Since organisational knowledge creation benefits most from an EO in the presence of both high levels of business ties and market dynamism, managers must pay attention to factors affecting entrepreneurial orientation. Managers must consider the entrepreneurial posture and create an EO spirit such as creating a free atmosphere in which employees can learn and encouraging routine-breaking actions in their firms. Governments are also advised to encourage the breeding of EO through promoting appropriate education, support and training programs for firms (Li *et al*., 2017).

Limitations and Future Research Directions

The existence of potentially inaccurate or careless responses to the questionnaire items and restriction of the study population to certain businesses based in a specific area were among the limitations of this study. Future researchers are encouraged to test various moderator variables in order to investigate better the impact of high-performance systems on organisational innovation strategies, such as different individual and organisational capabilities, organisational leadership styles, and characteristics of the relevant industry. In particular, variables that prevent the creation of entrepreneurial orientation and thus innovative strategies in the organisation, even when there are high-performance systems in the organisation. Another suggestion for future research is that instead of measuring the innovativeness of the organisation's strategies, some other observable variables such as income from innovation or the number of innovative products can be used. Also, testing the model in different statistical populations can ensure the model validity.

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