

ORIGINAL ARTICLE



Enhancing Technological Innovation Capabilities: The Role of Human Capital in Iranian Sports Manufacturing Companies

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ABSTRACT

Background. To effectively response to environmental changes and gain a competitive advantage, sports manufacturing companies should invest in human capital. **Objectives.** The study aimed at examining the effects of human capital on technological innovation capabilities in Iranian sports manufacturing companies. **Methods.** Conducted applied research and the survey. Data were collected using standard questionnaires in human capital and technological innovation capabilities. The reliability of the questionnaires was 0.81 and 0.85, respectively. The study was conducted on 546 employees from 77 sports manufacturing companies. To evaluate the research hypotheses, structural equation modeling based on partial least-squares method was used. **Results.** The study results indicated a significant impact of brand associations on brand equity and brand citizenship behavior; human capital also had a significant impact on technological innovation capabilities. According to ranking results, the three main features of the human capital of sports manufacturing companies respectively were skills and expertise, knowledge, and experience. **Conclusion.** The main factors can significantly affect the development of human capital and technological innovation capabilities in Iranian sports manufacturing companies.

KEY WORDS: *Humans, Capital, Manufacturing and Industrial Facilities, Sports*

INTRODUCTION

The sport industry, as a type of industry with a set of activities related to the production and sale of sport products (1), plays an important role in the development of the national economy of different societies (2) and improves employment and health of the society (3). One of the infrastructures of the sport industry is the sports manufacturing companies, and their attention to the development of sport also leads to the economic prosperity of the country (2). Therefore, understanding the innovative capability of Iranian manufacturing companies was the main aim of the study, since such

companies are vital for the development of sport industry, the economy of the country, and, consequently, the improvement of the well-being and health of the society.

Technological innovation capabilities are a kind of resource and companies require to improve their current products and processes (4). Hence, technological innovation capabilities include product innovation, which refers to a series of correlated steps to create a distinct product, such as the development of a novel product or improvement of the current ones (5), while process innovation refers to new

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technologies, which facilitate the development of innovation capabilities and the empowerment of the company to select and use such new technologies strategically (6). Since it is difficult to protect companies by inventions and copyrights; it is necessary to create the capability of continuous innovation for manufacturing companies to deal with their competitors (7). One of the factors influencing the development of technological innovation capabilities is the level of human capital development in manufacturing companies (8).

Today, human capital is the most important capital of sports businesses. Human capital development is one of the effective ways to improve performance and productivity of sports manufacturing companies and an optimum manner to benefit from the capability of individuals and groups to achieve organizational goals, since human capital is an essential factor for all businesses (9). Conceptually, human capital refers to any value-creating conscious learning that leads to the flourishing of individual thought (10). Human capital emphasizes on the strategy of exploration of individuals' internal merits, which consists of several economic sources for firms (3) and today, the ability of managers to develop human capitals, mainly relies on the improvement of human capital, and deliberately use of human as the factors influencing the success of manufacturing businesses (9). Hence, human capital should be considered as a source at the firm level, which can lead to the acquisition of a sustainable competitive advantage for the firm (11, 12). On the other hand, in the current era, due to the highly competitive environment among firms and businesses, they face many challenges, including lack of financial resources, low productivity, awareness of the customers of competitive prices, the rise of prices of raw materials, government regulations, and labor costs (13, 14). As a result, one of the solutions to the challenges faced by firms is to pay more attention to human capital and its dimensions (15).

The study expanded the existing knowledge by experimentally examining a higher-order theoretical model and showed the relationship between the technological innovation capabilities and the human capital of sports manufacturing companies. Based on the employed approach, we are helping the Iranian sports industry literature and sports manufacturing firms in four ways.

First, the study provided a more complete understanding of technological innovation capabilities while previous researches focused on innovation or at least one or two of its dimensions in manufacturing companies. Previous researches examined the innovation capability as a dimension simultaneously or in its dimensions, including the capability innovation of process and the innovation capability of products (5, 16, 17). While in the present research, technological innovation capabilities are considered as a prerequisite; and companies with higher technological innovation capabilities are more capable in dimensions including services, products, resources, processes, and research and development. Second, given the intense competitive environment in sports, the manufacturing of sports products is different from other products in terms of quality and performance and more attentions should be paid to the improvement of such products in terms of research and development since sport products should have the highest quality regarding biomechanics and performance. Therefore, the current research aimed at examining the dimensions of technological innovation capabilities based on the characteristics of such companies. Third, a conceptual model of human capital should be experimentally examined as a higher order structure in the five first-order factors: 1) knowledge; 2) ability and creativity; 3) experience; 4) skill and expertise; and 5) leadership and motivation; while previous researches focused on narrower dimensions of human capital; for example, Wayne & Selce focused only on the effect of staff training on small business marketing (18). It seems to be a controversy, because the experience of business owners is considered as the main factor in innovation arena. Fourth, according to the importance of sports manufacturing companies and their effective role in health, economics, and gross national product (GDP), paying more attention and prioritizing the human capital dimensions in such companies seems necessary. So that the Nike Sportswear manufacturing company with a gross reproduction rate of US \$34.350 billion in 2017 stood at the top of 103 countries in terms of GNP (19). Hence, the current study aimed at examining the technological innovation capabilities and human capital dimensions in this field. Therefore, in particular, the research model may enable the

owners of Iranian sports manufacturing companies to identify the technological innovation and human capital capabilities of such companies.

Theoretical Framework. Empirical evidence also supports the positive role of human capital and innovation (20-23). According to endogenous growth theory by Nelson and Phelps (1966), training managers and employees (e.g., primary, secondary, third) accelerates generation and dissemination of innovation (24). Also, human capital, which is developed through experiences of people, can improve innovation in the sport business (25), and when the experiences are integrated into knowledge, it creates a learning process, which discovers new insight and provides new opportunities (7).

Wadhwa in a research on the role of human capital and social managers in the technological innovation of small businesses showed that managers with higher human capital; i.e., social capital, experience, and knowledge, more invested in technological innovations. Despite this evidence, more research should be performed on the following two areas (26): first, Devine and Selce focused only on the effect of staff training in the innovative marketing of small firms. This seems to be a controversy, because the experience of business executives and employees is considered as the main factors in the innovation (18). Second, the study by Herman et al., focused only on product innovation (27).

In this regard, more attention should be paid on the innovation capability of firms in more comprehensive dimensions including process, services, products, and human capital in a larger sample of other industries such as sports. This formed the basis of the following hypothesis: The first hypothesis. Human capital significantly

contributes to the innovation capability of Iranian sports manufacturing companies.

A review of the literature showed that paying more attention to the capabilities of human capital and its role in the development of firms attracted the attention of many researchers and policymakers in recent decades (28-30).

They showed that human capital often includes structures such as knowledge, skills, abilities, experience, and motivation that support individual level analysis (10); in this regard, Jahanian in a study showed that the development of human capitals standards in marine educational institutions were: the commitment of organization to support human capitals, encouraging human capitals to improve performance, institutions commitment to ensure the equality of human capitals, providing opportunity to set clear objectives to develop human capitals, supporting the development of human capitals in the institution by managers, and continuous training of human capitals in the institution (31). Also, Vidotto et al., showed in their research that dimensions effective on human capital were leadership and motivation, satisfaction, and creativity of employees (32), and ultimately Naderi et al., in a research on the relationship between dimensions of human capital and organizational performance, showed a positive and significant correlation of human capital and its components, knowledge and expertise with profits, sales, income, and customer satisfaction (10). Given the importance of each influential structure on human capital, the second hypothesis of the research was as follows:

Second hypothesis. There is a significant difference between the dimensions of human capital in Iranian sports manufacturing companies. Based on research hypotheses, the research model is depicted in Figure 1.

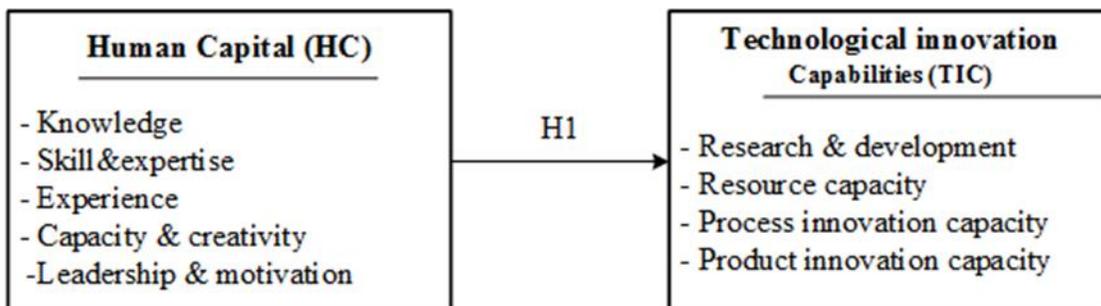


Figure 1. The Conceptual Model of the Role of Human Capital in the Technological Innovation Capabilities

MATERIALS AND METHODS

The present study was conducted according to the objectives using questionnaires. The data were collected from 8711 managers and employees of 77 moderate and large sports manufacturing companies in Iran. To select these companies out of more than 900 Iranian sports manufacturing businesses, the information of Iranian National Tax Administration, Iran's Company Registration Office, and Iran's Information and Service Database (Faaltarin.com)- the largest online database, as well as firm size criteria (firms with less than 50 individuals as small, 50 to 100 as moderate, and above 100 individuals as large), and the activity history of active companies according to experts' opinion, in two sectors of sportswear and equipment, from 2018 to 2019, with least five years of work experience and popular brand were used. Since the sample size was calculated 368 according to the Krejci and Morgan table, 770 questionnaires were distributed and finally 546 questionnaires (response rate of 68%) from 77 companies were entered into data analysis. In the current study, human capital was measured by the questionnaire developed by Naderi et al. (10), Bontis (33) and Jogaratnam (11), with five dimensions: 1) knowledge, 2) skill and expertise, 3) experience, 4) ability and creativity, 5) leadership and motivation. Finally, Liu & Jiang (34) and Camisón & Villar-López (35) developed the questionnaire used to measure technological innovation capabilities with four dimensions: 1) research and development, 2) resources, 3)

innovation of processes, and 4) product innovation. The validity of the questionnaire was verified by 10 experts in sports management. Also, the reliability of the questionnaires was 0.81 and 0.85 using Cronbach's alpha coefficient. In the current study, structural equation modeling technique was used to provide a model using PLS and SPSS version 22.

RESULTS

The demographic details of the samples showed that 48% of the studied firms were moderate and 52% large. According to the activity filed of the company, 53% were active in the sportswear sector and 53% in sports equipment. Also, based on the year of the activity, most firms (31%) had more than 15 years experiences and only 18% had 5-8 years experiences; eventually the majority of the samples were employees (81%) and only 19% were managers. Demographic information of the samples is presented in Table 1.

Figure 2 illustrates the human capital role model in technological innovation capabilities in a meaningful state by means of t-value coefficients. It tests all the measurement equations (factor loads) and standard coefficients using t-statistics.

The results showed that all variables and dimensions on the basis of significance and coefficients of T obtained, had an effective role in their structure, also the results obtained from the amount of human capital's role on technological innovation capabilities was 473.8 which was significant at 0.001.

Table 1. Demographic Characteristics of the Study Participants

Content	Frequency	Percentage (%)
Company size		
Median	37	48
Large	40	52
Number of staff		
50-99	37	48
100-149	24	31
150-199	12	16
More than 200	4	5
Organizational Level		
Manager	104	19
Staff	442	81
History of activity, yr		
5-8	14	18
9-11	21	27
11-15	18	24
More than 15	24	31
Field of activity		
Sportswear	41	53
Sports equipment	36	47

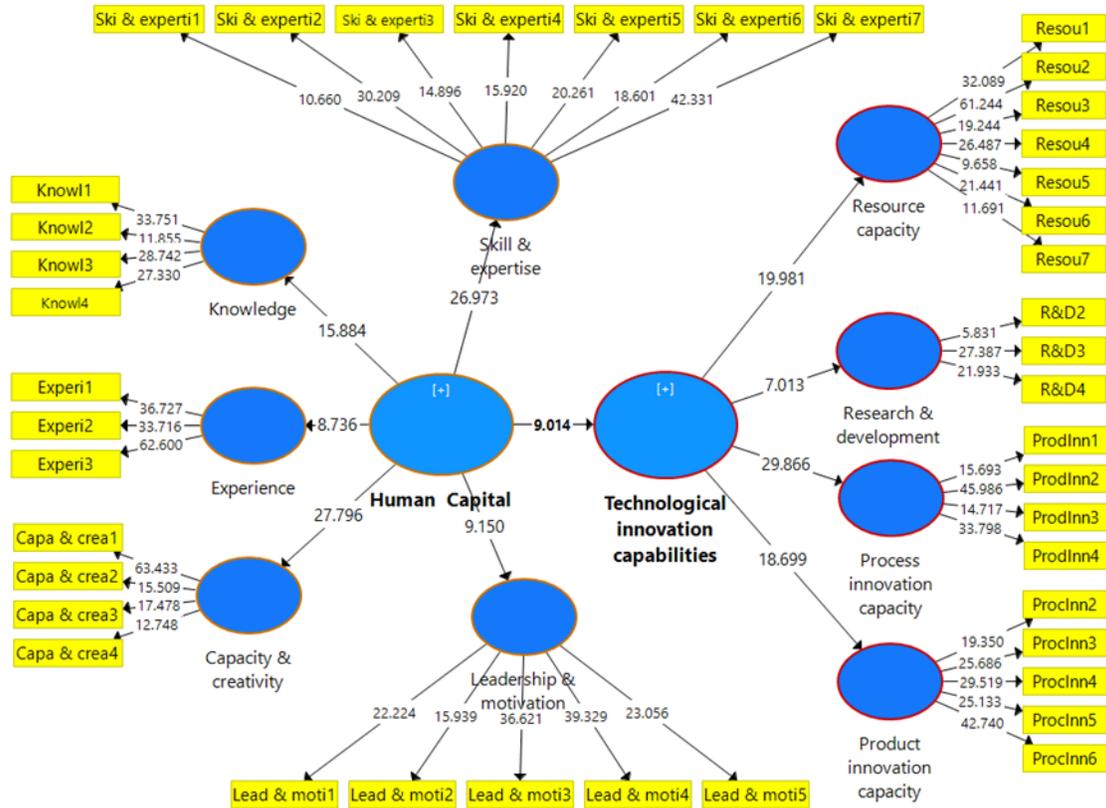


Figure 2. Research Model of the Role of Human Capital in the Technological Innovation Capabilities in a Meaningful State

Table 2. Model fit Indices

Component	Cronbach's α	Composite Reliability α	Average Variance Extracted α	R ²
Human capital				
Knowledge	0.917	0.942	0.801	0.695
Skill and expertise	0.931	0.944	0.708	0.772
Experience	0.917	0.947	0.857	0.591
Capacity and creativity	0.877	0.916	0.733	0.781
Leadership and motivation	0.934	0.950	0.791	0.559
Technological innovation capabilities				
Research and development capacity	0.761	0.864	0.682	0.401
Resource capacity	0.938	0.950	0.733	0.753
Process innovation capacity	0.928	0.946	0.777	0.726
Product innovation capacity	0.890	0.924	0.754	0.754

Model Fit Assessment. Before the partial fit model, the general fit of the conceptual model is dealt with. The PLS model provides the fitting of measurement models, average variance extracted (AVE), and composite reliability (CR), and reports the R² index (coefficient of determination) is reported as a criterion for fitting of structural models. Values greater than 4.0 for the value of extracted variance average (36) and more than 0.7 for Composite Reliability (37) represent the good fit for the measurement models and Chin (1998) (38) reported values of 0.19, 0.33, and 0.67 as weak, moderate, and good values for the amount R².

According to Table 2, the values of composite reliability and extracted variance average for the

hidden variables of the model were good. Also, the R² index is calculated and reported only for the hidden variables of the model (the hidden variable plays the role of the dependent variable in the model), where dependent variables of the main conceptual model are reported; the findings indicate that the model has a good fit.

Based on the results shown in Table 3, for all human capital variables and technological innovation capabilities, all indices had a significant weight and a significant load at a confidence interval of 99%. Figure 3 shows the indices and questions related to the technological and human capital capabilities; all had a factor load of > 0.7, which played a significant role in their structures. Also, human capital had a

significant effect on the technological innovation capabilities (0.72). According to the results of Table 4, human capital had a significant effect on

the technological innovation capabilities in Iranian manufacturing companies.

Table 3. Estimated Factor Loads and Their Level of Significance

Variable	Factor Load	t	p
Human capital			
Skill and expertise	0.879	27.393	0.001
Knowledge	0.834	15.556	0.001
Experience	0.769	8.540	0.001
Capacity and creativity	0.884	28.701	0.001
Leadership and motivation	0.748	9.751	0.001
Technological innovation capabilities			
Research and development capacity	0.634	6.926	0.001
Resource capacity	0.868	22.556	0.001
Process innovation capacity	0.852	17.577	0.001
Product innovation capacity	0.868	27.686	0.001

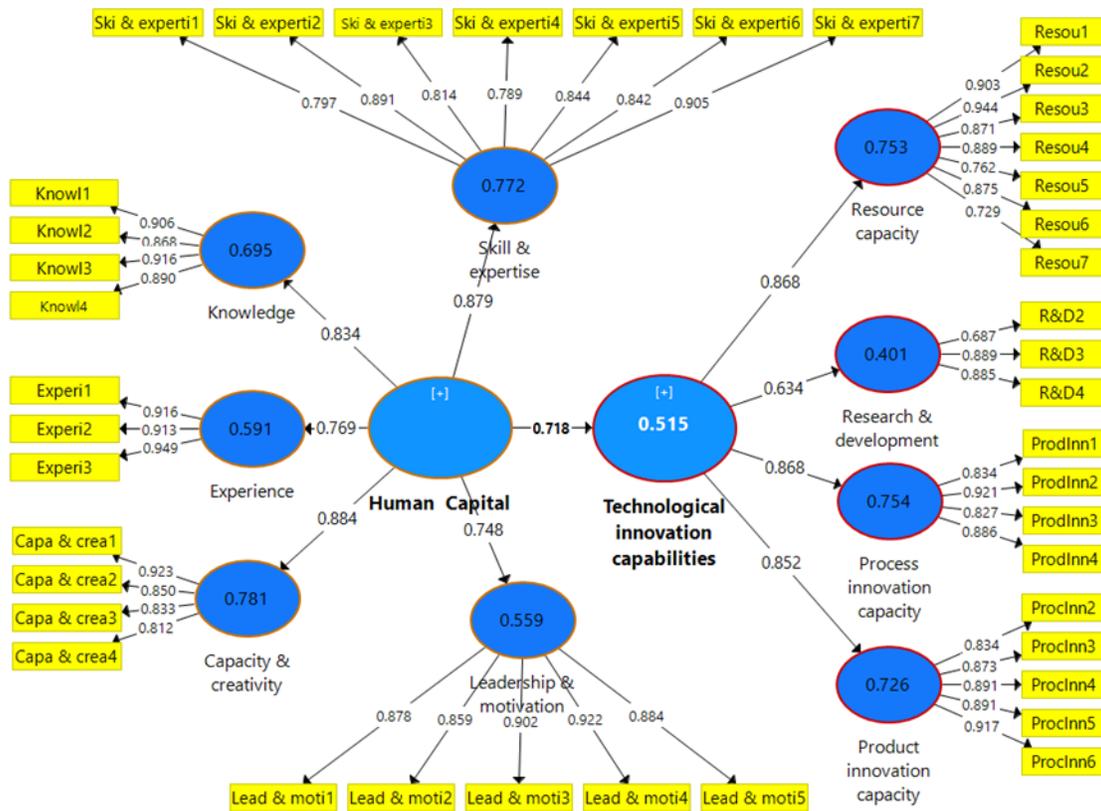


Figure 3. Research Model of the Role of Human Capital on the Technological Innovation Capabilities in the State of Standard Coefficients and Factor Load

Table 4. Direct Effects, t-Statistic and Result of the Effect of Research Variables

Variable	β	t	P	Result
Human capital technological innovation capabilities	0.718	8.473	< 0.001	Accept

Table 5. Prioritization of the Dimensions of Human Capital Development in Iranian Sports Manufacturing Companies

Component	Factor Load	Mean Rank	Rank
Knowledge	0.834	3.03	3
Skill and expertise	0.879	3.41	1
Experience	0.769	2.53	5
Capacity and creativity	0.884	2.97	4
Leadership and motivation	0.748	3.07	2

The researcher used the Friedman statistical test to rank the effective dimensions on human

capital development; the results of the Chi-square test were significant as a prerequisite for

Friedman test ($P < 0.05$) ($X^2 = 17.138$), degree of freedom ($df = 4$, $P = 0.020$); therefore, there was a significant difference between the mean of factors and the Friedman test to prioritize the components of the research. Prioritization of the main components of the research showed that skill and expertise, leadership and motivation, knowledge, creativity and capability, and experience of human capitals had the highest priority, respectively (Table 5).

DISCUSSION

Considering the importance of human capitals in sports manufacturing companies and their undeniable effect on the promotion and success of the firms, the present study aimed at analyzing the dimensions affecting human capital development and their role on technological innovation capabilities in Iranian sports manufacturing companies. To achieve this, the role of human capital was determined on the technological innovation capabilities and then, the dimensions of human capital were prioritized. The results showed that human capital had a direct and positive effect on the technological innovation capabilities of Iranian sports manufacturing companies ($\beta = 0.435$, $t = 3.232$, $P < 0.01$). This result was consistent with those of McQuirk et al. (8), Wadhwa (20), and Oliveira et al. (23). Wadhwa showed that managers with higher human capital, i.e., experience, knowledge, and social capital, focused and invested more in technological innovation (26). Therefore, managers and staff with higher levels of education and experience have more knowledge and skills, which increases the capability of their resources.

In a sports manufacturing company, managers with higher education, knowledge, and experience are more able to understand and evaluate new information and distinguish between promising and useless ideas. It enables managers to apply their skills, expertise, knowledge, experiences, and creativities to develop the capability of product innovation, resources, and process. So, new production methods can be used faster to create new ideas, which may lead to the development of technological innovation capabilities in sports manufacturing companies.

Also, the results of the current study showed that among the dimensions of human capital development, the skill and expertise of human capitals, leadership and motivation, and

knowledge of human capital have the highest priority over others. Accordingly, the role of people's skill and expertise in human capital development was more remarkable in sports manufacturing companies, and the result of the research was consistent with those of Naderi et al. (10), Yen (39), Nasehifar et al. (9), Engström et al. (40), and Vidotto et al. (32). Naderi et al., in a research on the relationship between human capital dimensions and organizational performance showed that among the dimensions of human capital, knowledge and expertise as well as skill has a positive and significant relationship with productivity, sales, income, etc. Since the relative superiority of professional skills over other dimensions is considered by the profession and job and expertise is the absolute superiority of the individual in carrying out his work and activities related to his field of expertise (10), having skill and expertise is a factor in the development of human capital. The skills and expertise as a dimension of human capital, bring unique knowledge to individuals, which is achieved only through the intangible information of the firm.

This involves the staff's privileged skills in providing solutions for specific issues of the firm, and it helps them to use more unique operational practices that play an important role in the development of human capital of Iranian sports manufacturing firms.

The second factor that played a significant role in the development of human capital in sports manufacturing companies was the leadership and motivation, which was consistent with those of Naderi et al. (10) and Vidotto et al. (32).

Vidotto et al., also showed that the more influential dimensions were leadership and motivation, and satisfaction and creativity of the staff. Therefore, having a firm with motivated managers and employees and using individuals with leadership skills may contribute to the development of human capital (32). Thus, by providing financial and non-financial incentives and creating equal opportunities for the promotion of employees, all the staffing capabilities can be used, which may lead to the development of human capital in sports manufacturing companies. Finally, the third factor that contributed to the development of human capital in Iranian sports manufacturing companies was the knowledge. This finding was consistent with those of Marimuthu et al. (41),

Vidotto et al. (32), Naderi et al. (10), and Nasehifar et al. (9).

Nasehifar et al., identified the components of human capitals development in small and moderate organizations, and showed that three dimensions of behavior, structure, and background have a significant role in the development of human capitals in small and moderate organizations. In the structural dimension, they showed that the discovery and attracting highly educated human capitals and training them were important in the development of human capitals (9). Also, Adralin considered education as an effective factor in career progression, and gave more importance to technical education than behavioral education (42). Also, Naderi et al., in their research, considered knowledge as a dimension of human capital. Therefore, since the knowledge of human capitals means familiarity, remembering, understanding, and systematic awareness (appropriate to the questions of what is it, why is it, and how is it), and includes everything that the individuals of the organizations know about the processes, products and services, market customers and competitors (10), if the human capitals benefits from it, then it is considered as an effective factor in the development of human capital. So that higher education enables business owners to successfully manage the firms, identify the appropriate market, and be more prepared to provide practical foreign financing programs that are effective for economic growth (7, 43).

Considering the position and importance of Iranian sports manufacturing companies in the development of sport in Iran, and owing to the necessity and importance of studying sports manufacturing issues, authors should pay more

attention to the following suggestions in future studies. In the current study, the dimensions of human capital development were discussed in five dimensions. Further research should be considered on other dimensions such as culture, politics, and human capital development barriers. On the other hand, since the study was conducted on moderate and large sports manufacturing companies, other authors may perform similar studies on small manufacturing businesses as well as other sport-related businesses such as services. In general, the study focused only on human capital dimensions of technological innovation capabilities; other studies can examine the role of these dimensions in other variables, such as market orientation and performance in Iranian sports manufacturing companies.

APPLICABLE REMARKS

- Considering the results of the current research and the importance of each dimension of human capital and influencing factors, it is recommended that the managers and owners of Iran's sports manufacturing companies create a knowledge management system, a database of experienced individuals of the firm, and discover, attract, and train the staff, support employees to develop new ideas, and determine the path of career improvement for employees.
- It is also suggested that, based on the dimensions of technological innovation capabilities found in the present study, the managers of Iranian sports manufacturing companies should work on their research and development departments to, along with upgrading innovative products, observe the daily improvement of the sports manufacturing companies of Iran.

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