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IDENTIFICATION OF STRUCTURAL FACTORS AFFECTING THE CREATION OF INTERDISCIPLINARY RESEARCH-BASED UNIVERSITY IN THE WORLD

Asefeh Mostajeran Gortani[1], Nader Gholi Ghourchian[2] and Fattah Nazem[1]
[1]*Department of Education, College of Education and Counselling, Roudehen Branch, Islamic Azad University, Roudehen, Iran*
[2]*Department of Management, Tehran Science and Research Branch, Islamic Azad University (IAU), Tehran, Iran*
Author for Correspondence

ABSTRACT
The main objective of this study is to identify the structural factors affecting the creation of interdisciplinary research-based university in the world. The research is applied in terms of objective, the descriptive-survey according to the implementation and has the combined type. The statistical population consists of all top managers and faculty members at universities of Tehran including the state and Islamic Azad Universities of District 8. The research sample consists of 515 people (men and women) which are selected through stratified random sampling during the academic year of 2014-15. The interviews and researcher-made questionnaire are the research tools. The validity of tools (content and construct) is approved by advisor and supervisor professors and three experts in this field and the reliability of questionnaire is obtained equal to 0.85 and confirmed by Cronbach's alpha. The descriptive and inferential statistics are utilized for data analysis and the exploratory and confirmatory factor analysis methods in LISREL software are applied to find the effective factors. The results indicate that the following systems are effective in creating the interdisciplinary university structure: 1- leadership and management, 2- infrastructural structures and technologies, 3- The way of developing the objectives, program and curriculum, 4- Financing and the way of budgeting.

Keywords: Structural Factors, University, Interdisciplinary Research

INTRODUCTION
The highly variable context of science and technology in this century has created numerous challenges for education of higher education systems. One of the major challenges in education is to find the solutions for increasing the students' flexibility and adaptability to such this changing world (Khorsandi, 2008).
The perspective of university system is changing from the interest in a mere theoretical and expertise knowledge with a separate structure of traditional scientific disciplines to a new approach on the construction of links between the scientific disciplines. This change is inspired by "Marshall McLuhan" theory caused by passing the mechanized period (leading to a professional, sectional and minor prospective) to the moment period of electricity which creates the coincidence of "data transfer" and "time network communication" inter the scientific specialized disciplines (RegeColet, 2002). It should be noted that the new methods are emerged for learning and higher education in recent few decades and the effective social survival is scientifically impossible without interdiseplinary expansion. Klein and Newell (1997) and Newell (2001) also believe that the interdisciplinary education increases the students' ability to understand the technical issues, tolerance of ambiguity and sensitivity to ethical issues. In this regard, the structure of universities should be changed and designed in a way they meet the needs of digital generation. This study seeks to achieve the structural characteristics of interdisciplinary university. According to the mentioned issues and the interdisciplinary presence for more than three decades in the top universities of the world, it can be inferred that the use of interdisciplinary education at these universities has been institutional and inevitable and the developing countries should be developed by modeling and localizing the applied methods at leading universities in the field of interdisciplinary research.

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MATERIALS AND METHODS

The research is applied in terms of objective, the descriptive-survey according to the implementation and has the combined type. The statistical population consists of all top managers and faculty members at universities of Tehran including the state and Islamic Azad Universities of District 8. The research sample consists of 515 people (men and women) which are selected through stratified random sampling during the academic year of 2014-15. The interviews and researcher-made questionnaire are the research tools. The validity of tools (content and construct) is approved by advisor and supervisor professors and three experts in this field and the reliability of questionnaire is obtained equal to 0.85 and confirmed by Cronbach's alpha. The descriptive and inferential statistics are utilized for data analysis and the exploratory and confirmatory factor analysis methods in LISREL software are applied to find the effective factors.

RESULTS AND DISCUSSION
Results

Data Analysis for Research Question: What are the structural dimensions, indices and standards associated with the interdisciplinary research in the world?

To answer this question, first the interdisciplinary dimensions, indices and standards are obtained as the questionnaire by investigating the research literature and existing theoretical principles and provided for experts. After collecting data, the confirmatory factor analysis method (principal component analysis or PCA) is utilized at two stages for validating the questionnaire, as well as determining the components in order to: 1) comply the extracted components and factors with 12 components and 4 main factors obtained through the analysis of experimental and theoretical background as well as the experts' opinions; 2) determine the components of interdiseplinary studies in country, 3) verify the construct validity of questionnaire.

At the second stage, 12 components extracted in first-order exploratory factor analysis are subjected to the principal component analysis in order to make the extracted factors comply with 4 factors of which are obtained from investigating the theoretical and empirical literature as well as the experts' opinions.

The KMO sizes and results of Bartlett's Test of Sphericity for components of interdisciplinary research are shown in Table 2.

Table 2: KMO sizes and results of Bartlett's Test of Sphericity for components of interdisciplinary research

Adequacy of sampling	0.917	
	Chi-square	13474.86
Bartlett's Test of Sphericity	Degrees of freedom	300
	Significance level	0.000

As shown in this table, the KMO value is equal to 0.97 which is close to 1. Furthermore, the significance level of Bartlett's Test of Sphericity is equal to zero which is less than 0.05 indicating that it is statistically significant. Thus, it can be concluded based on both criteria that the implementation of factor analysis is justifiable based on the correlation matrix obtained in sample group.

The second output of exploratory factor analysis is called the table of Communalities indicating the correlation coefficients of variables. If this number is smaller than 0.5 in a variable, that variable (question) should be removed and the exploratory factor analysis be re-done. The more the values of communalities are increased, the more the extracted factors show better variables (Habibpour and Safari, 2012).

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Table 3: Communalities for extracting 8 factors

	Initial communalities	Extracted communalities
Regulatory strategies and decisions for change	1	0.86
Team and participative leadership	1	0.85
Selectivity of designing the procedures and implementation of standards	1	0.89
Designing and supplying the infrastructures to use the technologies	1	0.91
Redefining the system of designing the structure and organization	1	0.80
Designing the policy of mission, vision and objectives	1	0.90
Designing and rethinking the objectives and strategies	1	0.86
Capacity building and budget forecasting	1	0.87
Institutionalizing the investments attraction and utilizing the financial incentives	1	0.89
Creating the necessary infrastructures to improve and strengthen the financial resources	1	0.89
Designing and implementing the internationalization and virtualization strategy of education	1	0.86
Participation and preparation of necessary infrastructures	1	0.88

According to the table above, the values of extracted communalities from the analysis of components is higher than 0.5 which confirms the appropriateness of data and factor analysis.

According to the implementation of factor analysis on the 12 identified components in the first-order exploratory analysis, 4 main factors are identified and named based on the literature and described in the following table.

Table 4: Identified factors by analysis of main elements and variables loaded on them

Structural factors	Structural component of interdisciplinary research- based university
Factor A: Management and leadership system	1. Multitasking performance with the aim at development and empowerment; 2. Regulatory strategies and decisions for change; 3. Team and participative leadership (by changing the individual mental structure)
Factor B: Structural system, infrastructures and organizational entity	4. Selectivity of designing the procedures and implementation of standards; 5. Designing and supplying the infrastructures to use the best technologies and IT equipment; 6. Redefining the system of designing the structure and organization
Factor C: System of developing the policy, objectives, program and curriculum based on maintaining the top position	7. Designing the policy of appropriate or interdisciplinary mission, vision and objectives; 8. Designing and rethinking the interdisciplinary objectives, strategies and curricula; 9. Principles of designing and rethinking in the field interdisciplinary curricula
Factor D: Financial System, Budgeting	10. Capacity building and budget forecasting; 11. Institutionalizing the investments attraction and utilizing the financial incentives; 12. Creating the necessary infrastructures to improve and strengthen the financial resources

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Data analysis in the field of second research question: How is the structural status of interdisciplinary research at Universities of Iran?

After identifying the components of interdisciplinary research according to the experts' views, the descriptive indices of each factor and its questionnaire components are first provided in both current and the ideal status, and then the significance of extracted components is investigated in terms of obtained mean through one-sample t-test. In this method, the observed mean of each component is compared with expected mean (the average score of scale which is equal to 3).

Table 5: Descriptive indices in both the current and ideal status based on the extracted components of Factor A (management and leadership system)

Current status				Component	Ideal status			
Standard deviation	Mean	Sample size	Number of items		Number of items	Sample size	Mean	Standard deviation
0.59	2.09	525	4	Multitasking performance with the aim at development and empowerment	4	525	4.42	0.51
0.58	1.98	525	4	Regulatory strategies and decisions for change	4	525	4.42	0.45
0.51	1.84	525	4	Team and participative leadership by changing the individual mental structure	4	525	4.33	0.74
0.47	1.97	525	12	Factor A	12	525	4.39	0.44

According to the table above:

The importance of component, namely, "The multitasking performance with the aim at development and empowerment" is estimated equal to 2.09±0.59 in current status and 4.42±0.51 in ideal status indicating that the importance of this component in current status is less than the average value (3) and also has a significant difference from ideal status.

The importance of component, namely, "The regulatory strategies and decisions for change" is estimated equal to 1.98±0.58 in current status and 4.42±0.45 in ideal status indicating that the importance of this component in current status is less than the average value (3) and also has a significant difference from ideal status.

The importance of component, namely, "The team and participative leadership by changing the individual mental structure" is estimated equal to 1.84±0.51 in current status and 4.33±0.74 in ideal status indicating that the importance of this component in current status is less than the average value (3) and also has a significant difference from ideal status.

The importance of Factor A (management and leadership system) is estimated equal to 1.97±0.47 in current status indicating that the importance of this factor in current status is less than the average value (3) and also has a significant difference from ideal status (4.39).

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Table 6: Descriptive indices in both the current and ideal status based on the extracted components of Factor B (Structural system, infrastructures and organizational entity)

Current status				Component	Ideal status			
Standard deviation	**Mean**	**Sample size**	**Number of items**		**Number of items**	**Sample size**	**Mean**	**Standard deviation**
0.58	1.87	525	4	Redefining the system of designing the structure and organization and redesigning the university system and mechanisms	4	525	4.03	0.65
0.56	1.98	525	4	Designing and supplying the infrastructures to use the best technologies and IT equipment	4	525	4.26	0.66
0.58	1.66	525	4	Selectivity of designing the procedures and implementation of standards	4	525	4.44	0.66
0.45	1.84	525	12	Factor B	12	525	4.24	0.52

According to the table above:

The importance of component, namely, "Redefining the system of designing the structure and organization and redesigning the university system and mechanisms" is estimated equal to 1.87 ± 0.58 in current status and 4.03 ± 0.65 in ideal status indicating that the importance of this component in current status is less than the average value (3) and also has a significant difference from ideal status.

The importance of component, namely, "Designing and supplying the infrastructures to use the best technologies and IT equipment" is estimated equal to 1.98 ± 0.56 in current status and 4.26 ± 0.66 in ideal status indicating that the importance of this component in current status is less than the average value (3) and also has a significant difference from ideal status.

The importance of component, namely, "Selectivity of designing the procedures and implementation of standards" is estimated equal to 1.66 ± 0.58 in current status and 4.44 ± 0.66 in ideal status indicating that the importance of this component in current status is less than the average value (3) and also has a significant difference from ideal status.

The importance of Factor B (Structural system, infrastructures and organizational entity) is estimated equal to 1.84 ± 0.45 in current status indicating that the importance of this factor in current status is less than the average value (3) and also has a significant difference from ideal status (4.24)

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Table 7: Descriptive indices in both the current and ideal status based on the extracted components of Factor C (System of developing the policy, objectives, program and curriculum based on maintaining the top position)

Current status				**Component**	**Ideal status**			
Standard deviation	**Mean**	**Sample size**	**Number of items**		**Number of items**	**Sample size**	**Mean**	**Standard deviation**
0.72	1.89	525	4	Designing and rethinking the interdisciplinary objectives, strategies and curricula	4	525	4.37	0.65
0.61	2.00	525	4	Designing the policy of appropriate or interdisciplinary mission, vision and objectives	4	525	4.23	0.60
0.58	1.76	525	4	Principles of designing and rethinking in the field interdisciplinary curricula	4	525	4.08	0.85
0.57	1.89	525	13	Factor C	13	525	4.22	0.58

According to the table above:

The importance of component, namely, "Designing the policy of appropriate or interdisciplinary mission, vision and objectives" is estimated equal to 1.89±0.72 in current status and 4.37±0.65 in ideal status indicating that the importance of this component in current status is less than the average value (3) and also has a significant difference from ideal status.

The importance of component, namely, "Designing and rethinking the interdisciplinary objectives, strategies and curricula" is estimated equal to 2.00±0.61 in current status and 4.23±0.60 in ideal status indicating that the importance of this component in current status is less than the average value (3) and also has a significant difference from ideal status.

The importance of component, namely, "Principles of designing and rethinking in the field interdisciplinary curricula" is estimated equal to 1.76±0.58 in current status and 4.08±0.85 in ideal status indicating that the importance of this component in current status is less than the average value (3) and also has a significant difference from ideal status.

The importance of Factor C (System of developing the policy, objectives, program and curriculum based on maintaining the top position) is estimated equal to 1.89±0.57 in current status indicating that the importance of this component in current status is less than the average value (3) and also has a significant difference from ideal status (4.22)

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Table 8: Descriptive indices in both the current and ideal status based on the extracted components of Factor D (Financial System, Budgeting)

Current status					**Ideal status**			
Standard deviation	**Mean**	**Sample size**	**Number of items**	**Component**	**Number of items**	**Sample size**	**Mean**	**Standard deviation**
0.67	1.80	525	6	Capacity building and budget forecasting	6	525	4.29	0.75
0.51	1.55	525	3	Institutionalizing the investments attraction and utilizing the financial incentives	3	525	4.18	0.82
0.75	1.72	525	3	Creating the necessary infrastructures to improve and strengthen the financial resources	3	525	4.22	0.69
0.57	1.69	525	12	Factor D	12	525	4.23	0.67

According to the table above:

The importance of component, namely, "Capacity building and budget forecasting" is estimated equal to 1.80±0.67 in current status and 4.29±0.75 in ideal status indicating that the importance of this component in current status is less than the average value (3) and also has a significant difference from ideal status.

The importance of component, namely, "Institutionalizing the investments attraction and utilizing the financial incentives" is estimated equal to 1.55±0.51 in current status and 4.18±0.82 in ideal status indicating that the importance of this component in current status is less than the average value (3) and also has a significant difference from ideal status.

The importance of component, namely, "Creating the necessary infrastructures to improve and strengthen the financial resources" is estimated equal to 1.72±0.75 in current status and 4.22±0.69 in ideal status indicating that the importance of this component in current status is less than the average value (3) and also has a significant difference from ideal status.

The importance of Factor D (Financial System, Budgeting) is estimated equal to 1.69±0.57 in current status indicating that the importance of this component in current status is less than the average value (3) and also has a significant difference from ideal status (4.23)

Discussion

In this era, the education systems are faced with numerous challenges such as new professional demands, new approaches, information technologies, new learning approaches and education models (including the virtual education, e-learning and distance education), extensive process of international issues and globalization, and existence in global environment with high uncertainty and ambiguity.

However, due to the rapid exchange of information and futile attempt to memorize this mass of information, the education systems should inevitably adopt the method under which the people have timely access to information as well as establishing good relations between them and utilize this wide context of information in proper situation.

Therefore, the higher education system needs the application of new strategies and methods in education policy to develop the application of interdiseplinary curricula in this era, and this is possible only by changing the higher education system from the traditional education approach to new system as well as changing the knowledge and research, cultural, social and technological mechanisms and creating the new situations in these areas.

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The findings of this research prioritize and valorize the structural factors for creating the interdiseplinary university model as follows.

1- Creating the interdiseplinary structural system, infrastructures and organizational entities based on creating the superior position (As the most influential factor in creation of an interdisciplinary university);

2- Creating the system of developing the policy, objectives, program and curriculum based on maintaining the top position;

3- Creating the management and leadership system;

4- Creating the financial system and appropriate development and allocation of budget

• According to the research findings, the application of components such as the designing and supplying the infrastructures to use the best technologies and IT equipment, Redefining the system of designing the structure and organization and redesigning the university system and mechanisms, and selectivity of designing the procedures and implementation of standards have a significant impact on achieving the main objective of this research.

The findings of this research indicate the significant impact of this factor on the creation of interdisciplinary research-based university. Thus, the implementation of interdisciplinary curricula requires the creation and development of new structures. Considering that this structural factor is known as the most influential factor for creation of interdisciplinary university according to the research findings, this factor should be taken into serious consideration for creating an interdisciplinary university.

• The change in the traditional view on the role of universities in intensifying the competitive development in communities is the demand of the third millennium society. Beth Casey (2007) argues that the concept of development is the basic idea in interdisciplinary curricula. This concept plays a very active role in interdisciplinary issues and the creation of development capacity is one of the main principles of scientific plans, thus there should be the powerful decision-making and core authority as well as extensive structural changes.

• The management and leadership system factor, including the strategies of creating the team and participative leadership for changing the individual mental structure, multitasking performance with the aim at development and empowerment, and utilization of regulatory strategies and decisions for change, is one of the most effective structural factors in creating the interdisciplinary research-based university.

With regard to the interdisciplinary research paradigm, we should change the management and leadership procedure of organization (university). The first step to achieve this aim is to change the process of hierarchical credit system to flexible and non-hierarchical decisions.

• Utilization of the statutory financial system and appropriate allocation of budget are the important factors in creation, implementation and continuation of activities in any organization and social entity.

Casey (2007) has concluded in a research that all financial aids, both public and private, should be utilized in developing the interdisciplinary programs.

Therefore, the higher education system officials can take the advantage of their financial aids by inspiring from the cases above as well as providing the strategic plan to establish the infrastructure for public and private investment by allocating the facilities.

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