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Research Article

A model for the educational needs of fisheries researchers in the field of developing fisheries entrepreneurship ecosystems: Based on quantitative and qualitative approaches

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Abstract

The main purpose of this research was to design a model that meets the educational needs of Iranian fisheries researchers in developing fisheries entrepreneurship ecosystems. In this research, educational needs were identified using a mixed research approach (qualitative-quantitative). In the first stage, semi-structured interviews and grounded theory were used to develop a model of fisheries researchers entrepreneurship education. The results indicated that casual conditions include coordination and communication challenges, applied research needed by the private sector, teaching general entrepreneurship skills, background conditions including the personal characteristics of researchers, the difficulties of carrying out organizational and research activities and financing challenges were intervening conditions. Supporting commercialization and establishing business acceleration centers, and presenting commercialization models as part of strategic conditions, promoting sustainable production and harvest, and recognizing the advantages of knowledge and income for researchers were identified as the positive effects of entrepreneurship education on Iranian fisheries researchers in the development of fisheries entrepreneurship ecosystems. In the quantitative section a questionnaire was compiled and given to a statistical sample which included researchers and faculty members of the Iranian Fisheries Science Research Institute, Sampling was done through Cochran's formula (n=135). The identification of educational need items was accomplished through the employment of confirmatory factor analysis. Educational needs were categorized into seven components consist of 1) management and planning of applied research projects, 2) startup and entrepreneurship, 3) communication, 4) teamwork and networking, 5) fisheries Innovation ecosystem, 6) extension activities, principles and 7) rules and commercialization.

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Introduction

The fisheries sector accounted for approximately 17% of the world's animal protein supply in 2021 (FAO, 2022). Sustainable management of fisheries resources depends on the management of human behavior (Fulton *et al*., 2011). Social research on fisheries can be thoroughly applied and practical in nature. Each of these case studies was commissioned by a stakeholder organization, for purposes specifically related to fisheries management (Barclay *et al.,* 2017). Many agricultural scholars have come to agree that agricultural entrepreneurship (agribusiness) holds remarkable potential to foster economic development by generating both direct and indirect employment for the local populace and contributing to food security and nutrition (Bairwa *et al*., 2014; Mujuru, 2014). Dias *et al*. (2019) reviewed the studies related to agricultural entrepreneurship and showed that: from 1969-2012, most of the entrepreneurship research was found in entrepreneurial skills, sources of income and market and resources. But in the years 2013-2019, entrepreneurial behavior and skills and entrepreneurial strategies were taken into consideration. The development of entrepreneurial skills occurs through training and education. Entrepreneurship education is viewed as a valuable tool for enhancing the economic impact of entrepreneurs on global prosperity and development (Padi *et al.,* 2022). Entrepreneurship education seeks to provide people with knowledge, skills, and motivation to encourage entrepreneurial success (Onweh *et al.,* 2022). A study by Boahemaah *et al*. (2020) showed that individual factors (attitude towards behavior, entrepreneurial motivation, entrepreneurial resource, and perceived behavioral control) and entrepreneurship education have a positive direct effect on entrepreneurial intentions among undergraduate students. Finally, entrepreneurship education moderates the effects of individual factors on entrepreneurial intentions among undergraduate students in a positive direction. Entrepreneurial ecosystem is a new direction in entrepreneurial research that brings ecological thought into human socio-economic. Also, Li *et al.* (2023) study revealed that college students develop entrepreneurial competence through participation in entrepreneurship competitions, unlike students who only receive regular entrepreneurship education. Entrepreneurial ecosystem research includes the dual fields of environmentally sustainable development and entrepreneurial management (Kang *et al.,* 2021). Spigel and Harrison (2018) believed that entrepreneurial ecosystems represent the types of cultural, social, economic, and political environments within a region that supports high-growth entrepreneurship. Moreover, they are seen as part of a regional economic development strategy based on creating supportive environments that foster innovative start-ups (Spigel and Harrison, 2018). It can be said that research-based derivatives (RBSO) as agents of the entrepreneurial ecosystem determine the function of the knowledge spillover effects of the derivative companies on the entrepreneurial ecosystem and analyze the method to

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sustain economic growth and knowledge usage. The spilled knowledge ecosystems lead to the emergence of technology platforms, and then the platforms react upon the entrepreneurial ecosystems and provide the needed resources (Schillo, 2018; Attour and Lazaric, 2020). The findings of Opolot *et al.* (2018) showed that education has positively affected on entrepreneurial skills. They acquired business planning, value addition and packaging, branding and marketing knowledge and skills. Group leadership, accountability, communication, networking, and marketing skills of farmers were strengthened.

Iran needs to promote economic growth and entrepreneurship by creating innovation ecosystems in various industries, including fisheries. To achieve this, there is a need for skill development and motivation through education. The objective of this research is to identify the educational requirements of fisheries researchers and propose a model to fulfill them.

One of the prerequisites for researchers to become successful in entrepreneurship is the ability to commercialize their ideas. The stage of commercialization and implementation is sometimes not reached by research in institutions (Delfani *et al.*, 2017). According to researchers, this is a result of administrative bureaucracy and the existence of numerous and sometimes conflicting regulations and directives. Upon employment in institutions, researchers are responsible for administrative tasks and are required to complete them. These administrative tasks are often given priority, especially at the beginning of employment. The time-consuming nature of these tasks in research innovation causes loss of value (Izadi and Ghatbari, 2021) and ultimately reducing or even destroying the potential for research commercialization. Additionally, implementation department priority is not a top in the policies of upstream organizations, as one tends to prioritize the publication of research articles in reputable journals. As a result, implementation and research activities that lead to implementation are not as visible and transparent in these institutes and research institutions.

The central phenomenon of this research is the entrepreneurship education of researchers. Therefore, it requires different fields of knowledge such as:

1. General skills: including planning and time management, production unit management, information access, administrative correspondence and writing, business advisory, banking facilities, and laws (Ahmadpour *et al*., 2016).
2. Individual knowledge of entrepreneurship; Familiarity with entrepreneurial behavior, personality traits, creativity and innovation, ability to present new business ideas, familiarity with the concepts of risk, innovation, business development customer orientation (Papzan *et al.*, 2015; Ahmadpour *et al*., 2016).
3. Commercialization of research; Marketing and sales, understanding consumers, Identify competitors (Ahmadpour *et al.*, 2016).
4. Personal skills; specialized software, social media, educational and extension methods, familiarity with foreign

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languages, Familiarity with target markets, knowledge of the principles of productivity (Rahmati, 2011; Ahmadpour *et al*., 2016).

5. Management skills; financial management, financing, human resources management, recruitment rules and programs, risk management, policy makin,g and management, having specialized knowledge in the field of fisheries (Rahmati, 2011; Papzan *et al.*, 2015).

Contextual conditions seem to be the personality characteristics of researchers in the discussion of entrepreneurship and have differences that can create dual and different conditions in fisheries' entrepreneurship. Overall, the personal interest of researchers has a great influence on directing them towards applied and farm-oriented research work and ultimately entrepreneurship. Some researchers, who seem to be more in number, are interested in the laboratory and workshop research works. This can be due to two reasons: A) the personality characteristics of the researchers, and they are naturally risk-averse or have experienced failure or incomplete implementation of them to be the personality traits of researchers in the discussion of entrepreneurship, which can create varying conditions in fisheries entrepreneurship. In general, the personal interests of researchers greatly influence their focus on applied and farm-oriented research, ultimately leading to entrepreneurship. A larger number of researchers seem to be interested in laboratory and workshop research, or in other words, desk be this may due to two reasons. The first reason is the researchers' personality traits, as naturally may risk-averse be or have of previously experienced failure or incomplete implementation of their responsible projects due to personal reasons or lack of support from their institute. B) The second reason may be a transfer of experiences and information from researchers who had unsuccessful projects. Failure discouragement can lead to negative work. Feedback, causes researchers to focus solely on research. However, there are also researchers who are interested in executive work for the opposite reasons. This group may be more risk-taking for personal reasons or have had successful experiences with previous plans and projects.

Strategies for commercialization: Preserving the rights of researchers in the process of commercialization, it is important to protect the intellectual and material rights of researchers. As researchers invest their time and effort into their projects, have hoped to receive material rewards or ownership intellectual of their property. However, some interviewees expressed their concerns about private sector or not institutions to do this prioritized issue (Sharifzadeh and Abdullahzadeh, 2016). Researchers expect to receive a percentage of the material benefits of profitability after their project has been implemented. To create a specific and separate deputy entitled “Fisheries Deputy” in all Agriculture-Jahad Provincial Organizations for further facilitation of communications and to reduce administrative bureaucracy in commercialization and entrepreneurship. Planning is crucial for successful commercialization. Knowledge-based

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authority companies are the result of applied research, and it is important for researchers to be familiar with how companies are created and operated (Niazi and Omani, 2020). The ability to define projects, which indicate its potential for commercialization, should be considered. Potential Effective communication with the industry sector for commercialization of research. Another key factor in the development of entrepreneurship in fisheries. Therefore, encouraging researchers to collaborate with the industry sector is necessary to develop specialist's commercialization models.

Sustainable production and harvesting are the consequences of entrepreneurship education of researchers. Entrepreneurship education and the implementation of applied research can increase income of researchers, positively impacting their motivation to continue their work, executive activities between organizations, promoting collaboration ability, effectively communication with the private sector, and users for sustainable production. Commutation improves their conducting of applied research with the private sector, which can build trust between them, and lead the implementation of high-quality and problem-oriented projects.

Materials and methods

This study used a cross-sectional methodology and a survey to gather descriptive data for a practical goal. employing a mixed approach, incorporating both quantitative and qualitative methods (Johanson & Onwuegbuzie, 2004). The research was conducted in two phases:

1-In the initial stage of this research, our objective was to develop a theory of fisheries entrepreneurship using the Grounded Theory methodology. To support this, we gathered data from fisheries specialists in the field of entrepreneurship from the Iranian Fisheries Science Research Institute (IFSRI) and its affiliated research centers. In this section data collection methods included semi-structured interviews, observation, and review of relevant sources. The systematic grounded theory with MAXQUDA$_{10}$ software was used for data analysis and using Strauss and Corbin (1990) approach (Fig. 1). For coding which includes three stages of coding: open coding, axial coding, and selective coding (Lee, 2001; Creswell and Creswell, 2017) (Fig. 2).

The qualitative section of the study included a sample of 25 researchers and managers with significant experience in entrepreneurship education. They were selected using purposeful and snowball sampling methods.

2- In this section confirmatory factor analysis and Smart-PLS software were employed. The statistical population consisted of 208 faculty members and non-academic researchers from the Iranian Fisheries Science Research Institute (IFSRI) and affiliated national research centers. The statistical sample was determined using Cochran's formula. The number of samples was determined to be 135 researchers and 120 questionnaires were completed:

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$$n = \frac{\frac{Z^2 pq}{d^2}}{1+\frac{1}{N}\left(\frac{Z^2 pq}{2a}-1\right)} \Rightarrow$$

$$n = \frac{\frac{3.841*0.5*0.5}{.0025}}{1+\frac{1}{208}\left(\frac{3.841*.5*.5}{0.0025}-1\right)} = 135$$

Where n is Statistical sample size; N is the size of the statistical population; d is a permissible error (normally considered equal to 0.05); z is the value of the normal variable with a confidence level of 1 α-. In the two-domain test, the z value for the 95% confidence level is 1.96 and for the 99% confidence level is 2.58; p is the proportion of possessing the desired attribute (for example, male population); q=(p-1) is proportion of not having the desired attribute (for example, female population). Usually, p and q are considered 0.5.; sampling was done using the stratified method with proportional assignment (Table 1).

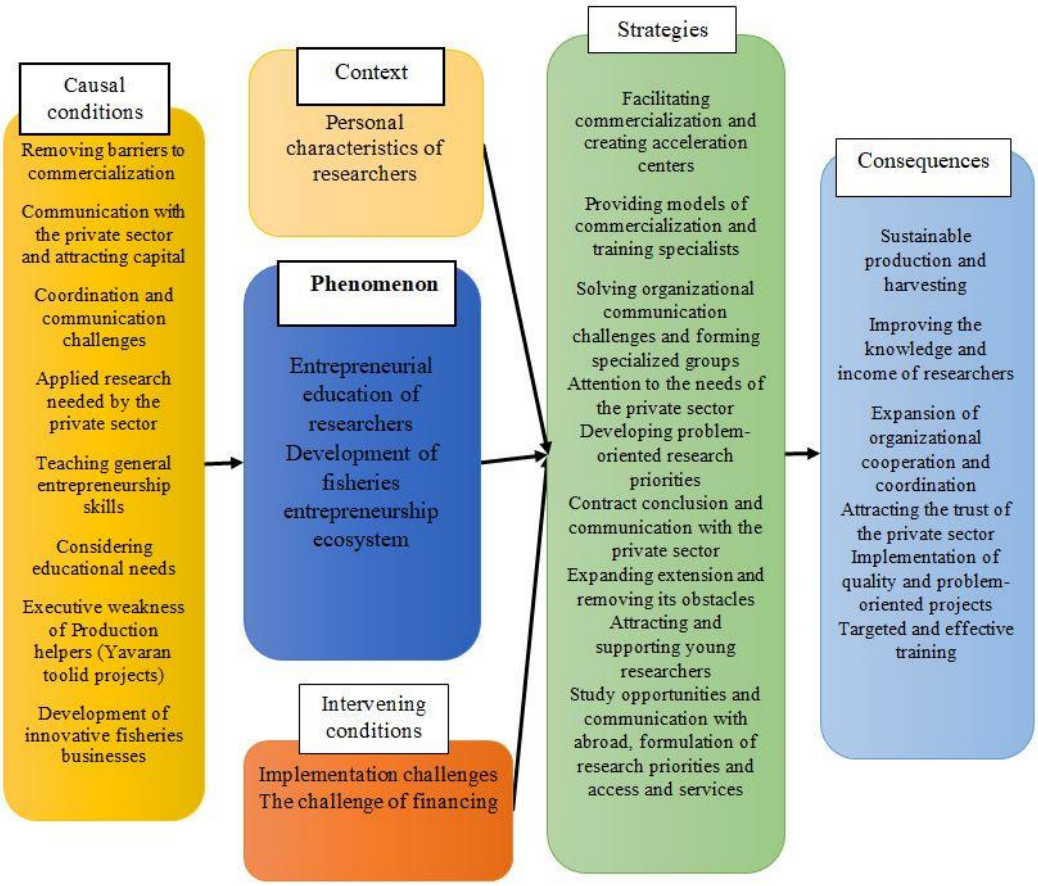


Figure 1: Paradigm model of coding of entrepreneurial education of researchers.

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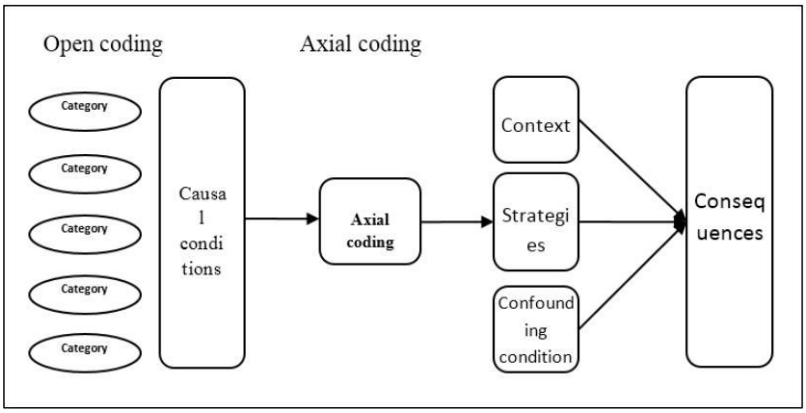


Figure 2: Open and axial coding paradigm (Creswell and Creswell, 2017).

Table 1: The number of samples in each of the three fields.

Field	Number of samples
Fisheries	38
Aquaculture	56
Fisheries industries	26
Total	120

Results

Based on research findings 44%researchers who had the highest frequency were in the age group of 46-55 years, 46% of researchers had 20-30 years of work experience, 55% of researchers were non-faculty member researchers (Table 2).

Table 2: Descriptive findings of statistical sample.

Variable	Categorize	Frequency (%)
Age (yr) Average:47.78	<35	6 (5.0)
	35-45	41 (34.0)
	46-55	52 (44.0)
	≥ 55	19 (16.0)
work experience(yr) Average:20	≤10	22 (18.7)
	10-20	33 (46.7)
	20-30	54 (46.0)
	≥30	9 (7.6)
faculty member	Yes	53 (45.5)
	No	66 (55.5)
number of research projects Average:1.7	No idea	30 (26.1)
	1-2	47 (40.9)
	3-4	11 (9.6)
	>5	27 (23.5)
Number of scientific articles Average:4.32	<5	46 (40.0)
	5-10	26 (22.6)
	10-15	16 (13.9)
	>15	27 (23.5)
A member or owner of a scientific, research and commercial company	Yes	31 (26.9)
	No	84 (73.1)

Smart PLS software was used to examine the coefficients and significance of the components of the entrepreneurship educational needs of researchers and

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fisheries faculty members. In the methodology of the structural equation model, the validity of the structure was studoed in order to determine whether the indicators selected to measure the desired structures have the necessary accuracy. That is, have the questions to measure the variables been chosen correctly or not? For this purpose, confirmatory factor analysis (CFA) was used. The amount of factor loadings is one of the methods of determining the reliability of research questions. The estimation of the factor loadings showed that the factor loadings were more than 0.5. Therefore, the questions of research were correct and the validity of the model was confirmed (Fig. 3).

For each factor loading to be significant, each indicator with its structure has a significant t value (p= 0.05), that, its value must be outside the range (1.96 and -1.96), then this indicator correctly measures the component. Based on the results shown in Figure 4, all the indicators used are significant and have acceptable accuracy.

Based on the results listed in Table 3, all values of Composite Reliability (CR) indices and Cronbach's alpha are above 0.7, therefore, the results confirm that the conditions for establishing reliability are confirmed. The value of the Average Variance Extracted (AVE) is also higher than 0.5, the items account for over 50% of the variance of their respective constructs. The favorable values of this index indicate the existence of convergent validity.

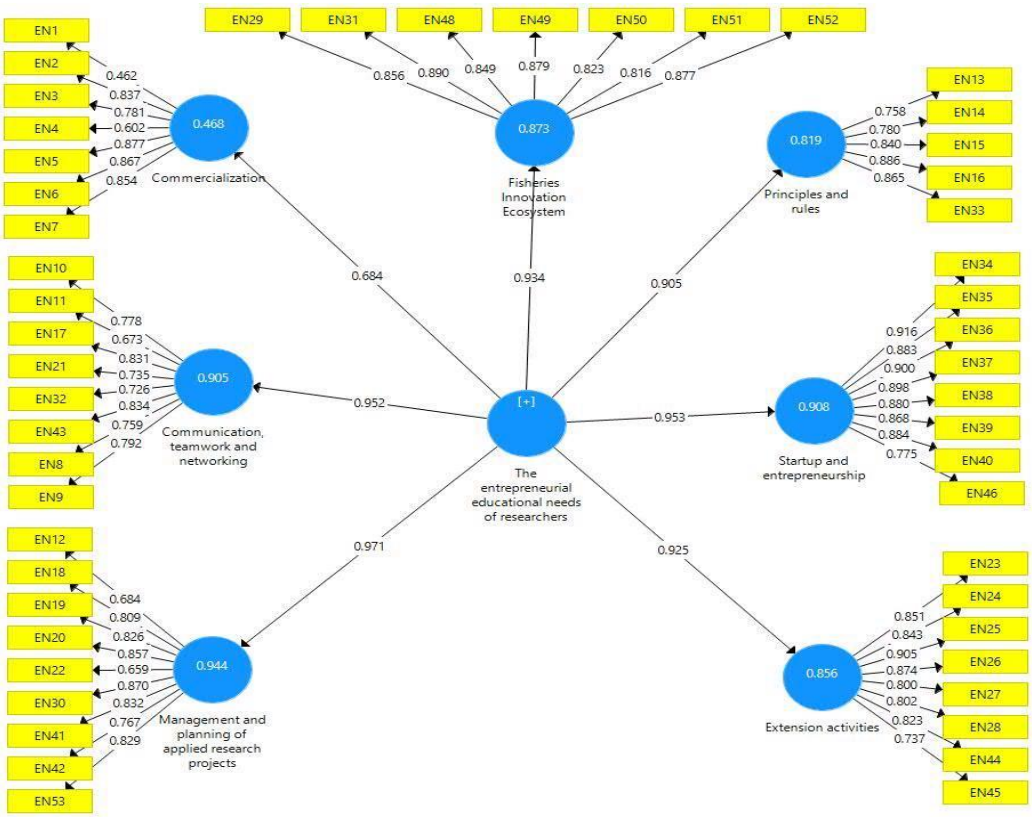


Figure 3: The final estimated model of educational needs of entrepreneurship of researchers with factor loading.

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According to the R^2 values of the components of entrepreneurship educational needs, they are prioritized in the following order; Management and planning of applied research projects, Startup and entrepreneurship, Communication, teamwork, and networking, Fisheries Innovation Ecosystem, Extension activities, Principles and rules, Commercialization (Table 4).

To demonstrate divergent validity, the correlation between all constructs must be lower than the average squared value of the extracted variance for each construct. This indicates that no two variables are highly correlated and that the items are effectively distinguishing between the constructs. This criterion is commonly known as the Fornell and Larcker criterion, which states that the correlation between a variable and its own questions should be higher than the correlation between those questions and other variables (Fornell and Larcker, 1981). The results in Table 5 also support the presence of divergent validity (Table 5).

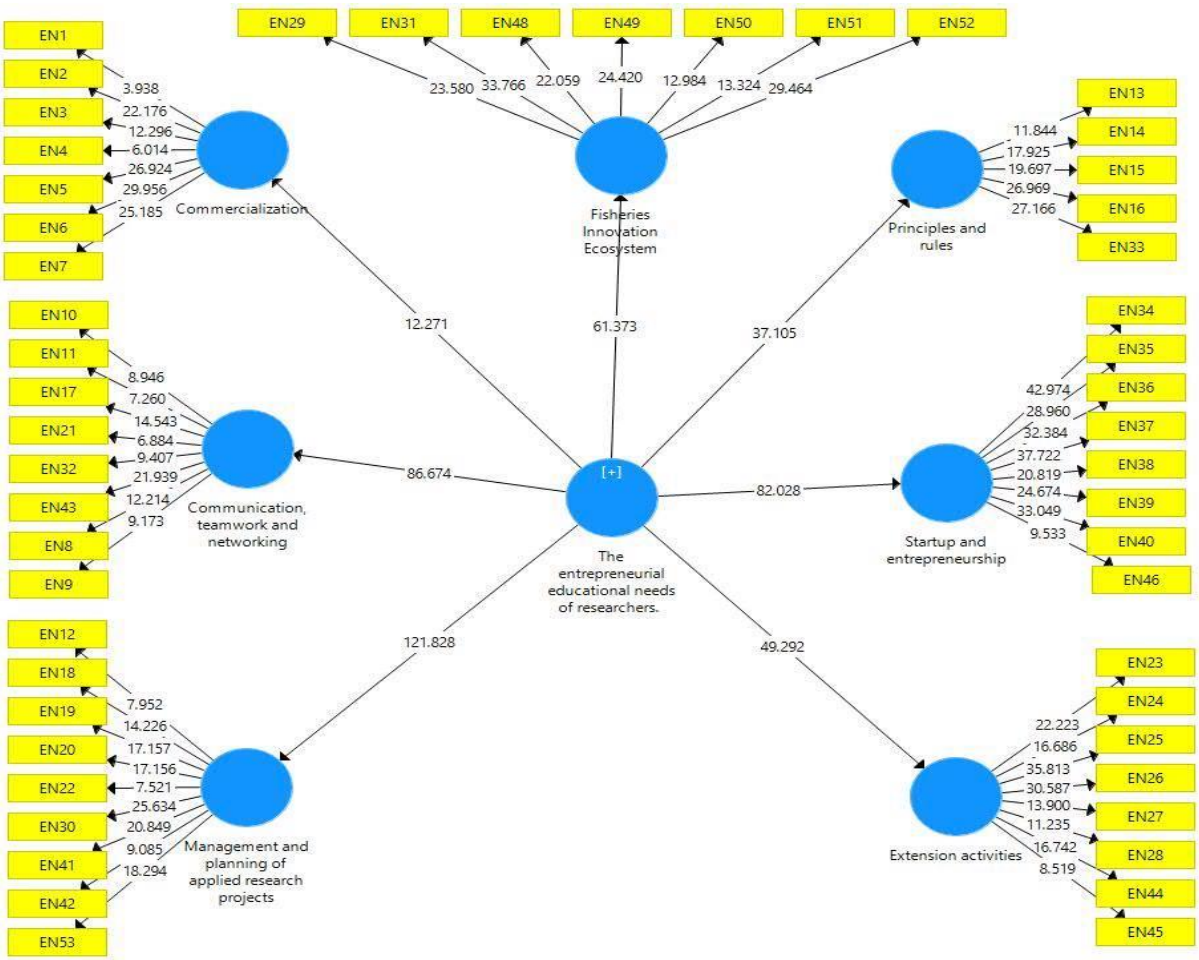


Figure 4: The model of the components of educational needs of researchers entrepreneurship in the state of statistical significance.

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Table 3: The results of the confirmatory factor analysis of the educational need components of researchers' entrepreneurship.

Variable	Symbol	Component	AVE	CR	Cronbach's alpha
• Understanding the material and intellectual rights of researchers in the commercialization of research accomplishments and findings	A1	Commercialization	0.68	0.92	0.90
• Planning for the commercialization of research findings and their administrative processes	A2				
• Understanding of knowledge-based companies and the capability to establish them	A3				
• Defining research projects with the ability to commercialize findings	A4				
• Communication with the industry sector and effective follow-up of the process of commercialization of findings	A5				
• Acknowledging accelerator centers to establish communication between researchers and investors	A6				
• Successful models of commercialization of research findings	A7				
○ How to form a team and network in fisheries entrepreneurship projects	A8	Communication, teamwork and networking	0.66	0.93	0.92
○ Implementation of joint projects with the private sector	A9				
○ Presenting and introducing research results and achievements to the private sector	A10				
○ Teamwork and networking in fisheries research activities	A11				
○ Communicating with the producers of the country's fisheries and aquatics sector	A17				
○ Establish strong communication with managers and experts and meet your research needs	A21				
○ Working in virtual networks and communicating with users to solve their problems	A32				
○ Effective communication with the promoters of fishing areas	A43				
• How to finance research projects through the private sector	A22	Management and planning of applied research projects	0.91	0.60	0.94
• Planning and implementation of technological research in the field of fisheries	A12				
• Assessment of educational needs of operators of different fisheries fields	A18				
• How to formulate research-promotional plans in the field of fisheries	A19				
• Planning and implementation of applied research required by the market	A20				
• How to plan and implement needs-based projects	A30				

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Variable	Symbol	Component	AVE	CR	Cronbach's alpha
• Components of economic estimation of problem-oriented research projects (required by the market)	A41	Principles and rules	0.80	0.95	0.94
• Proper management of practical and executive research projects in the fisheries sector	A42				
• Indigenous knowledge of fisheries operators and how to use them in the sustainable development of the fisheries industry	A47				
• Evaluation of entrepreneurial plans and new fishing businesses	A53				
○ Rules and policies of entrepreneurship and creation of new fishing businesses	A13				
○ Compilation and submission of reports on the results of research activities to institutions and organizations	A14				
○ The principles and regulations of concluding a research contract with institutions outside the Ministry of Jihad and Agriculture/AREEO organization	A15				
○ The principles and regulations of concluding a research contract with institutions within the ministry	A16				
○ Principles and regulations of public-private partnership (public-private partnership) in the field of fisheries	A33				
• Preparation and editing of promotional periodicals in the field of fisheries (mastering the principles of promotional periodical writing)	A23	Extension activities	0.71	0.95	0.94
• Working as an active promoter in fisheries affairs	A24				
• Solutions to transfer new scientific and practical findings to the operators of fishing farms	A25				
• Preparation of educational-promotional clips for the operators of fishing farms	A26				
• Preparation of an application to teach innovations to the operators of fishing farms	A27				
• How to implement research-promotion projects at the farm level	A28				
• Using new technologies in the training of farmers in extension classes/farm day	A44				
• New and practical scientific technologies and innovations in their specialized field	A45				
○ The concept of innovation and entrepreneurship and its processes in the field of fisheries	A35	Startup and entrepreneurship	0.73	0.94	0.92
○ Creativity techniques in fisheries research and entrepreneurship activities	A36				
○ The characteristics of entrepreneurs in the fishing industry and how to strengthen them	A37				

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Variable	Symbol	Component	AVE	CR	Cronbach's alpha
○ How to participate in entrepreneurial and startup events to attract investors	A38				
○ Entrepreneurial potentials and technological employment in the field of fisheries	A39				
○ Customer-oriented techniques in fishing businesses	A40				
○ Risk management components in fishing entrepreneurial	A46				
• The value chain of goods and services in the fisheries industry	A29	Fisheries Innovation Ecosystem	0.74	0.96	0.95
• Target markets for innovative fishery products	A31				
• The entrepreneurial ecosystem of fisheries and how to implement and strengthen it	A48				
• Interaction with those involved in the development of the fishery industry with an entrepreneurial approach	A49				
• Models of value creation and wealth creation and their application in fisheries	A50				
• Mentoring and its implementation methods in entrepreneurial events	A51				
• Stages of technological readiness levels in the development of fisheries industry	A52				

Table 4: Prioritizing the components of educational needs.

	R^2	R^2 Adjusted
Management and planning of applied research projects	0.944	0.943
Startup and entrepreneurship	0.908	0.907
Communication, teamwork, and networking	0.905	0.904
Fisheries Innovation Ecosystem	0.873	0.872
Extension activities	0.856	0.854
Principles and rules	0.819	0.817
Commercialization	0.468	0.463

Table 5: Correlation between factors and average variance extracted for each factor.

Components	Commercialization	Communication, teamwork and	Extension activities	Fisheries Inovation	Management and planning of applied research projects	Principles and rules	Startup and entrepreneurship
Commercialization	0.769						
Communication, teamwork, and networking	0.688	0.888					
Extension activities	0.512	0.886	0.901				
Fisheries Innovation Ecosystem	0.554	0.823	0.836	0.916			
Management and planning of applied research projects	0.619	0.858	0.898	0.908	0.896		
Principles and rules	0.599	0.861	0.801	0.801	0.879	0.858	
Startup and entrepreneurship	0.585	0.862	0.849	0.866	0.844	0.846	0.876

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Discussion

Based on the information presented in Figures 3 and 4 and Table 4, the components of entrepreneurship were categorized into seven distinct groups and then ranked in order of importance (as shown in Table 4). This section will delve into each component in greater detail, providing a comprehensive explanation of its prioritization.

Management and planning of applied research projects: Planning is an ongoing process that involves creating organized and informed strategies for the future. It is considered the primary responsibility in classical management theories. Planning involves a deliberate decision-making process to determine goals and future actions for individuals, groups, work units, or organizations. The planning manager or managers initiate the planning process by conducting a situational analysis. Compiling and submitting reports on the results of research activities to institutions and organizations. (Greching and Hisrich, 2005), and faculty members must possess the ability to compile suitable reports for their projects and demonstrate these projects contribute and problem-solve to addressing needs. They should also know how to secure funding for research projects from the private sector (Anokhin *et al*., 2008), researchers should have knowledge of how to finance research projects, as will increase the efficiency of their activities. Funding for projects eliminates the need for researchers to navigate administrative bureaucracy in order to secure findings. Planning and implementation of applied research which is required by the private sector, must be accurate and precise planning. Therefore, it is crucial to identify the stages of planning and implementation. Researchers must also be familiar with how to implement research-promotion projects at the farm; these projects plans have specific instructions that must be followed in order to implement such plans. How to plan and implement needs-oriented projects. Need-based projects require planning for needs assessment and implementation in order to successfully implement them. Additionally, planning and implementing needs-oriented projects require thorough needs of assessment and proper implementation in order to be accepted by users. Researchers should also be knowledgeable about the components of economic problem-oriented research estimating the financial costs and income of management of projects, as required by the private sector. Practical and operational sectors, proper research projects the fisheries special management is essential. These plans planning and implementation, considering both private and public especially involved the involvement of both in a coordination sector. Therefore, at an appropriate level is necessary.

Startup and entrepreneurship: Familiarization researchers with the concepts of entrepreneurship (Hadi *et al*., 2015; Opolot *et al*., 2018) and the required actions are prerequisites for entrepreneurship. Therefore, it is important, to be familiar with the concept of innovation and entrepreneurship and its processes in fisheries that leads to the development of researchers' activities and the identification of new entrepreneurial capacities in the fisheries sector. It also allows for familiarity with creative

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techniques in fisheries research and entrepreneurship activities (Rahman *et al.,* 2016; Castano *et al.,* 2016; Dias *et al*., 2019). This will in result it will the implementation of new research and the discovery of research and innovative address solutions to user-related issues. Production and also explore the characteristics of entrepreneurs in the fisheries industry and ways to enhance them. Entrepreneurship is characterized by risk-taking, and other qualities of researchers who are creative, etc. These characteristics can help drive the development of entrepreneurial activities in fisheries. How to participate in entrepreneurial and startup events to attract investors; One of the issues that researchers face in applied research is finding investors, participation in entrepreneurial events makes investors familiar with their plan and invest in their plan. Recognizing the entrepreneurial potential and entrepreneurial employment of the fisheries sector also has a significant contribution to entrepreneurial activities.

Innovation ecosystem and fisheries entrepreneurship: One of the processes that facilitates a researcher's entrepreneurship is familiarizing researchers with the concept of the innovation and entrepreneurship ecosystem (Shanthi *et al*., 2011). The innovation ecosystem will be a network of interconnected businesses. The value chain of goods and services in the fisheries industry; will also impact the researcher's outlook on conducting and entrepreneurial endeavors within the relevant field. A crucial aspect of activities is identifying target markets for innovative fishery products that stem from research projects. By finding the services of entrepreneurial ecosystems and new fishing businesses, knowing and applying new technologies and scientific innovations in their specialized field, knowing the fisheries entrepreneurship ecosystem and how to implement and strengthen it, value creation and wealth creation models and using them. They are important in fisheries.

Communication, teamwork, and networking: One of the key factors to development of entrepreneurship and commercialization is the nature and extent of their relationship with the private sector. how to communicate effectively with the private sector, the ability to carry out joint projects with the private sector (Greching and Hisrich, 2005), presenting and introducing research results and achievements to the private sector, communicating with the producers of the country's fisheries and aquatics sector, establishing strong communication with Managers and experts and to meet their research needs, how to gain the trust of fishery product producers, activity in virtual networks and communication with users to solve their problems, study (Giblin, 2011), interaction with those involved in the development of the fishery industry with an entrepreneurial approach in line with entrepreneurship It is important.

Extension activities: Assessing the educational needs of the operators of different fisheries and determining their educational needs is a solution for implementing problem-oriented studies and will determine the acceptance of the project by the private sector and the operators. Preparation and editing of promotional publications in the field of fisheries

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(mastering the principles of promotional publication) is one of the capabilities required for researchers, especially the promoters of findings to transfer technology and research results to users. Activities in the field of promotion as an active promoter in fisheries affairs, part of the researchers' activities should be field activities in order to connect with the beneficiaries.

The ways of transferring new scientific and practical findings to the users, considering the changing tastes and priorities of the users, it is suggested that they become aware of the new ways of transferring scientific findings. Compilation of brochures, articles and summarized promotional clips for the use of users is one of the methods of increasing the information and awareness of the users, their awareness of new findings in simple language, which should be done through promotional methods. The production of clips and short films also makes users visually and concretely familiar with new research technologies and findings.

Principles and rules: Knowing the rules and policies set by the government for entrepreneurship and the capability to create new fishing businesses is one of the first steps of entrepreneurship in this industry. The principles and regulations of contracting with institutions outside the Ministry of Agriculture-Jahad and AREEO Organization and the principles and regulations of contracting with institutions within the Ministry of Agriculture-Jahad are very important. The principles and regulations of public-private partnership (public-private partnership) considering the interest of the private sector in investing in profitable fishing activities, getting to know the principles of this cooperation will lead to the development of cooperation with the private sector and the expansion of the entrepreneurial activities of researchers.

Commercialization: One of the key components identified is the "commercialization of research findings". This refers to the process of transforming ideas and inventions into marketable products or services, ultimately leading to job creation and wealth generation. Commercialization involves a series of steps, beginning with the planning and development of the idea, followed by the production of technological goods and services, and concluding with the sale of these goods and services to the end consumer. In line with variables such as; planning for the commercialization of research findings and administrative processes, among the variables that should be taken into account, planning should be done by the Centers and Research Institutes. In planning for the commercialization of research findings and its administrative processes, considering the bureaucratic and administrative discussion and the slow progress of the commercialization process, it is necessary to plan for this process and clarify its steps carefully. Knowing the definition of research projects with the ability to commercialize findings should be taken into consideration when developing research project proposals. Formulating plans or projects without intended purpose and application reduces the ability to commercialize findings. Identifying accelerator centers to establish communication between researchers and

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investors (Mafi *et al.,* 2020), identifying these centers leads to Increasing the speed of research commercialization processes and identifying successful commercialization patterns of research findings in similar fields increases the motivation and awareness of researchers to commercialize research findings. There are solutions for commercialization such as finding successful patterns of commercialization (Gudarzi *et al.,* 2012), and identifying the components of the commercialization model (Bezrukova *et al.,* 2012). Finally suitable model for commercialization should be designed and proposed with the institutional and native contexts of our country.

Based on the available information and statistics, Iran's fisheries sector has a lot of development capacities that can provide a suitable environment for entrepreneurship and sustainable employment in the country. The result showed that the entrepreneurship knowledge of researchers isn't at a suitable level. On the other hand, researchers in the application of knowledge in the field are faced with issues and problems that may be due to personal reasons such as lack of risk-taking or organizational issues. Considering the scope of fisheries research in the country, research findings in institutions mostly do not reach the stage of commercialization and proper implementation. Also, The policies of organizations for promoting researchers are primarily based on their scientific publications rather than their entrepreneurial activities. Institutes should identify two groups of researchers :A group interested in entrepreneurship and farm activity and a group that is interested in research and laboratory work and assign their tasks based on their characteristics and experiences, or by exchanging experiences between the two groups, change the perspective of risk-averse researchers and their ability to implement entrepreneurial projects. to improve this finding is in agreement with other research findings of Grichnik and Hisrich (2005), and Duening *et al.* (2009) who mentioned personality traits are consistent with research articles in prestigious journals and reduce the motivation of the researchers for field activities (Castano *et al.,* 2016).

In this research, a model for entrepreneurship education was presented. Based on the research results the components of the model were prioritized in seven categories. These components are as follows: Management and planning of applied research projects, startup and entrepreneurship, communication, teamwork and networking, fisheries ınnovation ecosystem, extension activities, principles and rules, and commercialization .

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Conflicts of interest

The authors declare that they have no conflicts of interest related to this research.

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