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Investigating Alignment Between HRM Configurations and Innovation Strategy Modes in Iranian Knowledge-Based Service Firms

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ABSTRACT

This study aims to establish a relationship between HRM and innovation studies through human capital characteristics in order to achieve a better understanding of HRM's supportive role in innovation realization aligned with knowledge-based services. The study provides a new model of coordination between innovation modes of service sector firms and HR configuration adopted for managing people in these firms. By gathering data about the main variables from 132 Iranian knowledge-based service firms with more than 30 employees, all located in Tehran province (selected through systematic sampling), the status of every firm in the field of innovation mode and HR configuration was determined. The hypotheses were tested using contingency tables and binomial test. After testing hypotheses, it was found that the strongest alignment exists between market-oriented innovation and productivity-based HR configuration (at about 53%). The average value for the human capital characteristics in firms that had two mentioned statuses were more than another three statuses. To achieve ideal human capital management, managers of KBSFs need to pay more attention to the compatibility of their HR configurations with innovation modes of KBSFs in order to approach the satisfactory productivity level seen in such firms.

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1. Introduction

There are different approaches for stimulating organizations to achieve innovative performance. Human capital is one of the approaches used for this purpose (Alshekaili & Boerhannoeddin, 2011). The human capital of a firm is an important factor for innovation and economic development (Diebolt & Hippe, 2022; Isa & Muafi, 2022; Pradana et al., 2020), and is considered the set of skills, knowledge, capabilities, and other attributes embodied in people that can be translated into productivity (Lenihan et al., 2019). According to some studies, higher levels of human capital lead to increased innovation (Dakhli & De Clercq, 2004). The assessment of human capital, as the source of innovation, along with other variables, like HRM special practices, can strengthen the influence and impact of human capital on the innovation (Pizarro et al., 2009).

Research about different combinations of HRM practices and their effects on performance was triggered in 1990s. Organizations adopt different HR configurations depending on organizational differences (see Luo et al., 2021). The majority of studies have investigated the impact of different HR practices on different innovations, innovation strategies (Shipton et al., 2006), the role of human capital in innovation realization, the effect of HR practices on the promotion of human capital level, and innovation levels (Nieves & Quintana, 2016, 2018).

The purpose of this study was to show the relationship between HRM and innovation modes through human capital characteristics in order to capture a better understanding of HRM's supportive role in Iranian knowledge-based firms. The main question of the study was, "which HR configuration is adopted in KBFs aligned with each innovation mode?"

2. Theoretical Background

2.1 Introduction of Innovation Modes-Background

Prior to Schumpeter's debates over the innovation theory in his initial studies, researchers such as Max Weber, Gabriel Tarde, and Karl Marx (as suggested by Moldaschl, 2010) had defined innovation in many different ways but they had one concept in common: The novelty of change leading to value creation (see Baranskaitė & Labanauskaitė, 2020). Innovation is one of the critical organizational elements with strong effects on the outcome of organizations and can be defined as an organization's propensity to apply new ideas, inventions, and discoveries that result in the development of new products or services, managerial strategy, procedures, work methods, and technology (Iqbal et al., 2019).

Studies have revealed that many countries have adopted several innovation modes (Frenz & Lambert, 2012). All innovation modes have demonstrated the relationship between innovation, labor productivity, employment growth, and turnover in different countries (Filippetti, 2011). Studies about innovation modes in the service sector were triggered by Pavitt's study (1984) and have continued until now. Pavitt argued that the sources and purposes of innovation are sector-specific. Regarding industrial innovation, Pavitt's taxonomy suggests that firms can be divided into four broad categories:

1. Supplier dominated firms, i.e., those firms that acquire their technical expertise from their suppliers,
2. Specialized suppliers, especially in the field of equipment and capital goods, which provide the innovations to other firms,
3. Scale intensive firms, where the innovation is associated to scale, and
4. Science-based firms, which innovate through their internal R&D laboratories.

In subsequent versions of his taxonomy, Pavitt (1989) added information-intensive firms, where the most important source to innovate is the use of data. These firms included firms in the software as well as in advanced services such as banking and retailing (Hollenstein, 2003). Pavitt's taxonomy has been widely applied in the manufacturing sector and the service economy (Capponi et al., 2022). Thus, the innovation mode entered the literature of services.

Strategic value and uniqueness are the two dominant characteristics of human capital that can serve as the determinants of innovation modes and HR configurations. The strategic value of human capital indicates individuals' talents in improving organizational efficiency and effectiveness, discovering and extracting market opportunities, and neutralizing potential environmental threats. It shows the ratio of the benefits of customers from the skills of the employees to the imposed costs to the firm. If employees can contribute to the cost cut process or provide additional benefits to customers, they will create value (Lepak & Snell, 1999; Luo et al., 2021). This value directly affects the firm's

performance and innovation (Pizarro et al., 2009). Uniqueness indicates the extent of rareness and specialty of human capital in the labor market. Organizations invest in training their employees and developing their human capital in cases where they have unmovable employees, i.e., unique and organization-specific employees (Lepak & Snell, 1999; Luo et al., 2021). Pizarro et al. (2009) studied the role of strategic value and uniqueness in organizational innovation. According to the results, both items have a positive relationship with innovation where the effect of uniqueness on the realization of innovation is stronger than that of strategic value (Pizarro et al., 2009).

Possessing highly qualified employees and investing in training and developing human capital are among the important characteristics of innovative firms (Isa & Muafi, 2022). Such an investment, in turn, implies the uniqueness of the firm labor (Lepak & Snell, 1999). On the other hand, employee productivity, added value, and the measurement of their economic performance are among the dominant determinants of innovation modes (Hollenstein, 2003). Such modes have not been studied yet in the form of different innovation frameworks for inter-organizational coordination. To achieve a unique framework that shows human capital's role in innovation modes, this study adopted Hollenstein's five innovation-mode categorizations in the service sector. He extracted the modes after studying 2731 Swiss service firms and used 17 indices to complete his study. The properties of modes extracted by Hollenstein make it possible to categorize them in accordance with the two dominant attributes of human capital: Strategic value and uniqueness. Hollenstein (2003) found these results from the input and output data of innovative firms. He introduced the following modes:

1. IT-oriented innovations: Firms with IT-oriented innovations have an acceptable market perspective and possess unique and experienced laborers who are highly qualified employees to be working in an innovative entrepreneur firm. Such firms have made huge investments in IT development, and thus, they have offered high-standard innovative, and sometimes, new, products and services. In addition, the strategic value of each employee is higher than that of other modes.
2. Market-oriented innovations: Though firms with market-oriented innovations have an acceptable market perspective, they have a moderate status in innovation supply. In general, network-based working has a weak condition in these firms. The only knowledge-related connection between them and the outside world is market-oriented knowledge resources, including suppliers and users, or easily accessible knowledge resources, such as exhibitions. The firms have high-productive staff.
3. Cost-oriented process innovations: Firms with cost-oriented innovations are characterized by gradual process innovations with the goal of cost cut. The productivity of employees is close to the moderate level in the firms.
4. Science-based high-tech innovations: Firms with science-based high-tech innovations possess unique and experienced employees who are excellently highly qualified for working in a knowledge-based entrepreneur firm. They benefit from continuously active R&D departments, acceptable innovation opportunities, and a market perspective. Performing R&D activities inside the firm demands the widespread applications of outside-organization knowledge, including collaborative research projects generally accomplished by universities. Universities are considered as the primary partners of such firms. In this mode, the nominal productivity of staff is below moderate.
5. Weak innovators with extremely weak relationships: These firms are characterized by a weak demand perspective, high prices, few innovation opportunities, and relatively weak human resources. Adopting the new products of other firms is considered as their innovation (Hollenstein, 2003).

Since the firms in the fifth group are not innovative, and only imitate others' innovations, they were not included in the typology of innovation in the current study. Considering the uniqueness and strategic value of employees as the descriptive factors of human capital, and based on its similarity to the human resources architecture model (Lepak & Snell, 1999; 2002), the results of Hollenstein's study (2003) about the different modes of innovation were configured as a 2×2 matrix. Figure 1 shows the modes of innovation in our proposed model.

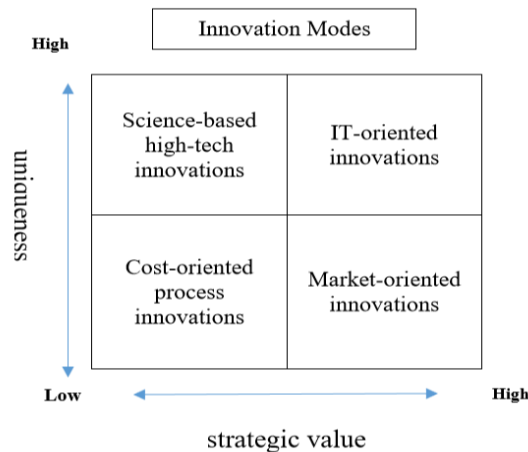


Figure 1. Innovation Modes (Hollenstein, 2003)

2.2 HR Configurations and Background

Studies on different HR configurations and their impact on performance have been triggered since 1990. HR systems use different appropriate HR practices. Therefore, organizations have different HR configurations due to organizational differences. MacDuffie (1995), Huselid (1995), Ichniowski (1997), and Michie and Sheehan (1999) have introduced sets of HR practices, with some remaining as policies and some becoming operational (see Laursen & Foss, 2014). One of the most comprehensive models originating from the resource-based view (RBV) was introduced by Lepak and Snell (2002). They combined the economic theory of transaction cost, human capital theory, and resource-based view, and concluded that the strategic value and uniqueness of human capital are the influential and determinant factors of the architectural style of human resources, including employment style, and employment relations, and finally, HRM practices. They used the two characteristics of human capital and offered a four-part model for HR configurations, each providing different definitions of human resource practices depending on labor types and the type of employment relations (Luo et al., 2021). Here, configuration means the set of HR practices adjusted based on the features of active human capital in the organization. In different HR configurations, organizations have human resources with different features, and the difference between employees demands different management methods (Melian-Gonzalez & Verano-Tacoronate, 2006). The following paragraphs explain different HR configurations, which are based on human resources type:

- *Commitment-based HR configuration*: The human capital in the cell located at the right-hand side of the 4-cell square is both valuable and unique. Emphasizing long-term relationships, and attracting and educating in-organization employees, this configuration can maintain and enhance the key capabilities of key employees. It establishes a long-term family-like relationship between employees and the organization.
- *Productivity-based HR configuration*: In this HR configuration, both individuals and organizations may intend to extend their relationships as long as there is a mutual profit. The application of this HR configuration to employees who already possess the necessary skills increases the effectiveness and productivity of staff in the shortest possible time and directly involves them in the process of creating value for customers.
- *Compliance-based HR configuration*: This HR configuration establishes an employment relationship based on an individual-organization deal. This means that work has merely an economic nature and encapsulates explicit definitions of tasks, schedules, and indispensable conditions where wages are paid based on working hours or basic piece rate as per job description and in accordance with organizational procedures and rules.
- *Collaboration-based HR configuration*: This HR configuration uses relational structures as well as consultancy relations with the ability to enhance knowledge and information share and build a collaborative working relationship based on a mutual investment. Researchers use the term “contract” to refer to external relations where each group helps achieve common outcomes and generally builds particular common assets that create value only through the attempts of one or

more groups. Engineers and scientists who conduct fundamental studies are classified in this class without any direct relationship with customers' demands (Lepak & Snell, 1999; 2002; Luo et al., 2021)

2.3 Explaining the Relationship Between Innovation and HR Configurations

Different researchers (see Seeck & Diehl, 2017) have studied the relationship between HRM and innovation performance in firms and have proven that there is a significant positive relationship between them (Easa & El Orra, 2020; Laursen & Foss, 2014).

Laursen and Foss (2014) showed that firms with different innovations can follow different models of HR practices. According to Miles and Snow (1984), the development of market-oriented HR systems is recommended for the firms seeking new products or markets, which are considered as innovative firms. Jimenez-Jimenez and Sanz-Valle (2005) indicated two HR systems with different but appropriate practices for innovative firms. Commitment and collaboration HR systems in the Chinese context of 125 firms with 50 employees indicated a positive impact on organizational innovation (Zhou et al., 2013). Stock et al. (2014) used four innovation-oriented practices, and Diaz-Fernandez et al. (2017) adopted four practices aiming at enhancing employee abilities, motivation, and opportunity to innovate. The commitment-based HR system was used by Ceylan (2013), showed a positive impact on innovation in her study on 103 Turkish firms. In summary, a bundle of different practices shows a positive association with innovation. Our aim in this study was to assess this relation using four quadrants in the HR architecture model.

3. Conceptual Model and Hypotheses

In this study, we reviewed the theoretical background and then designed a conceptual model and hypotheses. First, we described innovation modes. Second, we explained the role of human capital and its dominant characteristics, i.e., the determinants of innovation modes and HR configurations. Finally, we explained different HR configurations based on human resources types. All previous studies have indicated the necessity of HR configuration-innovation mode coordination. The main question of this study was, "which HR configuration is adopted in KBFs aligned with each innovation mode?"

Figure 2 shows the conceptual model of the study constituted based on the Lepak and Snell's HR architecture model (2002) and the model extracted from Hollenstein's study on innovation modes (2003). The following section explains the commonalities and similarities of the modes.

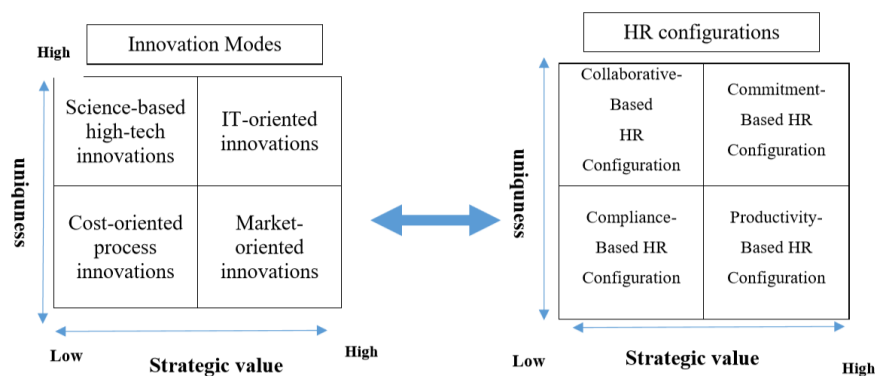


Figure 2. The Conceptual Model of Study

3.1 The Process of Establishing a Relationship Between Innovation Modes and HR Configurations and Hypotheses

3.1.1 Relationship Between IT-Oriented Innovation Mode and Commitment-Based HR Configuration

The active labor force of firms with this innovation mode is unique and possesses the special features required by the firm. Highly productive employees and higher rates of added value per employee are among the dominant features of firms with IT-oriented innovation mode; such productivity rates have not ever been observed in other modes (Hollenstein, 2003). According to Diebolt and Hippe (2022), workers who have more human capital may contribute to technological progress by the use of their

human capital if they have the necessary access to educational facilities and can handle new technologies in the best way. Capozza and Divella (2019) showed that if firms want to improve their technological capabilities, they should invest in different forms of human capital, namely a highly educated workforce and experienced managers. It was also argued that those HR systems characterized by highly productive employees emphasize employee commitment (Arthur, 1992) and serve as high-performance working systems for establishing commitment-based and long-term employment relationships. Meanwhile, human capital is extremely unique and has high strategic value in commitment-based configuration (Lepak & Snell, 1999). Thus, it can be concluded that the IT-oriented innovation mode is coordinated with commitment-based HR configuration. Hence, the following hypothesis can be proposed:

Hypothesis 1: The rate of coordination between IT-oriented innovation mode and commitment-based HR configuration exceeds 30%.

3.1.2 The Relationship Between Market-Oriented Innovation Mode and Productivity-Based HR Configuration

The progressive market-oriented innovation mode is characterized by highly productive employees. In firms with this innovation mode, the supply and demand of innovation creation have an acceptable level, the labor force is not unique, and the market perspective is desirable. In addition, there are few input data for innovation, but the output of innovation is very valuable from economic and technological standpoints (Hollenstein, 2003). In productivity HR configuration, the required labor force is available in the labor market and is not unique. This means that such firms have acceptable supply and demand conditions in the labor market. However, this configuration pays attention to the higher rates of productivity and added value generated by employees. On the other hand, according to studies, this innovation mode is appropriate for firms following a low-cost production strategy (Lepak & Snell, 1999). As noted above, there are few innovation inputs in the market-oriented innovation mode. Therefore, despite producing high-value final products, the production cost is low. Thus, we can conclude that this innovation mode is coordinated with productivity-based HR configuration as it possesses a high-productive labor force, and both concentrate on low-cost production strategy. Hence, the following hypothesis can be proposed:

Hypothesis 2: The rate of coordination between market-oriented innovation mode and productivity-based HR configuration exceeds 30%.

3.1.3 Relationships Between Cost-Oriented Process Innovation Mode and Compliance-Based HR Configuration

In the cost-oriented process innovation mode, the amount of employee-created value and productivity is below the moderate level, and the labor force is not unique. Cost reduction is the main aim of innovative processes. This mode pays special attention to institutionalized and contractual cooperation for executing design and development activities (Hollenstein, 2003). On the other hand, the main aim of compliance-based HR configuration is cost reduction through contract-based employment. Since required skills are not firm-specific skills, unique and valuable employees are not important subjects in this configuration. Therefore, there are diverse resources for such skills, and firms can reduce employment-induced costs by outsourcing. The reduction of costs in the HR employment process is highlighted in this configuration. In addition, the strategic value of human capital is low (Lepak & Snell, 1999). Thus, coordination is observed between cost-oriented process innovation mode and compliance-based HR configuration.

Hypothesis 3: The rate of coordination between cost-oriented process innovation mode and compliance-based HR configuration exceeds 30%.

3.1.4 Relationship Between Science-Based High-Tech Innovation Mode and Collaboration-based HR Configuration

A high-tech business has to constantly innovate and acquire unique resources to hold its competitive advantages (Huang et al., 2019). Despite the extensive uniqueness of human resources in this mode,

labor productivity and added value are below the moderate level. The innovation mode of integrated-network science-based high-tech firms is the only innovation mode in which firms collaborate with universities as their primary partners to carry out their R&D activities. This builds a widespread grid of out-firm knowledge resources associated with the scientific activities of such firms (Hollenstein, 2003). On the other hand, collaboration-based HR configuration aims to put collaborations into practice in order to share and transfer knowledge and skills within a contract and participation framework. In addition, human capital has a low strategic value and a high uniqueness level in this configuration (Lepak & Snell, 1999). Thus, we can conclude that the coordination between integrated-network science-based high-tech innovation mode and collaboration-based HR configuration is obvious. Hence, the following hypothesis can be proposed:

Hypothesis 4: The rate of coordination between science-based innovation mode and collaboration-based HR configuration exceeds 30%.

4. Methodology of Research

This study was a quantitative survey research. Survey research is a quantitative method for collecting information from a pool of respondents by asking multiple survey questions. This research type includes the recruitment of individuals, collection, and analysis of data. Survey research provides a quantitative or numeric description of trends, attitudes, or opinions of a population by studying a sample of that population, using questionnaires or structured interviews for data collection, with the intent of generalizing from a sample to a population (Creswell, 2005; Fowler, 2009).

In this survey, the firms were asked to fill in a questionnaire on their innovative activities, HRM practices, and their human capital characteristics. The data was collected using questionnaires. The innovation indices of Hollenstein's (2003) study and Lepak and Snell's (2002) questionnaires were used to determine innovation modes and HR configurations, respectively. The content validity of the questionnaire was measured using the Delphi technique in two rounds and collecting the opinions of 14 experts in the HR and innovation field. The questionnaire had 94 items on a 5-point Likert scale. For all items measuring innovation modes and HR configurations, 1 indicated strong disagreement and 5 indicated strong agreement. The population of this study consisted of all KBSFs located in Tehran with more than 30 employees. According to the EU definition, firms with less than 50 employees are referred to as small enterprises and those with 50 to 250 employees are referred to as medium enterprises (EU, 2015). The selection criterion was set for small firms that had more than 30 employees. The total number of active KBSFs in the growth and technology centers of Tehran province was 200 firms, based on which the sample size was calculated by Cochran's formula and Morgan table as 132 firms. Finally, 132 firms from four sectors (knowledge-based high-tech services firms, financial firms, IT firms, and firms with business and management consultancy activities) were selected through systematic sampling. The number of firms that responded to the questionnaire was almost equal in all four sectors and there was no considerable difference. Every firm received three questionnaires. The questionnaires were collected from each firm with the most informed and knowledgeable employees as the responders. Based on judgment sampling, the respondents consisted of the CEO, human resources manager, and IT manager of the firms. The status of each firm in innovation mode and HR configuration was determined based on the mean score of the three questionnaires.

Next, confirmatory factor analysis was performed on both innovation modes and HR configurations. Tables 1 and 2 show the validity and reliability of all variables of the study. Good quality indicators for the proposed model were achieved for all constructs in terms of Average Variance Extracted (convergent validity), compounded reliability, Cronbach's Alpha, and communalities.

Table 1. Validity, Reliability, and Fitness of Innovation Modes

Latent variables	AVE	CR	R square	CA	\overline{AVE}	$\overline{R^2}$	GOF
Innovation modes	0.7655	0.9421	0	0.9362			
IT-oriented	0.6024	0.9229	0.5089	0.904			
Market-oriented	0.7317	0.9314	0.3453	0.9071	0.80811	0.7484	0.6047
Cost-oriented	0.5592	0.9421	0.6249	0.9327			
Science-based	0.6064	0.9236	0.7608	0.9031			

Table 2. Validity, Reliability, and Fitness of HR Configurations

Latent variables	AVE	CR	R square	CA	\overline{AVE}	$\overline{R^2}$	GOF
HR configurations	0.7198	0.9492	0	0.9388			
Commitment-based	0.5463	0.9428	0.9285	0.9335			
Productivity-based	0.5703	0.9287	0.8605	0.9131	0.7709	0.8261	0.6368
Compliance-based	0.5416	0.9083	0.4411	0.8455			
Collaboration-based	0.5931	0.852	0.4998	0.7736			

In addition, to construct validity, which is used to assess the degree of the consistency of selected indicators in measuring constructs, this study took discriminant validity into account. In this type of validity, the indicators of each construct differentiate measurements from other constructs of the model in a proper manner. Therefore, every indicator should measure only its own construct and they should be combined in a manner that can well differentiate constructs from each other. The convergent validity was analyzed using the Average Variance Extracted. The Average Variance Extracted value for all studied constructs was above 0.5. The reliability of the questionnaire was confirmed using combined reliability (CR) and Cronbach's alpha (CA). It is suggested that if the indices are above 0.7, then the reliability of this questionnaire will be confirmed. In this study, all coefficients were above 0.7, implying the reliability of the measurement tool. The index of goodness of fitness (GOF) shows the fitness of the quality of the structured model with the measured model. It equals to:

$$GOF = \sqrt{\overline{AVE}} \times \sqrt{\overline{R^2}}$$

Where \overline{AVE} , $\overline{R^2}$ are mean AVE and mean R^2 , respectively.

If $GOF > 0.5$, the fitness of the model is corroborated. In this study, the index of fitness was above 0.5, implying the acceptable fitness of this model. Tables 2 and 3 show the appropriateness of the study data with factor structure and theoretical fundamentals of study. This, in turn, indicates the congruence of items with the theoretical constructs of the study.

5. Data Analysis and Findings

For the statistical analysis of cross-classified categorical data, we used the contingency table. A contingency table is essentially a display format used to analyze and record the relationship between two or more categorical variables. It is the categorical equivalent of the scatterplot used to analyze the relationship between two continuous variables. The table displays sample values in relation to two different variables that may be dependent or contingent on one another. The emphasis here is on the verification methods for the 2*2 contingency tables used to summarize verification datasets for dichotomous variables. The term contingency table was first used by the statistician Karl Pearson in 1900. For the analysis of two-way contingency tables, Karl Pearson (1900) proposed –among other things – an approach based on the bivariate normal. The approach assumes that the row and column classifications arise from underlying continuous random variables that have a bivariate normal distribution, so the sample contingency table comes from a discretized bivariate normal (Goodman, 1981).

Considering the contents of Table 3, we can conclude that the market-oriented innovation mode is the dominant innovation mode in KBFs (48 firms), followed respectively by science-based innovation mode (38 firms), cost-oriented process innovation mode (28 firms), and IT-oriented innovation mode (18 firms). In addition, commitment-based HR configuration is the governing HR configuration in

KBFs (53 firms), followed by productivity-based HR configuration (32 firms), compliance-based HR configuration (27 firms), and collaboration-based HR configuration (20 firms). The main diagonal of this table demonstrates the compatibility of innovation modes with corresponding HR configurations in 43 firms out of 132 (compatibility= 33%). The highest compatibility is seen between market-oriented innovation mode and productivity HR configuration (40%), followed by the compatibility of cost-oriented process innovation mode and compliance HR configuration (37%).

Table 3. Coordination Percentage of Innovation Modes and HR Configurations

HR configurations	Innovation Modes				Total
	IT-oriented	Market-oriented	Cost-oriented	Science-based	
Commitment-based	9 17/0%	20 37/7%	7 13/2%	17 32/1%	53 100/0%
Productivity-based	1 3/1%	17 53/1%	5 15/6%	9 28/1%	32 100/0%
Compliance-based	4 14/8%	8 29/6%	10 37%	5 18/5%	27 100/0%
Collaboration-based	4 20/0%	3 15/0%	6 30/0%	7 35/0%	20 100/0%
Total	18 13/6%	48 36/4%	28 21/2%	38 28/8%	132 100/0%

One-tailed statistical tests were used to examine directional hypotheses. Generally, the ratio of 50% is considered to be the measure in binomial tests, which are also called proportion tests. However, in this study, it was considered 30%, as this study tried to discover the minimum compatibility and relationship between modes. Since we found that the coordination between innovation modes and HR configurations in contingency tables was less than 50%, according to Miller and Miller (2014), we can claim a 30% coordination rate in our hypothesis. Considering the sample size and sampling distribution, the test statistic is a standard normal distribution (z test). In order to perform a binomial test on the items of both models with a coordination percentage of above 30%, test statistic was calculated based on 33% obvious coordination indicated in Table 3. The value of the test statistic was 0.77, which was compared with the critical value of 1.64. According to statistical tables, the value of Z is 1.64 in a confidence interval of 95%. Since the obtained Z does not lie inside the critical zone, the null hypothesis is not rejected in the confidence interval of 95%.

Table 4 shows the level of coordination between HR configurations and corresponding innovation modes as well as the Z value of each mode. By comparing the Z value with test statistic, we can argue that all hypotheses are rejected, except for hypothesis 3. Since the test statistic of hypothesis 3 is 2.83 (inside the critical region), the coordination level > 30% was only observed between the market-oriented innovation mode and productivity HR configuration. Although the results showed 33% coordination between collaboration-based HR configuration and science-based innovation mode, their coordination was rejected after the examination of the hypothesis because in binomial test parts of data are lost.

Table 4. Examination of Hypotheses for Compatibility of HR Configurations and Corresponding Innovation Modes

HR configurations	Status	Number	Proportion	Z score	Result
Commitment-based	Proportionate	9	17%	-2/09	Acceptance of null hypothesis
	Disproportionate	53			
Productivity-based	Proportionate	17	53%	2/83	Rejection of null hypothesis
	Disproportionate	32			
Compliance-based	Proportionate	10	37%	0/79	Acceptance of null hypothesis
	Disproportionate	27			
Collaboration-based	Proportionate	7	35%	0/49	Acceptance of null hypothesis
	Disproportionate	20			

Thus, according to the data derived from 132 firms, the market-oriented innovation mode and commitment HR configuration were the highest-frequent modes/configurations. Following the

examination of hypotheses, only alternative hypothesis 2 was accepted. The highest compatibility (53%) was observed between the market-oriented innovation mode and the productivity-based HR configuration (coordination > 30%). In organizations with the market-oriented innovation mode and the productivity-based HR configuration, i.e., organizations with the highest compatibility of adopted innovation mode and HR configuration – mean uniqueness and mean strategic value were higher than those seen in incompatible cases or where the compatibility was below 30%. For example, the mean uniqueness in firms with the market-oriented innovation mode and productivity-based HR configuration was 4.03, and the mean strategic value of employees was 4, whereas both of these were lower (3.50 and 3.80, respectively) in firms with the market-oriented innovation mode and the commitment-based HR configuration (incompatible modes). In all studied firms, the mean strategic value (3.50) was higher than the mean uniqueness (3.30), implying the concentration of such firms on labor productivity.

5. Discussion, Implications, and Future Research Directions

In this study, we attempted to answer the question of whether KBFs have adopted innovation mode-compatible HR configurations to manage their human resources. First, the results of the hypothesis examination revealed that the level of coordination between the market-oriented innovation mode and the productivity-based HR configuration (both emphasizing productivity and output) is above 30%. Our findings are consistent with the study carried out by Adla et al. (2020). According to them, due to SMEs' scarce resources, SME leaders and managers are usually unable to implement costly HRM practices (Ayoko, 2021). Therefore, firms whose innovation strategy is productivity and cost reduction apply productivity-based HR configuration. Second, the dominance of the market-oriented innovation mode over other modes shows the incremental nature of innovation in the majority of KBSFs, because the level of innovation input in such firms is rather low and they have a moderate level in supply-side conditions for innovations. This finding is in accordance with Oslo Manual (OECD, 2005, p. 11), which indicates that innovation in service-oriented sectors is often less formally organized and more incremental in nature. Nevertheless, innovation output is very valuable in such firms, compared with their weak facilities, and from economic and technological points of view, their innovated products have an acceptable position in the market. This means that such firms have highly productive employees. Third, in all studied KBSFs, the mean strategic value (3.50) was higher than the mean uniqueness (3.30), implying the concentration of such firms on labor productivity. This shows that services in Iran are aware of the value that a labor force can bring to a firm. Fourth, since the mean of human capital characteristics in compatible quadrants was higher than the mean score of them in firms with incompatible modes, it can be concluded that KBSFs have concentrated on the productivity of human capital and used their available resources in the best way to move in the direction of marketing. Given that Iran is under sanctions, the adoption of such a strategy by KBSFs seems appropriate and inevitable. The research by Sandri and Widodo (2020) also shows that a higher rate of human capital will lead to a higher level of marketing performance. According to Becker (1964), who is widely acknowledged as the founder of human capital theory, human capital increases the productivity of workers. Such firms that adopt productivity-based HR configuration and market-oriented innovation mode are characterized by employing labor who are available in the market for the considered jobs and have previously acquired the necessary skills and experiences required by the firm. Employing skilled employees who are directly selected from the labor market enables the firms to save their development costs. This enables them to rapidly access a wide set of capabilities which, in turn, results in a positive return on capital. Nevertheless, this return on capital in exchange of human capital depends on the extent of value and productivity created in the firm by the employees. Performance appraisal is based on the quality of work and labor productivity. Wages and salaries are paid in accordance with the typical wage level of the market. Employees participate in the decision-making process and this enhances the potential of their strategic value. According to a study by Tajeddini et al. (2020), the integration of HRM systems with effective people management can enable a more effective continuous service innovation.

The low ratio of innovation input data to output is another dominant characteristic of the market-oriented innovation mode, which is very valuable from economic and technological points of view. This is why production cost is low despite valuable final products. It can be argued that the use of high-productive labor, concentration on low-cost production, and the achievement of economically valuable outputs are indicators demonstrating the compatibility of productivity-based HR configuration and market-oriented innovation mode. These indicators have a high mean in the mentioned configuration and mode, which implies coordination.

The study by Pizarro et al. (2009) showed that the influence of uniqueness on the generation of innovation is stronger than that of strategic value to a large extent. It can be argued that innovation in

Iran's service sector is not considered as much valuable as it is expected. However, the higher levels of uniqueness in market-oriented innovations confirm that innovation is generated more in firms with market-oriented innovation compared with those with other modes. The comparison of the results with Hollenstein's (2003) results reveals that in Swiss firms, the index of uniqueness has higher values in science-based innovations followed by IT-oriented mode. Such a difference may imply a remarkable difference in the economic growth and development of both countries as well as differences in organizational investments and concentration on innovation modes. Iran and Switzerland ranked 63 and 2 in the world, respectively, in terms of the human development index in 2017, while the rank of Iran was 65 in 2019 and 70 in 2020, but Switzerland has kept its situation as the second country in the world during 4 years. Such a great gap can explain the difference between the results (United Nations Development Program, 2019, 2020). In their study on the innovation of 13 countries, Srholec and Verspagen (2012) revealed that innovation modes differ from one country to another depending on the differences between countries and regions and as well as sectors. Likewise, Corrocher et al. (2009) showed that innovation modes are inevitably affected by country and region. A comparative study of Swiss and Greek contexts revealed that there is a notable difference between the two countries regarding the human capital role in innovation. While in Greece, human capital does not have any impact on innovation, in Switzerland, it positively affects R&D activity and product innovation (Arvanitis et al., 2016). Recently, Diebolt and Hipee (2022), using a large new dataset on regional human capital and other factors in the 19th and 20th centuries in Europe, showed that human capital is a significant determinant of current regional innovation and economic disparities.

Our research outcomes offer some practical guidelines. This research results can assist business owners and managers as well as public administration in the implementation of public policies to stimulate and encourage the growth of innovation in the services. Since the market-oriented innovation mode is the highest-frequent mode among the group of modes, the nature of innovation in this mode is incremental, and networking and using external knowledge sources in this mode is rather weak. Therefore, Iranian knowledge-based service policymakers can direct firms to radical innovation by provision of guidelines to them to foster this type of innovation by developing collaboration with external knowledge sources, as well as universities and research institutes. Previous studies highlight the increased importance of universities in fostering innovation processes (Baycan & Stough, 2013; Wixe et al., 2023). On the other hand, due to the scarcity of resources in SMEs, the government should engage in various support policies to the extent that service firms – according to their innovation mode – can implement the right policies regarding their human resources.

The results of this study will be helpful for HR managers of KBFs, too. We suggest they pay more attention to the compatibility of their HR configurations with innovation modes of KBFs. It seems that the Iranian KBFs have a long way ahead to achieve such a satisfactory level. According to the results, the strategic value mean of human capital is higher than the uniqueness mean in Iranian KBSFs, and the majority of KBFs have adopted commitment-based HR configuration followed by productivity HR configuration. Both are common in the high strategic value of human capital. The results of Pizarro et al. (2009) revealed that uniqueness plays a stronger role in innovation realization. Therefore, KBSFs are recommended to further concentrate on employing special, unique, skillful, and elite employees in their employment policies in order to succeed in achieving scientific innovations. It is necessary to find the best ways to draw upon the skills and knowledge of the workforce. In addition, we suggest these firms improve the capability of their workforce by using HR practices aimed at fostering employees' learning and autonomy at work. According to Capozza and Divella (2019), fostering employees' learning and autonomy appears more important than the educational attainment of workers. Furthermore, we suggest determining the status of Iranian KBSFs by considering innovation modes and HR configurations to create an identity for them. This will coordinate innovation and HRM strategies in every firm to improve performance management and gain competitive advantage.

Another result we found in this study was the heterogeneity in the adopted innovation modes and HR configurations by the firms that even worked in a homogeneous sector. Therefore, it is recommended to explore in future studies the innovation modes and HRM practices adopted by KBFs in a specific service sector to get the advantage of the similarity of firms in terms of working scope and to conduct studies on a more homogeneous set. This will show whether the results and modes are

similar or different in a homogeneous setting. This will be helpful for future comparative studies or meta-analyses.

One of the main limitations of this study was a lack of access to more knowledge-based service firms. Similar surveys in other countries show that the number of firms participating in these kinds of research is higher than 1000, but we only had access to firms located in Tehran. Examining more firms will definitely give better results. For future research, it would be useful to assess the impact of firm and client-specific human capital and client capital on innovation modes and alignment of HRM bundles with them in service firms.

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