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The Pattern Design of Research Commercialization in Sport Physiology

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ABSTRACT

The aim of this study was to develop a pattern of research commercialization in sport physiology research. Regarding the purpose of the study, it's an applied research conducted using both descriptive and analytical methods. The population consisted of all 1150 faculty members and doctoral students of sport physiology in public and private universities across the country. 261 participants participated in this study as the sample. To collect data, a questionnaire constructed by the researcher was used consisting of 51 questions. To determine the content and face validity, the questionnaire was sent to 20 professors of sport physiology who had the experience of commercialization and they confirmed it. Reliability using Cronbach's alpha coefficient in a preliminary study was 0.784 that was acceptable. Results showed six factors related to the commercialization of sport physiology research: financial and administrative infrastructure, researcher's capabilities, the educational system, research and interactive strategies, personality and culture, and information network.

Keywords*: Pattern design***,** *Research Commercialization, Sport physiology*

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INTRODUCTION

Today, science is a mean to develop countries and it is not merely expanding the boundaries of knowledge as it was in the past. In other words, developed countries are seeking knowledge that can provide economic benefits for them. The importance of knowledge transfers and use of research results in advanced countries and developing countries is well understood (Sidiqi et al., 2007).

In the past, scientists and researchers refused to commercialize research. This situation has changed due to pressure on universities to take part in economic development and opportunities to earn wealth (Etzkowitz, 2003). The research findings play an important role in improving the quality of life and developing the welfare of society. However, these findings are not important as long as they are not practical and available to applicants, and a lot of expenses spent on research and knowledge production are not compensated. Low-income countries due to lack of resources faced many challenges in making knowledge practical (Santesso & Tugwell, 2006). In response to these conditions and in order to achieve more revenue and sources, universities turned to commercialization and considered income-generating activities as important parts of their strategic plan (Bok, 2003). Academics adopt two approaches in order to fill the gap between production and application of research results: first, the traditional approach of the research that they followed the publication of their results. Second is an entrepreneurial approach that they seek commercialization of the results (Etzkowitz, 1998). The purpose of commercializing is transferring an idea, method, object, skill, technical knowledge, intellectual property, discovery, or invention resulted from scientific research conducted in the university sector to an industrial environment where it can lead to development or improvement of products or processes. It also includes all the methods that can help transferring the technology produced by the university to industry, such as granting patents, joint ventures, and so on (Rasmussen et al., 2006). Galushko and Sagynbekov (2014) stated that various research projects should strengthen the relationship between industry and academia and assist commercialization process. Wu et al. (2015) conducted a unique study through university patent license and stated that there are individual and organizational factors in the commercialization of a patented invention. Dastoom et al. (2013) examined the interaction between academic environment and sports industry in Iran, and stated that there is no appropriate unit in both parts to deal adequately with each other. They also showed in their study that instructor classes, research projects, seminars and conferences, workshops, instructor and faculty working in both sectors, internship-entrepreneurship, and publication as the most important areas of cooperation between the two environments were high in number but might not have quality. Generally, they stated that the lack of interaction between the academic environment and the executive part of sport is due to several structural and planning reasons.

It should be considered that until the results are not employed in public practice, practically, there will not be any profits resulting from research for university or community. Strategies

used in transferring scientific findings and applying them have not achieved much success and this shows that the conversion of research findings to application and usage is complicated and requires various factors such as the powerful intellectual, creativity, skills, knowledge and diligence at the organizational level (Kitson et al., 1996). Targeting in the fields of science and technology as well as developing comprehensive scientific map, creating financial funds supporting research and innovation, approval and issuance of patents scheme, approving a bill for knowledge-based companies, establishing National Elite Foundation, financial and legal support of the innovators and approving the regulation of commercialization, suggest that the importance of science and technology in national development has been perceived and should be expanded. The mismatch between academic activities and society needs and lack of familiarity of researchers and practitioners with commercial activity, cause for the failure of most researches in the commercialization process. This shows a need for further study research.

METHODOLOGY

This study is an applied research that was conducted through a descriptive-analytical method. The population consisted of all 1150 faculty members and doctoral students of sport physiology in public and private universities across the country. Since factor analysis was used in this study, the sample size was determined based on this method. Habibpour and Safari (2009) pointed to a rate of 5 participant's respondent per 1 variable. Since the numbers of questions were 50, sample size should be 250 people. Data collection was performed in the form of library studies and questionnaire. The researcher performed extensive literature survey and literature review constructed a questionnaire with two demographic parts consisting of 7 items and a business part including 51 items. To determine the content and face validity, the questionnaire was sent to 20 professors of sport physiology who had the experience of commercialization and in this field. There are also many problems in sports organizations and sports centers working in various sport sectors that need to do research in this field. In Iran, there is not an appropriate interaction between academic environments and the executive branch of sport due to a variety of structural and programming reasons (Dastoom et al., 2013). On the other hand, in the School of Sport Sciences a lot of researches are conducted each year particularly in the field of sports physiology. These researches, however, do not actually help to meet the needs of the community in relation to sports. Furthermore, they do not provide any benefit for faculty of physical education. There is no study in the field of sports sciences especially sport physiology research so far that has examined the factors that transfer results to the community and has profited physical education colleges. Therefore, the present study seeks to develop a pattern of research commercialization in sport physiology

in a preliminary study was 0.784 that was acceptable. Regarding the possibility that some participants might not participate in the study, the researchers randomly sent the questionnaire to 320 members of the research community. 261 questionnaires were answered. To analyze the data, the researcher employed descriptive and inferential methods including Kolmogorov-Smirnov, and exploratory and confirmatory factor analysis using SPSS and AMOS software. As you can see, the results in Figure 1 and Table 1 indicate that questions related to the commercialization have high loading factors and the fitting indicators are respectable. Then 6 factors related to commercialization were identified using exploratory factor analysis using SPSS version 21. They are in this order: Administrative and Financial Infrastructure (10 item), Researcher Capabilities (8 item), Educational System (3 item), Research and Interactive Strategies (5 item), Personality and Culture (3 item) and Information Network (3 item). The rest of the questions were excluded since they didn't have high loading factors.

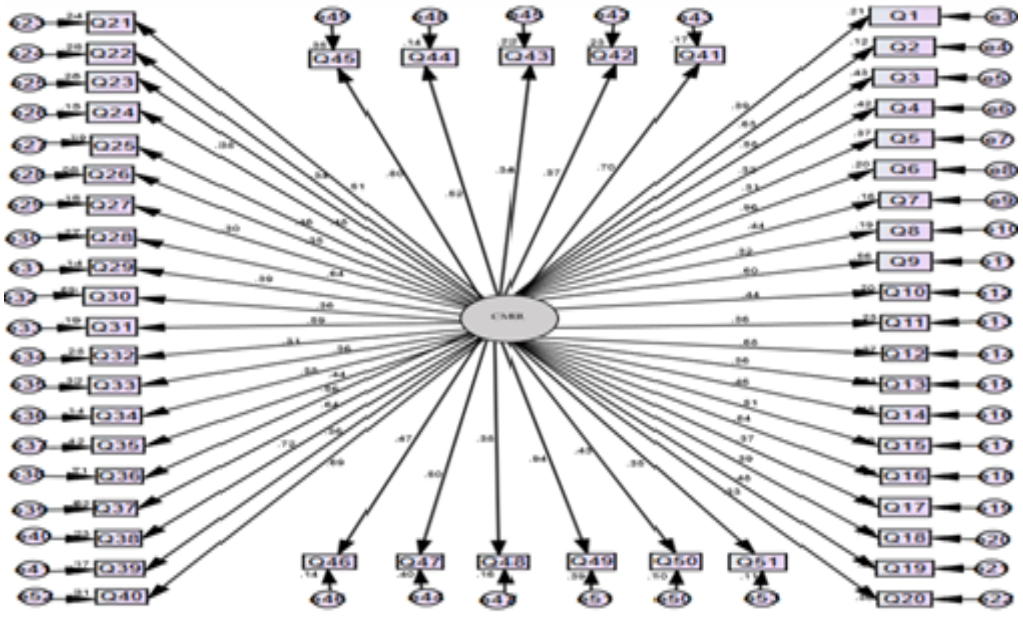

Figure 1. Confirmatory Factor Analysis

Table 1. Fitting indicators

	X^2 / df	RMSEA	GFI	NFI	CFI
Commercialization (CMR)	0.931	0.082	0.92	0.97	0.94

Results

Table 2. Descriptive Statistics

Gender	**Female**	**76**	**Commercialization Method**	**Publication of scientific books**	**49**
	Male	185		Transferring research results	13
Academic Rank	PhD student	145		Conducting joint research with organizations	54
	Educator	23		Forming university distributary companies	0
	Assistant Professor	76			
	Associate Professor	15			
	Professor	2			
Commercialization Experience	Yes	116			
	No	145			

The samples were 185 males and 76 females. 145 doctoral candidates had the highest number of participants. In addition, 116 of the total participants had an experience of commercializing of their researches. Conducting joint research with organizations 54 and publishing scientific books with 49 had the highest number in commercialization methods (Table.2).

To investigate the normal distribution of data, the researcher used K-S test and according to the results, the data was normal. Cronbach's alpha was used to investigate the factor's internal consistency. Consistent with the results of Table 3, "The Researcher's Ability" (α= 0.86) had the maximum amount of alpha and "Information Network" (α= 0.75) had the least amount of alpha.

Table 3. Cronbach's Alpha values of Factors

factor	Number of questions	k-s	Cronbach's Alpha
Researcher Capabilities	8	0.11	0.86
Research and Interactive Strategies	5	0.23	0.81
Administrative and Financial Infrastructure	10	0.18	0.79
Personality and Culture	3	0.46	0.77
Educational System	3	0.54	0.77
Information Network	3	0.15	0.75

To conduct confirmatory factor analysis of the questionnaire, AMOS software was used, and the obtained results are shown in Table 4.

Table 4. Confirmatory Factor Analysis

Items	Numbers of Questions	Questions	Load Factor	T Value
Researcher Capabilities	4	Researcher's comprehensive knowledge of exercise science	0.88	1
	8	Identifying and articulate athlete physiological problems	0.79	4.876

	5	Conducting applied research in exercise science	0.70	4.307
	2	Having comprehensive and up to date knowledge in nutrition and food supplements	0.63	4.227
	3	Conducting applied research in relation to nutrition	0.51	3.996
	6	Comprehensive knowledge in wellness and health activities	0.44	3.790
	1	Familiarity to up to date tools and equipment	0.37	3.516
	9	Sports activities experience	0.32	3.411
Research and Interactive Strategies	14	Selection of topics based on sports community needs	0.66	1
	16	Conducting applied research and speed in presentation	0.62	4.149
	38	Receiving capacity in organizations	0.53	3.992
	36	Proper interaction and communication between colleges	0.36	3.503
	13	Increasing of faculty members	0.35	3.496
Administrative and Financial Infrastructure	17	Allocation of resources	0.83	1
	24	Provide appropriate banking facilities	0.80	4.989
	23	Support and financing	0.77	4.791
	42	Supportive policies	0.71	4.644
	22	Developing a favorable investment pattern	0.65	4.312
	27	Knowledge-based sports	0.54	4.034
	40	Transparent policy	0.47	3.852
	20	Attracting academic staff	0.41	3.713
	25	Formation of academic companies	0.36	3.564
	41	Officials' commitment	0.31	3.451
Educational System	45	Alignment of education and research	0.94	1
	47	Applied courses content	0.52	4.007
	44	Production of new science	0.48	3.891
Personality and Culture	31	Researchers' efforts in solving problems	0.49	1
	29	Researcher's risk taking ability	0.46	3.829
	32	Promotion of commercialization culture in faculties	0.34	3.458
Information Network	48	Information networks Ideas	0.78	1
	50	Holding shared conferences	0.32	3.456
	49	Extension of access to information resources	0.35	3.554

The results of factor analysis in Table 4 show that all of factors' parameters have satisfactory T amount and acceptable level of factor loadings with error level < 0.05, and they are appropriate indicators to measure these components. The relationship between the factors is shown in Table 5.

Table 5. The Correlation Between Commercialization factors

Items		**Researcher Capabilities**	**Research and Interactive Strategies**	**Administrative and Financial Infrastructure**	**Personality and Culture**	**Educational System**	**Information Network**
Researcher Capabilities	Load Factor		0.869	0.671	0.873	0.493	0.547
	T Value		6.564	4.931	4.237	5.046	4.768
Research and Interactive Strategies	Load Factor			0.485	0.692	0.594	0.385
	T Value			3.989	3.472	5.183	3.139
Administrative and Financial Infrastructure	Load Factor				0.653	0.745	0.754
	T Value				3.178	4.841	4.902
	Load Factor					0.562	0.621

Personality and Culture	T Value					4.422	3.293
Educational System	Load Factor						0.442
	T Value						4.647
Information Network	Load Factor						
	T Value						

As you can see in Table 5, based on the factor loading and T value, there is a significant relationship between all the factors. Based on the relationship and T value, 6 components with commercialization concept listed in Table 6 and Figure 2, It is clear that all the relations in the relationship between each component and commercialization is acceptable.

Table 6. Standardized Regression Coefficients in the Model of Commercialization

Items	Concept	Estimate	S.E.	C.R.
Administrative and Financial Infrastructure	commercialization	0.88	0.341	5.687
Researcher Capabilities		0.79	0.386	5.127
Educational System		0.65	0.359	4.891
Research and Interactive Strategies		0.62	0.303	4.888
Personality and Culture		0.57	0.275	4.516
Information Network		0.48	1	1

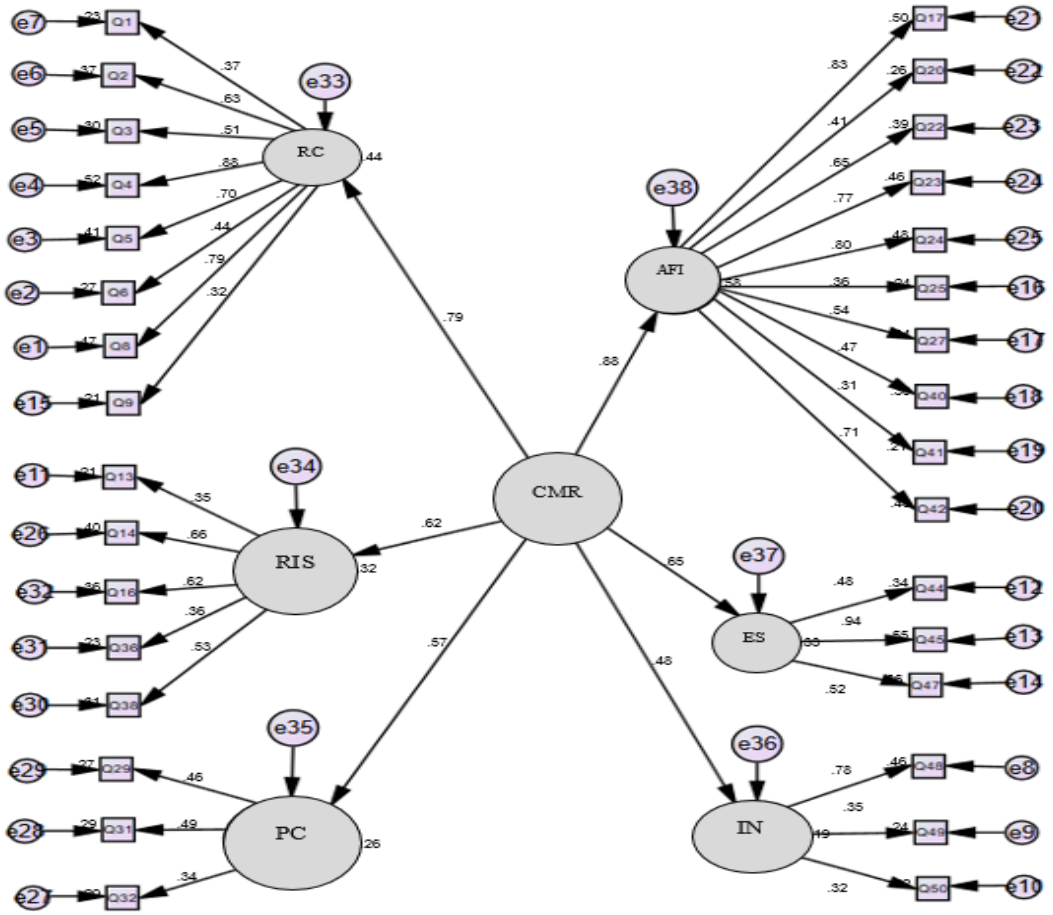

Figure 2. Loading Factors Between Factors and commercialization

As you can see in Figure 2, "The Administrative and Financial Infrastructure" and "The Researcher's Ability" are the most relevant factors to commercialization. "Personality and Culture" and "Information Network" are the least relevant factors to commercialization. In the fitness test, the dataset fitness has been analyzed and according to Table 7, The obtained model was confirmed.

Table 7. Indicator's Fitness Model

	X^2 / df	RMSEA	GFI	NFI	CFI
Commercialization (CMR)	0.952	0.081	0.91	0.96	0.93

DISCUSSION

The aim of this study was to analyze factors influencing commercialization of sport physiology research. The results showed six factors related to the commercialization of sport physiology research: financial and administrative infrastructure, researcher's capabilities, education system, research and interactive strategies, personality and culture, and information. Availability of proper infrastructure is one of the main factors in the commercialization of research results. In this study, infrastructure factor includes equipment and resources, organizational structure, finance and policies, and rules. To provide a product or service, materials and equipment to produce it are needed. Since research is presented as a product of the university to society, raw materials and equipment are needed to produce it. This is referred to as infrastructure factor. All the participants in this study are somehow doing research work, so they have fully understood the need to infrastructure. Therefore, they consider this factor as the most important factor in commercialization. Physical Education Organization in the manual of scientific and research development, the detailed document of physical education and sport development system, has cataloged the weaknesses of research in physical education and sports development in the country. The shortage of skilled manpower for research in sports and lack of facilities and study are of these weaknesses. So equipment's and resources are important factors in commercializing of the research as referred to in this study. Policies are factors that are considered in many studies (Cao et al., 2013, Perkmann et al., 2013). Commercial policies have been developed in developed countries, but developing countries are still faced with problems in policies. As Etzkowitz et al. (2000) points out in their study that the government of the U.S pays all the costs for the commercialization of research to the final stage and researchers have no problems in this respect. After commercialization, all the profit also goes to the research.

Other factors play a key role in commercializing of research results, but success will only come if the researchers have the ability to perform a high quality research. Most of researches in the field of sport physiology are performed in laboratory and semi-laboratory method and it requires the ability to perform these kinds of research projects. While all the infrastructure of research is provided, but the researcher does not have the ability to conduct an applied research and to use equipment and facilities, no success in commercialization will be achieved. Perkmann et al. (2013) considered education as one of the institutional factors. They pointed out that in addition to financial output, commercialization needs to have educational output as well. It means that a successful commercialization, in addition to financial wealth, should provide scientific richness and the two should happen in line with each other. Educational system is an important factor in commercialization. Since this study was conducted in an academic environment and education has a special place in this environment, so it might indicate the reason for the importance of this factor and can be considered as the basis for research commercialization. Galushko and Sagynbekov (2014) in a proprietary study investigated the relationship between industry and academia. They stated that if universities seek to commercialize their researches, they need to have extensive and permanent communication with the industry. Although the results of this study show the importance of interactions in sport physiology research results, there is not an appropriate interaction between academia and sports executive branch (Dastoom et al., 2013). One of the factors that can be effective in the relationship between universities and sports organizations in the country is personal communication between researchers and executive activists of sports. Individual attitude and motivation are important factors in leading academic researchers to commercialize their research results that must be considered, recognized, fulfilled, and strengthened in different ways. University-industry cooperation can cause promotion in research, innovation, and technology through investment by the industry and finding faculty members and producing science by universities. The government through the creation of incentive structures can help to make this connection (Cao et al., 2009). The government can help to make this connection through the creation of incentive structures (Cao et al., 2009). Financial and scientific success is one of incentives that should be considered by the universities and colleges of physical education. Attitude of researchers are also factors affecting the commercialization that university and society culture can affect shaping them. In order to perform applied research, the university needs to have precise information of industry and sports society demands and direct the researches based on these demands. The industry and the country's sports community need to be aware of new accomplishments and findings in the field of sports physiology at universities and can easily access research findings of this field. This requires an information network that is suitable to help both industry and universities to be informed about each other's achievements and requirements. Graduates and researches are two of the products and services that university offers to society and in particular the sports community. So if they do not have the necessary quality and do not have the ability to present change and achievement, industry and sports community will not use them.

Proper respond of educational system of sports sciences to the needs of sports system is an important part of strategic planning and development of the country. Proper accountability of universities to the needs of sports organizations causes these organizations to be attracted to the universities and this is a major step in the commercialization of university research results. Researches, however, showed that the pattern of university and sports interaction has not been very successful and is commonly known as one of the main challenges in sports development of the country. Criticisms approach in the interaction pattern of university and sports is that universities should act in such a way that their researches should be applicable and solve the problems of sports in the country (Dastoom et al., 2013). As long as universities do not have the

ability to provide applied research, the country's sports community will be reluctant to use them. Therefore, university and researchers cannot benefit. Universities should reconsider educational and research strategies. Sports physiology research should be performed based on the needs of industry and the sports community so that has the necessary quality both in scientific and practical terms. Universities need to provide their own researchers with necessary resources and equipment to carry out applied research. They should attempt to attract people to the faculty who have sufficient expertise and capabilities in different trends and areas of sports physiology. Governments should provide the basis for scientific development through legislation, especially legislation to support the researchers and their research accomplishments (patent laws, the laws of intellectual property rights, etc.), as well as financial conditions so that encourage the private and the public sectors to invest in the process of performing academic research. Moreover, governments and universities should provide conditions that researchers are motivated to do and commercialize them researches. They need to create such conditions that the commercialization of research becomes part of culture of universities and sports sciences colleges.

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