The impact of structural capital on the innovation performance in Syrian Universities: A field study in Tishreen University

Kinda A. Deeb, Maher M. Merhej[*]

Department of Business Administration, Faculty of Economics, Tishreen University, Syria
[*]E-mail: m.merheg@tishreen.edu.sy

Abstract

This study aimed at identifying the relationship between the Structural capital and innovation performance in Tishreen University. It applies the theoretical concepts. the researcher relied survey methodology, and distribution the questionnaire to 360 individual of the members of the Teaching Staff in Tishreen University, and then make a Field Study to show this relationship, the main result of this study is that there is a positive significant relationship between the Structural capital and innovation performance. We have provided a summary of the most important results that we have accessed with the presentation of some of the proposals and recommendations to improve the relationship in order to enhance innovation performance to the members of the Teaching Staff in Tishreen University.

Keywords: Intellectual capital, Structural capital, Innovation performance, Radical Innovation, Incremental Innovation

Introduction

To activate any structural capital organization helps us achieve innovation, whether it is a radical innovation (creating a new product, process), or incremental innovation (continuous improvement of a product or a process), as to increase the value of the organization and its capacity to create the competitive advantage that makes it successful and excellent.

The goal of our study is to show the impact of structural capital, as being one of intellectual capital dimensions, on the innovation performance in the educational sector, especially with having many studies that dealt the relation of intellectual capital with innovation performance in companies and service facilities (hotels and health) and industry.

This will lead us to discuss this topic as a result of shortage in studies that dealt with our research in educational sector, especially in Syria.

Research Problem:

Some previous studies and literatures indicated to the positive relation between the structural capital as a main dimension, in the intellectual capital with innovation performance; while others resulted in a negative relation between two variables.

This debate makes us research for the nature of relation between the two variable s in Tishreen University, where the indicators of measurement of such relation depend on phrases that measures each variable. If a phrase is positively formed and researchers, answers tend to agree, then that will be an indicator to have a higher innovation performance in Tishreen Uni. And vice versa.

Based on knowing the literary and critic review of researches by researcher especially in this subject, and on a survey study together with interviews conducted by the researcher as being done with the responsible for the administrative and educational process in Tishreen Uni. And also on those indicators, we pose the following main question:

Has the structural capital any impact on the innovation performance in Tishreen University?

Research Importance and Objective

The importance of this research resides in studying the structural capital by dimensions (codified knowledge, disciplined methods, organized culture) and also by studying the effect of this capital on innovation performance in the Syrian environment.

The objective of this research is to determine impact the structural capital on the innovation performance in Tishreen Uni.

Research Methodology

The survey systematic research and those related to methods follow initial and secondary data as per a questionnaire organized by a researcher after being published in some literatures and distributed to 360 researches, given back 333 of them where three of them were invalid to be analysed in the research, society composed of workers in the educational staff in Tishreen University (Deans, vice-dean, heads of department, quality units and teaching staff) who are 1881 in number as per statistics of planning and statistics directorate, then a programme SPSS is applied to be a tool for analysis of data available.

Structural Capital:

Structural capital is the one component, which does not reside in the heads of the employees and remains with the organisation even when they leave? (Roodt, 2011) And it is as a source of competitive advantage as it generates continuous improvement in the efficiency or effectiveness of the firm's performance of product market activities. (Michalski, 2008)

Structural capital is important to organizations because it deals with the mechanisms and structures of the organizations which, when complemented by individual innovative behavior, can assist individuals in their quest for optimum organizational innovation. (Kong, 2010)

It is the knowledge that stays within the firm at the end of the working day.

It comprises the organizational routines, procedures, systems, cultures, databases, etc.

Examples are organizational flexibility, a documentation service, the existence of a knowledge Centre, the general use of Information Technologies, organizational learning capacity, etc. (Karchegani et al., 2013)

A researcher defines the structural capital as codified knowledge which is knowledge storage in forms: documents, evidence, patents, databases; and disciplined methods that have a formal feature for supervision mechanisms where they refer to how to solve a problem in written rules like: steps series, main procedures that come from unifying previous successful activities or from best practices, as they are from organized culture that includes beliefs, common values among organization members where samples of intellectual capital is organized to be Scandia example, Sveiby example and others which they come from an organized culture special for each of them.

Innovation Performance

Amabile (1988) argues that creativity occurs in the mind and activity of a single person, or, at most, within the minds and activities of a small number of people working together on the same specific problem. In contrast, innovation occurs at the level of a system. It involves a large number of individuals working together in different units on different aspects of the very general problem of implementing new idea, but oddane (2008) strongly oppose the idea of linking "creativity" and "innovation" to the individual and collective levels, respectively. It reflects the erroneous assumption that creativity is merely an individual phenomenon, fully ignoring that creativity is also a social, collective. (Oddane, 2008)

Most writers distinguish innovation from invention by suggesting that innovation is concerned with the commercial and practical application of ideas or inventions. Invention, then, is the conception of the idea, whereas innovation is the subsequent translation of the invention into the economy. The following simple equation helps to show the relationship between the two terms: (Trott, 2005)

Innovation = theoretical conception + technical invention + commercial exploitation.

The researcher sees that invention is the concrete product that come from creativity and innovation. If creativity is a spark which produced the idea, and innovation is the implementation of that idea, so invention is the outcomes of that idea which will come as a product or a process or a new knowledge.

Innovation is consider a key success factor for companies to achieve and maintain competitive advantage in today's dynamic and challenging global marketplace. (Baker, 2014)

Innovation, from the researcher's point of view is defined as: a planned activity done by an individual to have some of expected benefits, which leads to inventing something new where newness is attributed to that individual, It is a reactionary process that requires a social organization through deep relation between organizational innovation, the process and the product. It is product of mutual learning process between the relational parties as a social, independent process to meet the interest owners as it researches for ideas, information and options available to make a decision. It depends on internal and external sources or both of them, as it can also be described as a process that it comes from it a product so new resulted from reaction between an individual and his unique style with what can be found in his environment.

The researcher defines innovation in universities as follows: to apply the available knowledge from research and development in a very new and innovative way, to find new methods to learn, new procedures for administrative, educational process to creat new and beneficial results in order to achieve added value for universities (radical innovation), to improve the current knowledge by having teaching and learning methods upgraded and to develop the whole process by improving the procedure of training the personnel (incremental innovation).

Researcher's Model

The researcher classifies the innovation into two types: radical innovation and incremental innovation, as he views both have all innovations to which the researcher refer.

Radical Innovation

Radical innovation is about making major changes in something established. The term 'radical' often refers to the degree of change in the efficiency or revenue of the product. (Sullivan, 2008) while the researcher views that radical innovation to involve creating new knowledge and techniques in teaching and administration by making use of experience and skill of human capital, and the organization to seek for structural system that enables it to write down knowledge including all their members in momuals, books and databases

Incremental Innovation

Incremental innovations involve "improving and exploiting an existing technological trajectory and it is built on and reinforce the applicability of existing knowledge. (Subramaniam and Youndt, 2005)

while the researcher views that incremental innovation includes improvement of the current knowledge and teaching methods and administrative, technical procedures by making use of experience and skill of human capital, and the organization to seek for improvement of the current

structural system that enables it to write down knowledge including all their members in momuals, books and databases.

Results And Discussion
Research Tool
The researcher depended on the questionnaire as a tool to gather data and personal interviews with a number of research sample and on Likert' scale with five potential choices (strongly agree, agree, neutral, disagree, strongly disagree).

Reliability Coefficient
The researcher used Cronbach's alpha method to calculate the stability of scales (Ghadeer, 2012) where Cronbach's alpha coefficient to have the stability of questionnaire phrases together and to calculate the stability of study variable individually.

The table (1) shows the value of stability of Cronbach's alpha totally except the sex variable (for it is the only one which is not ordinal) and equal to 0.891 (high stability coefficient) and greater than 0.60, and this indicates that all phrases enjoy good stability and no need to erase any of them.

Table 1: Scale: All Variables

Cronbach's Alpha	N of Items
.891	34

Source: SPSS 20

Alpha for each variable separately
The researcher calculated the stability coefficient for each variable separately, where the results were as follows:

The researcher finds as per the table (2) that the value of Cronbach's alpha for the used phrases in measuring each variable individually were all greater than 0>60, and this indicates that the data its validity was stable and no need to have any phrases omitted.

Table 2: Alpha for each variable separately

variable	Cronbach's Alpha	N of Items	variable	Cronbach's Alpha	N of Items
Codified Knowledge m6	.827	6	Radical innovation m11	.733	8
Disciplined methods m7	.745	5	Incremental innovation m12	.660	8
Organization Culture m8	.925	3			

Source: SPSS 20

Hypotheses Test: the general hypothesis of the main search:

Ho: there was no significant impact of the Structural Capital on innovation performance in Tishreen University.

H1: there was significant impact of the Structural Capital on innovation performance in Tishreen University.

It has several sub-hypotheses:

The first sub-hypothesis: there is a significant impact of the structural capital on the radical innovation in Tishreen University. Where there are other sub hypotheses to come from:

1. There is a significant relation between the codified knowledge and radical innovation performance.

2. There is a significant relation between the disciplined methods and radical innovation performance.

3. There is a significant relation between the culture of the organization and radical innovation performance.

To test the first sup hypothesis and those come out of which, the researcher gave a symbol (m6) to the codified knowledge, (m7) to the disciplined methods, (m8) to organized culture, (m11) to the radical innovation, (m14) to the structural capital and (m17) to innovation performance, then he calculated the Pearson Correlation, R Square. Where the table (3) shows the following:

There is a significant relation between the codified knowledge and radical innovation performance, where the Pearson Correlation coefficient amounts to 0.343 which indicates that there is a weak and proportional Correlation between the two variables,   as the R Square mounts 0.118 which indicates that 11.8% of changes in the radical innovation are related to changes in the codified knowledge. Since sig = p = 0.000< α=0.01,the researcher refuses null hypothesis which states that there is no significant relation between the codified knowledge and radical innovation performance and accepts the alternative hypothesis that states there a significant relation in this regard.

Table 3: Pearson Correlation for Structural Capital Dimensions with Radical Innovation

		m6	m7	m8	m11
m6	Pearson Correlation	1	.984**	.965**	.343**
	Sig. (2-tailed)		.000	.000	.000
	N	330	330	330	330
m7	Pearson Correlation	.984**	1	.935**	.360**
	Sig. (2-tailed)	.000		.000	.000
	N	330	330	330	330
m8	Pearson Correlation	.965**	.935**	1	.304**
	Sig. (2-tailed)	.000	.000		.000
	N	330	330	330	330
m11	Pearson Correlation	.343**	.360**	.304**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	330	330	330	330

Source: SPSS 20

There is a significant relation between the disciplined methods and radical innovation performance, where the Pearson Correlation coefficient amounts to 0.360 which indicates that there is a weak and proportional Correlation between the two variables, as the R Square mounts 0.130 which indicates that 13% of changes in the radical innovation are related to changes in the disciplined methods. Since sig = p = 0.000< α=0.01,the researcher refuses null hypothesis which states that there is no significant relation between the disciplined methods and radical innovation performance and accepts the alternative hypothesis that states there a significant relation in this regard.

 There is a significant relation between the culture of the organization and radical innovation performance, where the Pearson Correlation coefficient amounts to 0.304 which indicates that there is a weak and proportional Correlation between the two variables, as the R Square mounts 0.092 which indicates that 9.2% of changes in the radical innovation are related to changes in the culture of the organization. Since sig = p = 0.000< α=0.01,the researcher refuses null hypothesis which states that there is no significant relation between the culture of the organization   and radical innovation performance and accepts the alternative hypothesis that states there a significant relation in this regard.

The result of the first sup hypothesis test:

Table 4: Pearson Correlation for Structural Capital with Radical Innovation

		m14	m11
m14	Pearson Correlation	1	.335**
	Sig. (2-tailed)		.000
	N	330	330
m11	Pearson Correlation	.335**	1
	Sig. (2-tailed)	.000	
	N	330	330

Source: SPSS 20

The researcher finds as per the table (4) that the value of Pearson Correlation coefficient amounts 0.335 which indicates that there is a weak and proportional Correlation between the structural capital and the radical innovation, as the R Square mounts 0.112 which indicates that 11.2% of changes in the radical innovation are related to changes in the structural capital. Since sig = p = 0.000< α=0.01,the researcher refuses null hypothesis which states that there is no significant relation between the structural capital and radical innovation performance and accepts the alternative hypothesis that states there a significant relation in this regard.

The second sub-hypothesis: there is a significant impact of the structural capital on the incremental innovation in Tishreen University. Where there are other sub hypotheses to come from:

1. There is a significant relation between the codified knowledge and incremental innovation performance.

2. There is a significant relation between the disciplined methods and incremental innovation performance.

3. There is a significant relation between the culture of the organization and incremental innovation performance.

To test the second sup hypothesis and those come out of which, the researcher gave a symbol (m12) to the incremental innovation, then he calculated the Pearson Correlation, R Square. Where the table (5) shows the following:

Table 5: Pearson Correlation for Structural Capital Dimensions with Incremental Innovation

		m6	m7	m8	m12
m6	Pearson Correlation	1	.984**	.965**	.436**
	Sig. (2-tailed)		.000	.000	.000
m7	Pearson Correlation	.984**	1	.935**	.464**
	Sig. (2-tailed)	.000		.000	.000
m8	Pearson Correlation	.965**	.935**	1	.402**
	Sig. (2-tailed)	.000	.000		.000
m12	Pearson Correlation	.436**	.464**	.402**	1
	Sig. (2-tailed)	.000	.000	.000	

Source: SPSS 20

There is a significant relation between the codified knowledge and incremental innovation performance, where the Pearson Correlation coefficient amounts to 0.436 which indicates that there is a weak and proportional Correlation between the two variables, as the R Square mounts 0.190 which indicates that 19% of changes in the incremental innovation are related to changes in the codified knowledge. Since sig = p = 0.000< α=0.01,the researcher refuses null hypothesis which

states that there is no significant relation between the codified knowledge and incremental innovation performance and accepts the alternative hypothesis that states there a significant relation in this regard.

There is a significant relation between the disciplined methods and incremental innovation performance, where the Pearson Correlation coefficient amounts to 0.464 which indicates that there is a weak and proportional Correlation between the two variables, as the R Square mounts 0.215 which indicates that 21.5% of changes in the incremental innovation are related to changes in the disciplined methods. Since sig = p = 0.000< α=0.01,the researcher refuses null hypothesis which states that there is no significant relation between the disciplined methods and incremental innovation performance and accepts the alternative hypothesis that states there a significant relation in this regard.

There is a significant relation between the culture of the organization and incremental innovation performance, where the Pearson Correlation coefficient amounts to 0.402 which indicates that there is a weak and proportional Correlation between the two variables, as the R Square mounts 0.161 which indicates that 16.1% of changes in the incremental innovation are related to changes in the culture of the organization. Since sig = p = 0.000< α=0.01,the researcher refuses null hypothesis which states that there is no significant relation between the culture of the organization and incremental innovation performance and accepts the alternative hypothesis that states there a significant relation in this regard.

The result of the second sup hypothesis test:
The researcher finds as per the table (6) that the value of Pearson Correlation coefficient amounts 0.435 which indicates that there is a weak and proportional Correlation between the structural capital and the incremental innovation, as the R Square mounts 0.189 which indicates that 18.9% of changes in the incremental innovation are related to changes in the structural capital. Since sig = p = 0.000< α=0.01,the researcher refuses null hypothesis which states that there is no significant relation between the structural capital and incremental innovation performance and accepts the alternative hypothesis that states there a significant relation in this regard.

Table 6: Pearson Correlation for Structural Capital with Incremental Innovation

		m14	m12
m14	Pearson Correlation	1	.435**
	Sig. (2-tailed)		.000
m12	Pearson Correlation	.435**	1
	Sig. (2-tailed)	.000	

Source: SPSS 20

The General Main Hypothesis Test:
After the researcher tested the sup hypotheses, he tested the main hypothesis where the results were as follows:

There is a significant relation between the codified knowledge and innovation performance, where the Pearson Correlation coefficient amounts to 0.396 which indicates that there is a weak and proportional Correlation between the two variables, as the R Square mounts 0.157 which indicates that 15.7% of changes in the innovation performance are related to changes in the codified knowledge. Since sig = p = 0.000< α=0.01,the researcher refuses null hypothesis which states that there is no significant relation between the codified knowledge and innovation performance and accepts the alternative hypothesis that states there a significant relation in this regard.

There is a significant relation between the disciplined methods and innovation performance, where the Pearson Correlation coefficient amounts to 0.418 which indicates that there is a weak and

proportional Correlation between the two variables, as the R Square mounts 0.175 which indicates that 17.5% of changes in the innovation performance are related to changes in the disciplined methods. Since sig = p = 0.000< α=0.01,the researcher refuses null hypothesis which states that there is no significant relation between the disciplined methods and innovation performance and accepts the alternative hypothesis that states there a significant relation in this regard.

There is a significant relation between the culture of the organization and innovation performance, where the Pearson Correlation coefficient amounts to 0.359 which indicates that there is a weak and proportional Correlation between the two variables, as the R Square mounts 0.129 which indicates that 12.9% of changes in the innovation performance are related to changes in the culture of the organization. Since sig = p = 0.000< α=0.01,the researcher refuses null hypothesis which states that there is no significant relation between the culture of the organization and i innovation performance and accepts the alternative hypothesis that states there a significant relation in this regard. Where the table (7) shows that results.

Table 7: Pearson Correlation for Structural Capital Dimensions with Innovation

		m6	m7	m8	m17
m6	Pearson Correlation	1	.984**	.965**	.396**
	Sig. (2-tailed)		.000	.000	.000
m7	Pearson Correlation	.984**	1	.935**	.418**
	Sig. (2-tailed)	.000		.000	.000
m8	Pearson Correlation	.965**	.935**	1	.359**
	Sig. (2-tailed)	.000	.000		.000
m17	Pearson Correlation	.396**	.418**	.359**	1
	Sig. (2-tailed)	.000	.000	.000	

Source: SPSS 20

The Result Of The Main Hypothesis Test:

Table 8: Pearson Correlation for Structural Capital with Innovation

		m14	m17
m14	Pearson Correlation	1	.391**
	Sig. (2-tailed)		.000
m17	Pearson Correlation	.391**	1
	Sig. (2-tailed)	.000	

Source: SPSS 20

The researcher finds as per the table (8) that the value of Pearson Correlation coefficient amounts 0.391 which indicates that there is a weak and proportional Correlation between the structural capital and the innovation performance, as the R Square mounts 0.153 which indicates that 15.3% of changes in the innovation performance are related to changes in the structural capital.

Table 9: Descriptive Statistics

code	Mean	code	Mean
m6	2.0000	m11	3.1125
m7	1.9200	m12	3.2125
m8	2.0667	m14	1.9956
		m17	3.1625

Source: SPSS 20

Since sig = p = 0.000< α=0.01,the researcher refuses null hypothesis which states that there is no significant relation between the structural capital and innovation performance and accepts the alternative hypothesis that states there a significant relation in this regard.

Conclusions and recommendations

Conclusions

After the hypotheses being tested, the researcher was able to reach some of results, the most important of which are:

The main hypothesis proved that there was a significant relation between the structural capital and innovation performance, but it was weak.

The average of answers in the sample of special phrases amounted to (2.00) for the variable of codified knowledge as indicated in the table (9), and this shows the disagreement of the sample members to let university write the knowledge related to human capital which will affect the innovation performance. This resulted from not having information systems, needed equipment or not having the administrative staff who is responsible for transferring the knowledge from the individuals to the university (not to transfer the implied knowledge into explicit one, so, it makes it lose the human capital partially.

The average of sample members for the special phrases in regard to disciplined methods (1.92), and this indicates that sample members did not agree the university to follow the steps of troubleshooting for the issues in concern, or not following flexible rules to falicitate the innovation by the university, thus the procedures followed by the university are still complicated and routine, wasting time and efforts in making decisions as the university does not follow successful methods to deal with problems.

This result is compatible with not writing the knowledge because disciplined methods followed by the university limit the individual and not letting him get benefit from stored university knowledge to apply them in innovation tasks in question.

The average of sample members for the special phrases related to variable of organization culture amounted to (2.0667), and this indicates that those members did not approve the current university culture which has nothing to do with encouraging the innovation performance, In spite of having experience, skillful human capital, but the university, as the sample indicates, does nothing to support the capital with the structural capital to enhance the identity and to get a mutual understanding to their goals. This resulted from not having an encouraging culture to creat new knowledge inside the university and not improving the educational and administrative systems to match with the integration of human capital with that of structural.

Recommendations

The researcher recommends the following:

To keep abreast of fast-paced changes in the field of communication, technology and information where it is clear that the current systems are not effective, This can be done by following one of the organizational development strategies: as per speed (gradual, stage or comprehensive development), or as per the process responsibles (individual authority, team work) in order to develop systems of problem-solving, increasing confidence and respect with reaction among individuals to have positive culture that help creat organized environment to fulfill the goals in order to achieve the grounds for innovation performance.

The need to work in knowledge writing that the university human capital has by using the implied knowledge in minds instead of having them leaked. This can be done by printing books, information storage in digital formats or paper ones, and also to upgrade those means to avoid damage and wear.

To activate the role of cultural forums which clarify the role and the message of the university, to enhance the identity by spreading the culture of innovation for the personnel, to make what needed, information or techniques, available. This can be done by encouraging the personnel by rewards or incentives for creative works that they offer, or to increase their salaries, so many creative members will work in good conditions, and not to leave the university to work in other research organizations that appreciate their skills more.

References

Baker, D. R (2014). Innovation and Value Creation: A Cross-Industry Effects Study of Patent Generation. Unpublished doctoral dissertation. Capella University.

Ghadeer, B (2012). IBM SPSS Statistics 20. Syria, Aleppo.

Karchegani, M; Sofian, S; Amin, S (2013). The relationship between intellectual capital and innovation. International journal of business and management studies. 2(1), 561-581.

Kong, E. (2010). Innovation Processes in Social Enterprises: An IC Perspective. Journal of Intellectual Capital, 11(2), 158-178.

Michalski, M.S (2008). The Importance of Intellectual Capital for the Entrepreneurial Firm. Unpublished master's thesis. Mälardalen University: Västerås.

Oddane, A. T (2008). Organizational Condition for Innovation: A Multiperspective Approach to Innovation in a Large Industrial Company. Unpublished doctoral dissertation. Norwegian University of Science and Technology.

Roodt, M (2011). Intellectual Capital Characteristics for Competitive Advantage: Case study of A Multinational Corporation. Unpublished doctoral dissertation. South Africa University.

Subramaniam, M; Youndt, M.A (2005). The Influence of Intellectual Capital on the Types of Innovative Capabilities. Academy of Management Journal, 48(3), 450-463.

Sullivan, O.D (2008). Applying Innovation. Available on the Link: http://www.nuigalway.ie.sci-hub.org/staffsites/david_osullivan/documents/2011_ai_booklet.pdf.

Trott, P (2005). Innovation Management and New Product Development [3 ed.]. FT Press. Gosport.