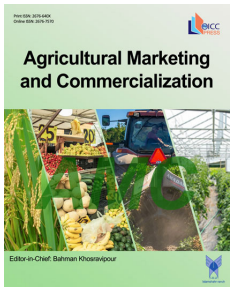

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Designing the Entrepreneurial and Knowledge Commercialization University Model at Khuzestan Islamic Azad University

Alireza Shakerian, Seyed Alireza Alavi*, Mohammad Reza Farhadpour

Department of Educational Management, Ahv.C., Islamic Azad University, Ahvaz, Iran.

***Corresponding author:** alavi@acecr.ac.ir

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Abstract:

The purpose of this research was designing the entrepreneurial and knowledge commercialization university model at Khuzestan Islamic Azad University. The structural equation model was designed with Smart PLS3 software. The validation of the factor structure and the evaluation of the measurement model were examined using confirmatory factor analysis in two parts. The statistical population of this study included all faculty members of Islamic Azad University of Khuzestan Province, totaling 1700 people. The Cochran formula was used to determine the statistical sample size. This number was 314 people. The results of the research show that appropriate educational content for entrepreneurship, socialization, institutionalization of entrepreneurship, facilitation of entrepreneurship directives and regulations, financial support and facilities, risk-taking, innovation and creativity, continuous communication with industry, development of technological infrastructure, and entrepreneurial management and leadership practices as a causal condition, social and cultural contexts, creativity and innovation contexts, economic contexts, organizational climate, political contexts, and research contexts as contextual conditions and developing an entrepreneurial ecosystem, paying attention to peripheral factors, creating motivation and encouragement, and forming a professors' database as intervening factors, had a positive and significant effect on the axial phenomenon of entrepreneurial and knowledge commercialization university. Finally, the identified strategies of entrepreneurial and knowledge commercialization university had a positive and significant effect on the consequences of implementing the model. The consequences of implementing the model in order of priority were commercialization of research and entrepreneurship, development of entrepreneurial businesses and increased employment, promotion of productivity and economic growth, matching university output with the needs of society and industry, improving educational quality and social development, and promoting innovative work and effort that had a positive and significant effect on entrepreneurial and knowledge commercialization university.

Keywords: Entrepreneurial University, Knowledge Commercialization, Khuzestan Islamic Azad University

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INTRODUCTION

The mismatch of skills with the needs of society among university graduates has contributed to the increase in existing social and economic challenges such as poverty and unemployment, especially in most developing countries. As a result, universities have been mandated to become entrepreneurial universities as a third mission, which leads to the advancement of knowledge, acquisition of skills and an entrepreneurial mindset, and supports the development of technology and innovations to meet the emerging needs of the economy (Salamzadeh et al., 2022). Entrepreneurial universities have attracted much attention in the last few years (Guerrero and Pugh, 2022). The

concept of an entrepreneurial university aims to promote the transfer of scientific knowledge to organizations and industries and to strengthen socio-economic development. Entrepreneurship, as a new approach to the business development process, provides organizations with the prospect of effectively entering new markets using innovative strategies and limited resources (Nesari et al., 2025). Entrepreneurship is a process that places a fundamental emphasis on innovation and creativity. Improving productivity, business development, and job creation are among the benefits of entrepreneurship (Rasouliazar et al., 2024; Ghodrati & Zand, 2023). The first wave occurred in pioneering universities in the United States such as MIT and Stanford, which established a patent policy, technology transfer, and university-industry partnerships. The second wave occurred in Western Europe, where universities transformed themselves into entrepreneurial institutions and supported academic entrepreneurs. In emerging economies, in the third wave, the promotion of academic entrepreneurship is on the political agenda of universities (Dalmarco et al., 2018). In recent years, there has been increasing pressure on universities to shift their primary focus from teaching and conducting research to adding a third mission, "helping society." The third mission is a multidisciplinary, complex, and evolving phenomenon that is related to the social and economic mission of universities in a broad sense (Compagnucci and Spigarelli, 2020). The emergence of the knowledge-based economy and the focus on entrepreneurship, coupled with globalization and the financial and environmental crises, are unprecedented challenges that have significantly contributed to the redesign and expansion of university missions (Rubens et al., 2017). Indeed, Universities that remain in the second wave and do not adopt a new approach based on innovation and entrepreneurship will not be accepted by society (Urdari et al., 2017). Universities that are in the third wave are becoming engines that contribute to the social, economic and cultural development of the regions in which they operate, through entrepreneurship, the transfer of knowledge and technology to industry and society in general (Agasisti et al., 2019).

In today's knowledge-based societies, universities are increasingly involved in development activities that go beyond teaching and research (Ardito et al., 2019; Rinaldi et al., 2018). In this regard, universities have begun to increase their engagement with communities and carry out a variety of activities (such as knowledge dissemination, social innovation development, consultancy services and entrepreneurship) with or without government support at local, regional, national and international levels (Guerrero and Pugh, 2022). Research on entrepreneurial universities has steadily increased over the years, especially in the fields of business and management, this increase is noteworthy. A variety of related topics have been developed in entrepreneurial universities, such as technology transfer, performance management (Audretsch, 2014), entrepreneurship education (Guerrero et al., 2015; Fayolle and Redford, 2014) and knowledge management (Scuotto et al., 2019; Secundo et al., 2019). In the present era, universities are recognized as facilitators of innovation and supporters of entrepreneurship in order to achieve success in social, economic, political and cultural fields (Cunningham & Menter, 2021; Graf & Menter, 2021; Wagner et al, 2021), but how can this success be achieved and fill the existing gap? This requires field studies and applied research (Civera et al, 2020; Audretsch & Belitski, 2021). In addition, the concept of "entrepreneurial university" has not yet been studied in detail and expertly according to the needs of different societies (Link, 2022).

In the current situation, higher education and universities have transformed and chosen a new path due to the evolution of knowledge-based societies. Bapurikar (2022) concluded in his research that the factors that promote entrepreneurial universities are financing, self-reliance, academic freedom, better linkages with industry, innovation, job creation and promotion of social and economic development. Hence, across the world, entrepreneurial universities are increasingly recognized as an important component to address financial and employment issues. However, various reports and studies show that entrepreneurial universities have not achieved these goals. This may be due to the challenges and lack of understanding of the critical success factors for an entrepreneurial university.

The most important research gap that has been pointed out in various studies is the lack of fundamental attention to entrepreneurship and commercialization of knowledge in the output of universities. Education-oriented and staying in the "first generation university" is one of the most important current problems of universities that has been criticized (Link, 2022; Fayolle and Redford, 2014; Audretsch, 2014).

METHODOLOGY

The approach governing this research is a quantitative causal approach. The questionnaire of this study had the following sections:

Components of entrepreneurial university implementation with 53 items,

Causal conditions affecting entrepreneurial university implementation with 33 items,

Contextual conditions affecting entrepreneurial university implementation with 28 items,

Intervening factors affecting entrepreneurial university implementation with 16 items,

Strategies affecting entrepreneurial university implementation with 26 items, and consequences of entrepreneurial university implementation with 29 items.

In order to determine the validity and construct validity of the questionnaire, the convergent validity method was used in the form of confirmatory factor analysis. Cronbach's alpha test and composite reliability were used to assess the reliability level of the questionnaire.

The structural equation model was designed with Smart PLS3 software. The validation of the factor structure and the evaluation of the measurement model were examined using confirmatory factor analysis in two parts. The interaction of causal conditions, contextual conditions and intervening factors with the axial phenomenon was analyzed through

structural equations. The composite reliability criterion (CR) was used to assess the reliability of the structure and the coefficient of determination (R^2) was used to assess the reliability of the variable. The R^2, Q^2 and GOF goodness of fit index were used to examine the fit of the measurement model of factors affecting academic entrepreneurship and knowledge commercialization. The statistical population of this study included all faculty members of Islamic Azad University of Khuzestan Province, totaling 1700 people. The Cochran formula was used to determine the statistical sample size. This number was 314 people. The research hypotheses are as follows:

Causal conditions have a significant role in the implementation of the entrepreneurial university and the commercialization of knowledge at the Islamic Azad University of Khuzestan.

Background conditions have a significant role in the implementation of the entrepreneurial university and the commercialization of knowledge at the Islamic Azad University of Khuzestan.

Intervening factors have a significant role in the implementation of the entrepreneurial university and the commercialization of knowledge at the Islamic Azad University of Khuzestan.

Background conditions have a significant role in the implementation of the entrepreneurial university and the commercialization of knowledge at the Islamic Azad University of Khuzestan.

Intervening factors have a significant role in the implementation of the entrepreneurial university and the commercialization of knowledge at the Islamic Azad University of Khuzestan.

Strategies for implementing the entrepreneurial university and the commercialization of knowledge at the Islamic Azad University of Khuzestan have a significant role in the outcomes.

RESULTS AND DISCUSSION

SLE Modeling

Data analysis in this study has been carried out through the structural equation model. Through this modeling, the direct and indirect effects of the variables in the given model can be analyzed. With this method, the causal structure between a set of variables can be examined. In this model, the relationships between a set of variables are evaluated and the causal effects of the variables on the dependent variable are examined and the suitability of the given model is fitted and confirmed.

1) Correlation test between variables and diagnostic validity

In structural equation analysis, one of the necessary conditions for analysis is the existence of a significant correlation between the research variables, which was evaluated in this study. Based on the results in Table 1, there is a significant correlation between all variables. Based on the results presented in Table 1, the correlation of the variables is shown. Based on the results, there is a significant relationship between all variables. To achieve diagnostic validity, it is necessary that the square root of the AVE estimate for each construct is greater than the correlation between that construct and other constructs in the model. Considering the value of the square root of the AVE estimate given in the diagonal of the table, the model has a desirable diagnostic validity.

2) Confirmatory factor analysis

Confirmatory factor analysis is a method used to evaluate the measurement model in structural equation modeling through SMART PLS3 software. The fit indices of the software output and the significance of the factor loadings of the items of different constructs of the questionnaire are used as a criterion for model confirmation.

2-1) Structural measurement model of causal conditions affecting the entrepreneurial university and knowledge commercialization

The results of examining the validity of the factor structure and evaluating the factor measurement model of the causal conditions affecting the entrepreneurial university and knowledge commercialization at the Islamic Azad University of Khuzestan using confirmatory factor analysis were presented in two parts:

2-1-1) Validity and reliability of the measurement model:

The validity of the measurement model of the causal conditions structure affecting the entrepreneurial university and commercialization of knowledge was measured at the Islamic Azad University of Khuzestan and the results are presented in Table 2. The standardized factor loadings of the variables belonging to the causal conditions structure were determined and the significance of the difference with

Table 1. Correlation matrix between research variables

Variables	Causal	Contextual	Intervening	Axial	Strategies	Consequences
Causal	0.746[a]					
Contextual	0.709*	0.798[a]				
Intervening	0.668*	0.631*	0.689[a]			
Axial	0.551*	0.472*	0.541*	0.638[a]		
Strategies	0.561*	0.519*	0.468*	0.513*	0.637[a]	
Consequences	0.612*	0.486*	0.541*	0.603*	0.407*	0.691[a]

*Correlation significance at 0.01 level, a: square root of AVE estimate

Table 2. Evaluation of the factor measurement model of causal conditions using confirmatory factor analysis

Construct	Variable	Standardized factor loading	Standard error	t	R^2	CR
Causal conditions	Appropriate educational content for entrepreneurship	0.519	0.153	2.222	0.53	0.814
	Socialization	0.745	0.118	1.308	0.61	
	Institutionalization of entrepreneurship	0.628	0.129	2.908	0.63	
	Facilitation of entrepreneurship directives and regulations	0.573	0.195	2.625	0.59	
	Financial support and facilities	0.518	0.163	2.359	0.48	
	Risk-taking and innovation and creativity	0.561	0.214	2.628	0.57	
	Continuous communication with industry	0.567	0.261	2.335	0.56	
	Development of technological infrastructure	0.652	0.289	2.528	0.52	
	Entrepreneurial management and leadership practices	0.606	0.301	2.891	0.56	

zero was determined using the t-test. Based on the results obtained for each variable, it has been shown that the load of that variable on the causal conditions structure affecting the entrepreneurial university and commercialization of knowledge at the Islamic Azad University of Khuzestan is significant at the 5% error level. Accordingly, 9 variables of the causal conditions structure, namely, appropriate educational content for entrepreneurship, socialization, institutionalization of entrepreneurship, facilitation of entrepreneurship directives and regulations, financial support and facilities, risk-taking, innovation and creativity, continuous communication with industry, development of technological infrastructure, and entrepreneurial management and leadership practices, have a significant contribution to the measurement of this structure. This confirms that the validity of the measurement model of the causal conditions structure is confirmed. In order to assess the reliability of the construct, the composite reliability criterion (CR) was used, and the coefficient of determination (R^2) was used to assess the reliability of the variable. The results are presented in Table 4. A CR value above 0.7 indicates that the reliability of the construct in question is desirable. Also, the higher the R^2 value for each variable, the higher the reliability of that variable in measuring the relevant construct.

The structural measurement model of causal conditions affecting entrepreneurial university and commercialization of knowledge is shown in Figure 1.

2.1.2) Assessment of the fit of the measurement model of causal conditions effective on entrepreneurial university and commercialization of knowledge

Based on the results of Table 3, the values of R^2, Q^2 and GOF have acceptable and suitable values and the model has a good fit.

To examine the fit of the model measuring the causal conditions affecting the implementation of the entrepreneurial university at the Islamic Azad University of Khuzestan, the R2, Q2 and GOF goodness of fit indices were used. The GOF index evaluates the fit of the structural and measurement parts simultaneously. The three values for evaluating the GOF index:

- Weak: if it is between 0.1 and 0.25.
- Moderate: if it is between 0.25 and 0.36.
- Strong: if it is greater than 0.36.

The second index is R^2. The higher the R^2 value related to the endogenous constructs of the model, the better the fit of the model. Three values of 0.19, 0.33 and 0.67 have been introduced as weak, moderate and strong values for this coefficient of determination (Chin, 1998). The third index of the predictive power of the model is the predictor correlation index or Q^2. This criterion determines the predictive ability of the model in endogenous constructs. Models that have acceptable structural fit should be able to predict the endogenous variables of the model. This means that in a model, the relationships between the constructs are correctly explained, the constructs have sufficient

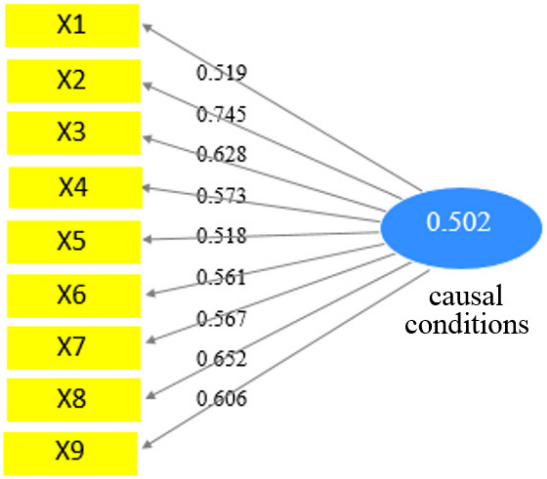

Figure 1. Structural measurement model of causal conditions affecting the entrepreneurial university and knowledge commercialization at the Islamic Azad University of Khuzestan

Table 3. R^2, Q^2, and GOF values for contextual condition model fit

Construct	R^2	Q^2	GOF
Contextual condition	0.784	0.561	0.498

Table 4. Evaluation of the factor measurement model of contextual conditions using confirmatory factor analysis

Construct	Variable	Standardized factor loading	Standard error	t	R^2	CR
Contextual conditions	Social and cultural contexts	0.619	0.218	2.658	0.59	0.822
	Creativity and innovation contexts	0.603	0.219	2.159	0.41	
	Economic contexts	0.509	0.226	1.467	0.66	
	Organizational climate	0.686	0.228	2.351	0.51	
	Political contexts	0.662	0.311	3.462	0.63	
	Legal contexts	0.567	0.298	2.259	0.61	
	Research contexts	0.598	0.289	2.561	0.51	

influence on each other and in this way the hypotheses are correctly confirmed. If the value of the Q^2 index is positive, it indicates that the model fit is appropriate and the model has adequate predictive power.

2-2) Structural measurement model of contextual conditions affecting the entrepreneurial university and knowledge commercialization

The results of examining the validity of the factor structure and evaluating the model for measuring the contextual conditions affecting the entrepreneurial university and knowledge commercialization at the Islamic Azad University of Khuzestan using confirmatory factor analysis were presented in two parts:

2-2-1) Validity and reliability of the measurement model:

Based on the results, the 7 contextual conditions construct variables, namely social and cultural contexts, creativity and innovation contexts, economic contexts, organizational climate, political contexts, and research contexts, play a significant role in measuring this construct. This confirms that the validity of the contextual conditions construct measurement model is confirmed. To evaluate the reliability of the construct, the composite reliability criterion (CR) and the coefficient of determination (R^2) were used to evaluate the reliability of the variable. The results are presented in Table 4. A CR value above 0.7 indicates that the reliability of the desired construct is desirable. Also, the higher the R^2 value for each variable, the higher the reliability of that variable in measuring the relevant construct.

The structural measurement model of contextual conditions affecting the entrepreneurial university and knowledge commercialization at the Islamic Azad University of Khuzestan is shown in Figure 2.

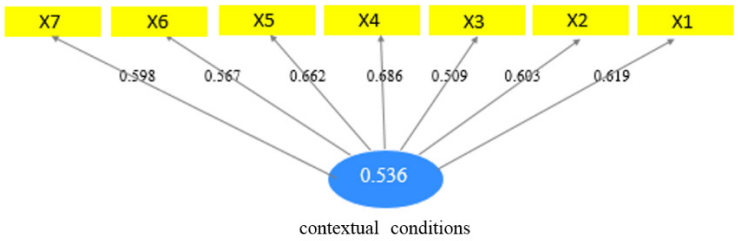

Figure 2. Structural measurement model of contextual conditions affecting the entrepreneurial university and knowledge commercialization at the Islamic Azad University of Khuzestan

Table 5. R^2, Q^2, and GOF values for contextual condition model fit

Construct	R^2	Q^2	GOF
Contextual condition	0.723	0.528	0.513

Table 6. Evaluation of the factor measurement model of intervening factors using confirmatory factor analysis

Construct	Variable	Standardized factor loading	Standard error	t	R^2	CR
Intervening factors	Developing an entrepreneurial ecosystem	0.563	0.240	3.455	0.51	0.781
	Paying attention to peripheral factors	0.549	0.252	2.257	0.48	
	Creating motivation and encouragement	0.458	0.341	3.219	0.66	
	Forming a professors' database	0.671	0.259	2.241	0.48	

2.2.2 Assessment of the fit of the measurement model of contextual conditions effective on entrepreneurial university and commercialization of knowledge

Based on the results of Table 5, the values of R^2, Q^2 and GOF have acceptable and suitable values and the model has a good fit.

2-3) Structural measurement model of intervening factors affecting the entrepreneurial university and knowledge commercialization

The results of examining the validity of the factor structure and evaluating the factor measurement model of the intervening factors affecting the entrepreneurial university and knowledge commercialization at the Islamic Azad University of Khuzestan using confirmatory factor analysis were presented in two parts:

2-3-1) Validity and reliability of the measurement model:

In order to examine the validity of the model for measuring the intervening factors affecting the implementation of the entrepreneurial university at the Islamic Azad University of Khuzestan, it is necessary to assess the extent and significance of the relationship between each observed variable and the interfering factors structure. The extent of this relationship was measured and analyzed by the factor loading of each variable on the interfering factors structure. The greater the observed factor loading of a variable on a factor, the greater the weight it will impose on that variable. In Table 6, the standardized factor loadings of the variables belonging to the interfering factors structure were determined and the significance of the difference with zero was determined using the t-test. Based on the results obtained for each variable, it was shown that the load of that variable on the interfering factors structure was significant at the 5% error level. Accordingly, the four variables of the interfering factors structure, namely, developing an entrepreneurial ecosystem, paying attention to peripheral factors, creating motivation and encouragement, and forming a professors' database, have a significant contribution to measuring this structure. This confirms that the validity of the model for measuring the interfering factors structure is confirmed. To assess the reliability of the construct, the composite reliability criterion (CR) was used, and the coefficient of determination (R2) was used to assess the reliability of the variable. The results are presented in Table 6. A CR value above 0.7 indicates that the reliability of the construct in question is desirable. Also, the higher the R^2 value for each variable, the higher the reliability of that variable in measuring the relevant construct.

The structural measurement model of intervening factors affecting entrepreneurial university and knowledge commercialization at the Islamic Azad University of Khuzestan is shown in Figure 3.

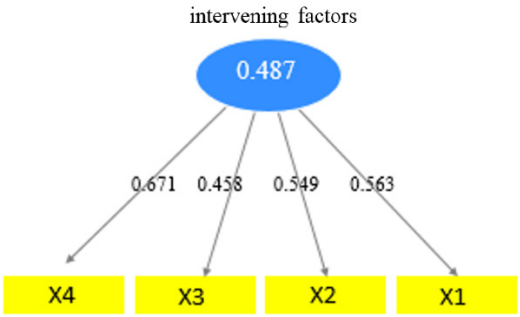

Figure 3. Structural measurement model of intervening factors affecting the entrepreneurial university and knowledge commercialization at the Islamic Azad University of Khuzestan

Table 7. R^2, Q^2, and GOF values for intervening factors model fit

Construct	R^2	Q^2	GOF
Intervening factors	0.721	0.549	0.621

Table 8. Evaluation of the factor measurement model of axial phenomenon using confirmatory factor analysis

Construct	Variable	Standardized factor loading	Standard error	t	R^2	CR
Axial phenomenon	Entrepreneurial education and research	0.501	0.240	3.455	0.51	0.706
	Knowledge commercialization	0.612	0.281	2.385	0.61	
	Entrepreneurial organizational culture	0.541	0.312	3.982	0.57	
	Entrepreneurial organizational approach	0.609	0.267	3.621	0.51	
	Entrepreneurial organizational policy	0.506	0.209	1.986	0.49	
	Entrepreneurial organizational structure	0.511	0.328	2.549	0.62	
	Entrepreneurial financial resources	0.604	0.279	2.284	0.56	
	Entrepreneurial vision	0.602	0.239	1.993	0.63	

2.3.2 Assessment of the fit of the measurement model of intervening factors effective on entrepreneurial university and knowledge commercialization at the Islamic Azad University of Khuzestan

Based on the results of Table 7, the values of R^2, Q^2 and GOF have acceptable and suitable values and the model has a good fit.

2-4) Structural measurement model of axial phenomenon affecting the entrepreneurial university and knowledge commercialization

The results of examining the validity of the factor structure and evaluating the factor measurement model of the axial phenomenon affecting the entrepreneurial university and knowledge commercialization at the Islamic Azad University of Khuzestan using confirmatory factor analysis were presented in two parts:

2-4-1) Validity and reliability of the measurement model:

In order to examine the validity of the model for measuring the axial phenomenon affecting the implementation of the entrepreneurial university at the Islamic Azad University of Khuzestan, it is necessary to assess the extent and significance of the relationship between each observed variable and the axial phenomenon structure. The extent of this relationship was measured and analyzed by the factor loading of each variable on the axial phenomenon structure. The greater the observed factor loading of a variable on a factor, the greater the weight it will impose on that variable. In Table 6, the standardized factor loadings of the variables belonging to the axial phenomenon structure were determined and the significance of the difference

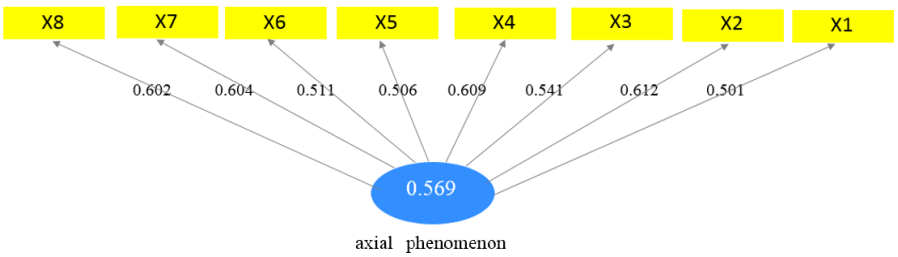

Figure 4. Structural measurement model of axial phenomenon of entrepreneurial university and knowledge commercialization at the Islamic Azad University of Khuzestan

Table 7. R^2, Q^2, and GOF values for intervening factors model fit

Construct	R^2	Q^2	GOF
Axial phenomenon	0.729	0.661	0.567

Table 8. Evaluation of the factor measurement model of strategies using confirmatory factor analysis

Construct	Variable	Standardized factor loading	Standard error	t	R^2	CR
Strategies	Setting development and creativity and innovation goals leading to entrepreneurship	0.592	0.221	2.381	0.63	0.697
	Training and empowering human resources in the field of entrepreneurship	0.554	0.281	2.354	0.60	
	Developing a curriculum with an entrepreneurial approach	0.627	0.298	2.371	0.54	
	Promoting the university's relationship with industry and society	0.598	0.312	1.928	0.62	
	Developing a university entrepreneurship strategic document	0.608	0.308	1.845	0.69	
	Supporting applied entrepreneurial research	0.498	0.281	2.127	0.71	

with zero was determined using the t-test. Based on the results obtained for each variable, it was shown that the load of that variable on the axial phenomenon structure was significant at the 5% error level. Accordingly, the eight variables of the axial phenomenon, namely, entrepreneurial education and research, knowledge commercialization, entrepreneurial organizational culture, entrepreneurial organizational approach, entrepreneurial organizational policy, entrepreneurial organizational structure, entrepreneurial financial resources, and entrepreneurial vision, have a significant contribution to measuring this structure. This confirms that the validity of the model for measuring the axial phenomenon is confirmed. To assess the reliability of the construct, the composite reliability criterion (CR) was used, and the coefficient of determination (R^2) was used to assess the reliability of the variable. The results are presented in Table 6. A CR value above 0.7 indicates that the reliability of the construct in question is desirable. Also, the higher the R^2 value for each variable, the higher the reliability of that variable in measuring the relevant construct.

The structural measurement model of axial phenomenon of entrepreneurial university and knowledge commercialization at the Islamic Azad University of Khuzestan is shown in Figure 3.

2.4.2 Assessment of the fit of the measurement model of axial phenomenon of entrepreneurial university and knowledge commercialization at the Islamic Azad University of Khuzestan

Based on the results of Table 9, the values of R^2, Q^2 and GOF have acceptable and suitable values and the model has a good fit.

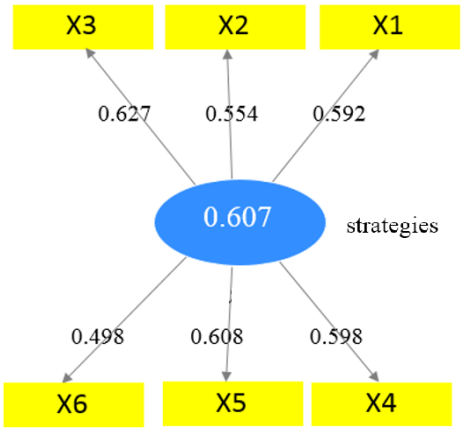

Figure 5. Structural measurement model of strategies of entrepreneurial university and knowledge commercialization at the Islamic Azad University of Khuzestan

Table 9. R^2, Q^2, and GOF values for intervening factors model fit

Construct	R^2	Q^2	GOF
Strategies	0.724	0.615	0.611

2-5) Structural measurement model of strategies effective on entrepreneurial university and knowledge commercialization

The results of examining the validity of the factor structure and evaluating the factor measurement model of the **strategies effective on** entrepreneurial university and knowledge commercialization at the Islamic Azad University of Khuzestan using confirmatory factor analysis were presented in two parts:

2-5-1) Validity and reliability of the measurement model:

In order to examine the validity of the model for measuring the strategies effective on implementation of the entrepreneurial university at the Islamic Azad University of Khuzestan, it is necessary to assess the extent and significance of the relationship between each observed variable and the strategies. The extent of this relationship was measured and analyzed by the factor loading of each variable on the strategies. The greater the observed factor loading of a variable on a factor, the greater the weight it will impose on that variable. In Table 8, the standardized factor loadings of the variables belonging to the strategies structure were determined and the significance of the difference with zero was determined using the t-test. Based on the results obtained for each variable, it was shown that the load of that variable on the strategies structure was significant at the 5% error level. Accordingly, the six variables of the strategies, namely, setting development and creativity and innovation goals leading to entrepreneurship, training and empowering human resources in the field of entrepreneurship, developing a curriculum with an entrepreneurial approach, promoting the university's relationship with industry and society, developing a university entrepreneurship strategic document, and supporting applied entrepreneurial research, have a significant contribution to measuring this structure. This confirms that the validity of the model for measuring the axial phenomenon is confirmed. To assess the reliability of the construct, the composite reliability criterion (CR) was used, and the coefficient of determination (R^2) was used to assess the reliability of the variable. The results are presented in Table 6. A CR value above 0.7 indicates that the reliability of the construct in question is desirable. Also, the higher the R^2 value for each variable, the higher the reliability of that variable in measuring the relevant construct.

The structural measurement model of strategies of entrepreneurial university and knowledge commercialization at the Islamic Azad University of Khuzestan is shown in Figure 4.

2.5.2 Assessment of the fit of the measurement model of strategies of entrepreneurial university and knowledge commercialization at the Islamic Azad University of Khuzestan

Based on the results of Table 9, the values of R^2, Q^2 and GOF have acceptable and suitable values and the model has a good fit.

2-6) Structural measurement consequences model of entrepreneurial university and knowledge commercialization

The results of examining the validity of the factor structure and evaluating the factor measurement consequences model of entrepreneurial university and knowledge commercialization at the Islamic Azad University of Khuzestan using confirmatory factor analysis were presented in two parts:

2-6-1) Validity and reliability of the measurement model:

In order to examine the validity of the model for measuring the consequences of implementation of the entrepreneurial

Table 10. Evaluation of the factor measurement model of consequences using confirmatory factor analysis

Construct	Variable	Standardized factor loading	Standard error	t	R^2	CR
Strategies	Commercialization of research and entrepreneurship	0.592	0.265	2.317	0.52	0.681
	Development of entrepreneurial businesses and increased employment	0.544	0.289	2.619	0.65	
	Promotion of productivity and economic growth	0.627	0.321	3.347	0.614	
	Matching university output with the needs of society and industry	0.598	0.285	2.512	0.52	
	Improving educational quality and social development	0.608	0.179	3.421	0.642	
	Promoting innovative work and effort	0.498	0.238	3.528		

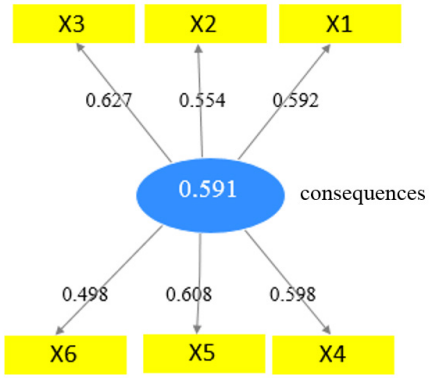

Figure 6. Structural measurement model of consequences of entrepreneurial university and knowledge commercialization at the Islamic Azad University of Khuzestan

Table 11. R^2, Q^2, and GOF values for intervening factors model fit

Construct	R^2	Q^2	GOF
Strategies	0.698	0.507	0.591

university at the Islamic Azad University of Khuzestan, it is necessary to assess the extent and significance of the relationship between each observed variable and the consequences. The extent of this relationship was measured and analyzed by the factor loading of each variable on the consequences. The greater the observed factor loading of a variable on a factor, the greater the weight it will impose on that variable. In Table 10, the standardized factor loadings of the variables belonging to the consequences structure were determined and the significance of the difference with zero was determined using the t-test. Based on the results obtained for each variable, it was shown that the load of that variable on the consequences structure was significant at the 5% error level. Accordingly, the six variables of the consequences, namely, commercialization of research and entrepreneurship, development of entrepreneurial businesses and increased employment, promotion of productivity and economic growth, matching university output with the needs of society and industry, improving educational quality and social development, and promoting innovative work and effort, have a significant contribution to measuring this structure. This confirms that the validity of the model for measuring the consequences is confirmed. To assess the reliability of the construct, the composite reliability criterion (CR) was used, and the coefficient of determination (R^2) was used to assess the reliability of the variable. The results are presented in Table 6. A CR value above 0.7 indicates that the reliability of the construct in question is desirable. Also, the higher the R^2 value for each variable, the higher the reliability of that variable in measuring the relevant construct.

The structural measurement model of consequences of entrepreneurial university and knowledge commercialization at the Islamic Azad University of Khuzestan is shown in Figure 5.

2.6.2 Assessment of the fit of the measurement model of consequences of entrepreneurial university and knowl-

Table 12. R^2, Q^2, and GOF values for fit the entire implementing the Entrepreneurial University and knowledge commercialization model

Construct	R^2	Q^2	GOF
Entrepreneurial university implementation	0.737	0.609	0.661

Table 13. The results of research hypothesis testing

Independent variable	Dependent variable	Path coefficient	t-value	R^2	Result
Causal conditions	Implementing the Entrepreneurial University and knowledge commercialization	0.618	3.598	0.492	Confirmed
Contextual conditions		0.608	3.759	0.688	Confirmed
Intervening factors		0.664	4.651	0.461	Confirmed
Contextual conditions	Strategies	0.609	3.168	0.523	Confirmed
Intervening factors	Strategies	0.771	2.892	0.611	Confirmed
Strategies	consequences	0.591	3.981	0.581	Confirmed

edge commercialization at the Islamic Azad University of Khuzestan

Based on the results of Table 11, the values of R^2, Q^2 and GOF have acceptable and suitable values and the model has a good fit.

3) Validation and determination of the degree of suitability of the proposed model for implementing the Entrepreneurial University and knowledge commercialization at Khuzestan Islamic Azad University

To test the research model and hypotheses, structural equation modeling was used using Smart PLS3 software. The fit of the structural model was also analyzed using R^2, Q^2, and GOF criteria. Based on the results in Table 12, the fit criteria have acceptable values.

The research hypotheses explaining the role of constructs in a paradigmatic model were tested. The results are presented in Table 13 and the final model in Figures 7 and 8. The results of Table 13 showed that causal conditions (β=0.618), contextual conditions (β=0.608) and intervening factors (β=0.664) had a positive and significant effect on Implementing the Entrepreneurial University and knowledge commercialization. Also, based on the results, it can be concluded that contextual conditions (β=0.609) and intervening factors (β=0.771) have a positive and significant effect on Implementing the Entrepreneurial University and knowledge commercialization strategies.

It can be stated that 56.9% of the changes in the implementation of the entrepreneurial university and the commercialization of knowledge at the Islamic Azad University of Khuzestan are explained by the independent variables of causal conditions, background conditions, and intervening factors. Also, 60.7% of the changes in strategies are affected by the status of the central phenomenon, background conditions, and intervening factors, and finally 59.1% of the changes in the consequences of the implementation of the entrepreneurial university and the commercialization of knowledge are due to the application of the identified strategies.

CONCLUSION AND RECOMMENDATION

Based on the results of the research, the identified causal conditions had a significant role in the implementation of the entrepreneurial university and knowledge commercialization at the Islamic Azad University of Khuzestan. Therefore, it is recommended that the following issues identified based on the experts' opinions be considered by planners:

1) Application of entrepreneurial management and leadership methods: attention to participatory management, transformational and effective management, and management based on creativity and entrepreneurship

2) Institutionalization of entrepreneurship: promotion of creativity and innovation values, training in financial skills, marketing, and entrepreneurial management, providing access to financial, business, and collaborative work consultations, and establishing support networks

3) Socialization: strengthening entrepreneurial identity, changing attitudes and beliefs towards entrepreneurship, developing an entrepreneurial communication network, promoting learning and accepting a culture of entrepreneurial values and behavior

4) Appropriate educational content for entrepreneurship: teaching the principles, concepts, and process of entrepreneurship, business planning training, sales marketing training, training in improving personal development skills, financial management training, and

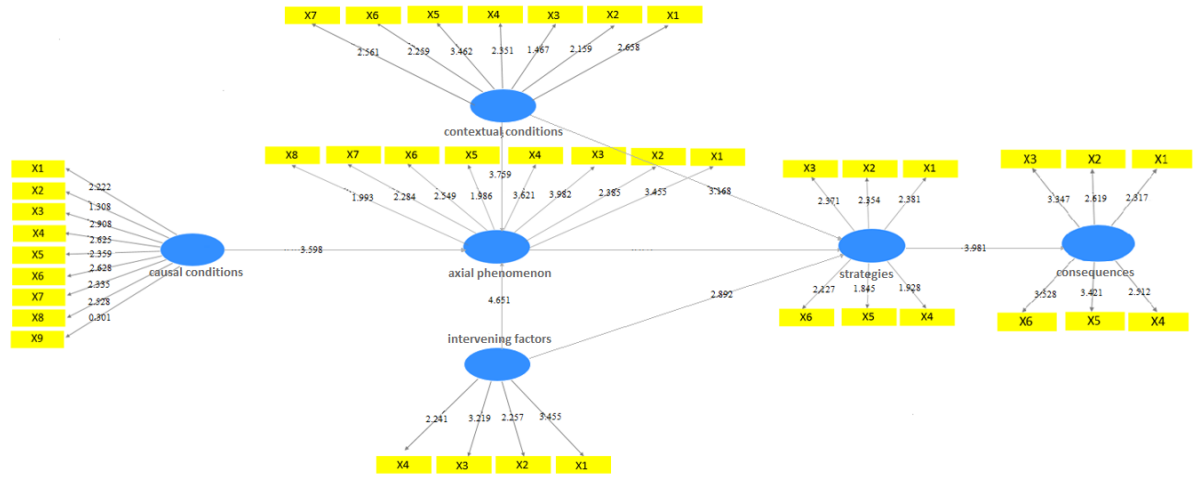

Figure 7. t-values for relationships between factors and variables of the causal model of Implementing the Entrepreneurial University and knowledge commercialization

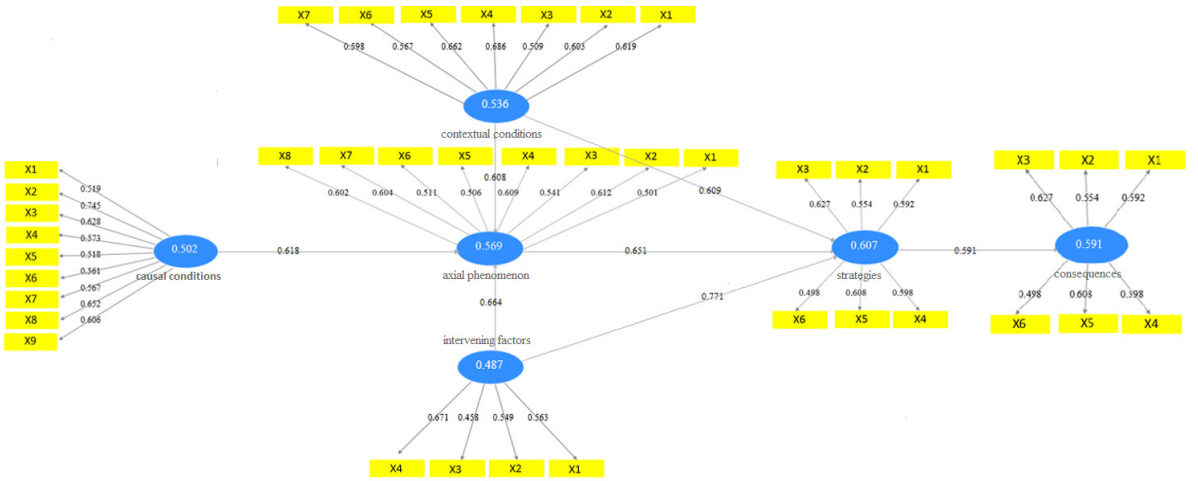

Figure 8. Standardized loading values for each of the factors and variables of the causal model of Implementing the Entrepreneurial University and knowledge commercialization

social entrepreneurship training

5) Facilitation of entrepreneurship directives and regulations: drafting directives to facilitate obtaining licenses, supporting new knowledge-based businesses, supporting female student entrepreneurs, and facilitating Administrative processes and removing legal obstacles

6) Development of technological infrastructure: Improving access to technology such as high-speed internet, creating a network space between entrepreneurs, specialized training in new technologies

7) Risk-taking, innovation and creativity: Facilitating environmental conditions for risk acceptance, encouraging creativity and continuous learning, and developing participation in creating innovation

8) Continuous communication with industry: Holding continuous meetings with industry, organizing training sessions for students in industry, and identifying the needs of the industry sector and trying to meet them

9) Financial support and facilities: Paying attention to entrepreneurship in university budgeting, allocating a portion of knowledge-based income to entrepreneurship, and providing support facilities for entrepreneurs

Based on the results of the research, the identified contextual conditions had a significant role in the implementation of the Entrepreneurial University and the commercialization of knowledge at Khuzestan Islamic Azad University. Therefore, it is recommended that the following issues identified based on the experts' opinions be considered by planners:

1) Organizational climate: governance of entrepreneurship in the university environment, entrepreneurship as a value in the university, importance given by university administrators to student and faculty entrepreneurship, and holding ideation conferences

2) Context of creativity and innovation: encouraging ideation and the emergence of creative behavior, creating a think tank and the necessary space for ideation, the existence of a spirit of creativity and innovation among university administrators, and the existence of sufficient motivation for entrepreneurship

3) Social and cultural context: developing an entrepreneurial culture, partnering with local institutions in the direction

of entrepreneurship, entrepreneurship networking, creating and developing entrepreneurship scientific associations, creating employment opportunities and reducing poverty
4) Economic context: economic needs assessment and market assessment, allocating the necessary budget in the field of entrepreneurship, access to financial resources, adapting to market conditions, improving the ability to market and sell products
5) Political context: facilitating tax policies, improving policies for the development of creative businesses, support and facilitation policies, Policies to support idea generation and intellectual property
6) Legal context: Legal protections, familiarity with labor laws and contracts, familiarity with intellectual property laws
7) Research context: Development of entrepreneurial startups, entrepreneurial competitions and holding entrepreneurial events
Considering the identification of intervening factors affecting the implementation of the Entrepreneurial University at the Islamic Azad University of Khuzestan, the following measures are suggested:
1) Motivation and encouragement: Encouraging and encouraging entrepreneurial attitudes, awarding points to entrepreneurial activities, annually selecting top university entrepreneurs, and providing facilities for entrepreneurial research projects
2) Establishing a professor database: Identifying entrepreneurial professors, identifying professors who are capable of solving industry problems, identifying professors who are capable of solving community problems
3) Developing an entrepreneurial ecosystem: Paying attention to growth centers, developing knowledge-based companies, recognizing industry needs, providing financial and facility support to growth centers and start-up companies, and supporting startups
4) Paying attention to peripheral factors: Changing society's perspective on entrepreneurship, the role of mass media, the role of cyberspace, and public education for culture building
Considering the identification of effective strategies for the implementation of the Entrepreneurial University at the Islamic Azad University of Khuzestan, the following measures are suggested:
1) Training and empowering human resources in the field of entrepreneurship: Holding applied training courses Entrepreneurship for students, holding applied entrepreneurship training courses for professors, conducting workshops for students in the industry sector, establishing research laboratories in universities, developing educational research centers in universities
2) Developing a curriculum with an entrepreneurial approach: paying attention to entrepreneurship in the lesson plans of various educational disciplines, making the practical part of the courses workshop-oriented, making the academic curriculum skill-oriented, implementing the workshop part of technical and engineering courses in the industry sector
3) Setting development goals and creativity and innovation leading to entrepreneurship: paying attention to creativity and innovation in the educational goals of the curriculum, implementing various ideation events, holding workshops to foster creativity and ideation, supporting creativity and ideation until it becomes a phenomenon, supporting innovations that lead to the development of entrepreneurship.
4) Supporting applied entrepreneurial research: Supporting research projects in line with the needs of the industry, supporting research projects in line with the needs of society, supporting research projects in line with entrepreneurial businesses
5) Developing a strategic document for university entrepreneurship: Developing an entrepreneurial vision for the university, paying attention to upstream documents supporting entrepreneurship, analyzing the internal and external environment in line with entrepreneurship development, identifying appropriate strategies along with an action plan for entrepreneurship development and operationalizing entrepreneurship development strategies
6) Improving the university's relationship with industry and society: Holding continuous meetings with the industry sector and assessing their needs, developing a curriculum tailored to the needs of the industry and with their participation, using experienced artisans in training the workshop sector and practical courses, and recognizing the needs of the community and implementing a curriculum tailored to the needs.
The most important limitations of the research were the dispersion of university units and the difficulty of respondents accessing the questionnaires. Also, the most important future research directions are as follows:
Measuring the obstacles to the realization of the entrepreneurial university
Identifying the factors affecting the development of knowledge-based companies in universities,
Mechanisms for strengthening entrepreneurial identity in universities
Results focus heavily on statistical reporting with limited theoretical or managerial discussion.
English writing quality needs improvement in some sections (repetitions, ambiguities, overly long sentences).
No mention of research limitations or future research directions.

Authors' Contributions: Alireza Shakerian: Writing – original draft, Formal analysis, Visualization. Seyed Alireza Alavi: Writing – original draft, Writing – review and editing, project administration. Mohammad Reza Farhadpour: Validation, Methodology, conceptualization.

Data Availability: The data that support the findings of this study are available from the corresponding author, upon reasonable request.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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