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Research Article

THE STUDY OF THE EFFECT OF BUSINESS INTELLIGENCE ON NETWORK STRUCTURE IN VIRTUAL ORGANIZATIONS

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ABSTRACT
The aim of this paper is to study the effect of business intelligence on network structure in virtual organizations which has been conducted with the use of Cochran's sampling formula and based on a sample of 200 of specialist experts in information technology fields which has been selected from 407 specialist experts. Cronbach's alpha coefficient of the designed questionnaire for all the elements have been obtained to be more than the empirical amount which is 0.7 (0.868 for business intelligent questionnaire and 0.879 network structure questionnaire) and this confirms the reliability of questionnaires used in this study. For the purpose of analysis of effects of business intelligence on network structure regression fit equations and path analysis method in LISREL software have been used. The effect coefficients obtained from research structural equations indicate that elements of strategic insights, common fate, alignment and congruence, applying knowledge, desire for change, and spirit of business intelligence have significant effect on network structure of organization and the effect of performance pressure element wasn't found to be significance. Interpretation of direct effect coefficients against the total effect coefficient indicate that each of these elements to a great extent can be explained by other elements and in other words organization's network structure in an indirect way takes effect from business intelligence elements and effect of these elements on network structure is not only direct and this indicate strong correlation between business intelligence in this study. Also comparison of regression standard coefficient in fitted model indicate that the effect of business intelligence elements can be ranked respectively as strategy insight, common fate, alignment and congruence, applying knowledge, desire for change and spirit.

Key Words: *Business Intelligence, Network Structure, Virtual Organizations*

INTRODUCTION
During recent years, business intelligence (BI) has been emerged as one of the 10 prominent priorities among chief technology officers (CIO) (Chin-Hoong Chee, 2011) and (Gartner, 2011). According to reports only in 2010, revenue from sales of analysis and business intelligence software has passed 10 billion dollars (Chin-Hoong Chee, 2011; Gartner, 2011). While it seems that BI market is so much volatile, applying BI system is big and complicated responsibility from financial point of view and in long-term it can engage most of the shareholders (Chin-Hoong Chee, 2011; Wixom and Watson, 2010; Yu and Corneous, 2010).
Relationships between companies through buyer-supplier relationship have effect on various economical phenomena from development of innovative ideas (1) to transmission of economic shocks (2) and trading patterns. Considering this, economists gradually directed their attention toward networks structures in companies. However, the companies' network structure in macro-economies has not been specified accurately in theoretical and experimental studies till now (Enghin Atalay *et al.*, 2011).
Virtual organization is among new concepts in management literature and there is no unique definition for it so far. This concept has emerged to existence considering today's need of organizations to a faster response to environmental needs and an effective dealing (Karimi, 2004). It is defined as "a flexible and

temporary network of independent organizations which share their competitive advantage, so that with optimization of organization's value chain processes they can have a good business opportunity" (A'bedi Ja'fari *et al.*, 2010).

Hence, in the present research, we have studied the effect of business intelligence on network structure of virtual organizations.

Business Intelligence (Organizational)

Business intelligence (BI) is referred to a type of business management which is used for explaining applied plans and technologies of gathering and providing access and data analysis and information about economical establishments in order to help these establishments to make optimized business decisions (Liya we *et al.*, 2007).

A lot of articles have tried to analyze the effective factors on BI. Some of these articles have provided some frameworks however there is no proved framework to rely on for this specific subject. Success of innovative BI programs in companies depends on various factors. Since BI implementation is dependent on successful application of IT resources, without any doubt, some of these factors are related to technology. However, information technology rarely is considered as a tool in implementation of BI approach. Success of BI mainly depends on organizational and process factors which business manamgnet depends on it. In spite of observed differences among various industries in terms of BI system, these factors should be identifies and classified. Existence of a connection between each factors of one of their combinations and success of BI programs should be confirmed (Szymon Ademala, 2011).

With significant changes, transformations and evolutions occurred in the environment of different organizations including public organizations from the beginning of 1980s onward, they are facing serious challenge for their survival in such a way that continuous movement in the path of current approaches in governing organizations seem impossible.

Since hierarchical and market structures cannot be a proper guidance for organizations' success in their goals path, therefore, attention to stakeholders and their participation through network governance has been introduced as a proper and substitute method (Chaiton *et al.*, 2000).

Therefore, the problem of uncorrected understanding of information in BI environment will have so many challenges. Therefore, providing comprehensive macro data in line with optimized understanding of BI products is considered as a critical issue in BI environment (Chin Hoong Chee, 2011; Bayard *et al.*, 2006; Pooniya, 2001; Poo *et al.*, 1997; Shankarayan and Aeon, 2006; Ashiat *et al.*, 1999; Wadowa *et al.*, 2002). In fact, Gartner in his studies have mentioned that management of macro data is one of the most important functions that BI environment should provide (Chin Hoong Chee, 2011; Aguiler Sawn, 2003).

Business intelligence is one of the branches of unlimited sea of information technology. Business intelligence is rather a new concept, however; it is related to an extensive domain of techniques, tools and applied programs (such as online transaction processing, online analytical processing, analytical database, data mining, intelligent decision support systems, knowledge management system, supply chain management, customer relationship management, enterprise resource planning and its aim is to improve the quality of operations and operation analysis. In addition to this, business intelligence is the process of changing data into information, in a way that enables commercial organization to analyze information so that with obtaining correct insight and understanding can consider needs of all the system beneficiaries (Rabiei *et al.*, 2010).

Alberesht provides a model for organizational intelligence having seven dimensions including strategy insight, common fate, desire to change, spirit, alignment and congruence, knowledge application and performance pressure.

- Strategy insight: in short it is ability to create, derive and express the organization goal.
- Common fate: when all or most of the organization member have engaged in work, they know what the mission of the organization is and they feel that they have a common goal and each of them compulsively feel the success of organization.

- Desire to change: some of organizational cultures are guided by their own founder executive teams. In these cultures, way of performance, thinking and reaction to surrounding environment has become so much similar that any kind of change indicates a type of disease and even chaos.
- Spirit: when we think about the work life quality of employees; when we think about their feelings regarding work and manamgnet and when we think about the level of their optimism toward their duties and progress and promotion opportunities in organization, a concept named spirit forms in our mind.
- Alignment and congruence: without existence of a set a regulations for implementation, each group will face lot of problems and disagreement in their works. Individuals and teams should organize themselves for realizing the mission of the organization; should divide their tasks and responsibilities and should place some regulations for dealing with each other and environment.
- Application of knowledge: today more than ever, actions which have lead to victory or defeat in an organization are mainly based on effective use of knowledge, information and data. Activity of every organization is highly dependent on obtained knowledge and immediate correct decisions.
- Performance pressure: managers should not be only engaged in performance (implementation). In an intelligent organization, each of the performers must be in their own operational position. Leaders can promote executive leverage concept and support it. But this will be most effective when it will be under an effective set of mutual expectations and operational requirement for joint success (Aminzad, 2010).

In the present study, we have adopted Alberesht commercial intelligence model.

Network Structure

Today, organizations are faced with dynamic and turbulent environments which require fast and flexible response to ever changes requirements of business. So many of organizations through adaptation of group-based, decentralized and scattered structures, which have been studies in different researches as virtual, network and cluster organizations, (Ahuja *et al.*, 2006; Disantis and Jackson, 1994; Druker, 1998) have reacted to this phenomenon (Ahuja *et al.*, 2006; Bayrayn and Johnson, 1994; Cameleous, 1993; Goldman *et al.*, 1995; Miles, 1991).

Recently in some studies, form and structure of complex social networks have been extensively modeled. Some examples in this regard include links in World Wide Web (WWW), job networks and friendship networks (Enghin Atalay, 2011).

Social essence have a close relationship with the idea of "society" in topic of social networks which has ignored the traditional view regarding the societies with local roots (Peter pal Zubscsek, 2011; Yakuiner, 1961; Putnam, 2001) and instead of that directly deals with primary structure of relations between persons. For example, Wiman and Worteli (1990), defines personal social network of a person as a set of active social relations of the person. These set of relations are often scattered and various in terms of social. With explaining these findings and extending them to relations networks we will show that societies aligned with key principles (important) have been organized in network closure theory (Peter pal Zubscsek, 2011; Barrette, 1992; Wassermann and Faust, 1994).

Importance of Network Structure in Organizations

Walker, Cogert and Shaan (1997) have stated that network structure will be effective in improving network performance when social capital is implemented correctly in organization's environment. In addition to this, Choi (2005) believes that network structure plays an important role in improving and removing social restrictions. These very restrictions directly guide information flow in creating and maintaining social capital. Therefore; social capital network is an important mediating factor between network structure and network performance. He argues that the level of social capital depends on network structure (Vital, 2007).

Due to some occurred situations (increased demand for participation in decision making and policies establishment related to various sectors and in various matters particularly in government organizations) hierarchical and market decision making model don't have the necessary and useful efficiency in establishing policies of organizations specially private and public sectors anymore (Hajar and Wagner,

2003; Powell, 1990). Hence, for being placed in a more correct path of organizational policy establishment, creation of policy networks with high social capital can be a proper reaction toward eliminating the shortcomings of past traditional methods, since currently the complexity and manamgnet problems are increasing every day (Margroom and Vital, 2004).

A group of organizations and autonomous bodies who are gathering together for goals they cannot achieve alone are considered networks (Chisholm, 1998). Networks have fundamental roles in creating cooperation between organizations for determining solutions to organizational problems and increasing success level of individuals and organizations in achieving their goals.

Network Organizations

Efforts of network organizations for preventing problems and creativity in competitive advantages of market have a central role. Network structures at least have three different forms including internal, stable, and dynamic.

- Internal network: is designed for achieving market resources, entrepreneurship and creativity without using external resources of an organization and the managers of these structures in line with regulating price, innovation and creativity are motivated. Internal networks have been adopted by General Motors from 1980s.
- Stable network: increases flexibility in value chain of an organization and in these structures and networks, assets often belong to more than one company but they are allocated to certain business. Often a group of sellers and suppliers are around companies and organizations which supply the input of the company and distribute and sell their outputs. For example, B.M.W. have outsourced 55% and 75% o its production expenses and uses from the services of other companies.
- Dynamic network: it is used in competitive and changing environments and they develop allocation and flexibility. For example toy companies are required to use external resources of organization.

Network structures have four main characteristics: independent organizations that each have responsibilities such as production, marketing and designing of products; have one coordinating center which matches these companies and mobilizes them toward the determined goals; matching market mechanisms of networks' elements with each other and coordinates information systems with clear information of network elements.

Virtual Organizations

Crandall and Wallace (1998) defines a virtual organization as "a network of people or work environments in which work is done at any time and any place and the common restrictions related to time, physical situation, scope of work, job position and pyramidal reporting relations doesn't exist". In other words, this type of organizations or working environments have more flexible conditions in which work is done at any time or any place with the use of information technologies. Today for many people virtual organizations and working environments are a better option. An ITAC study conducted in 2001, indicate that in America 28 million employees are working in these types of organizations (Akkirman and Harris, 2005).

Virtual working places refer to a form of working place in which relationships between colleagues is through information and communication technology. Using such an environment requires more scientific studies, because management of a virtual working place has so many differences with a normal and common working place. The theories of classical management theory have been prepared based on normal organizations in which employees work in a face to face manner with each other. In case of using the same approaches for manamgnet of virtual organizations, certainly we will face serious problems. The main changes which are to be understood while managing a virtual organization includes: group processes, establishing relationship, enhancing and training employees, common activities and so on. Regarding virtual activities and working places, the most emphasis and focus is usually is on using information and communication technology. Kirkman and Mathieu (2004) have emphasized on this matter that what distinguishes virtual working environments with normal ones is not geographical

locations of the employees but the use of technology for establishing communication among them. Based on the provided definition by Lipnack and Stamps (2000), " a virtual team is consisted of people who work in dependent to each other on a common goal in different times, places and organizations with the use of technology" (Gerda Mihhailova, 2008).

While changing from traditional organizations to virtual organizations, achievement of success requires more than only implementing new technologies (Handy, 1995). For achieving success in this regard, organizations should succeed in creating trust among employees (Cascio, 2000; Handy, 1995; Holton, 2001; McCready *et al.*, 2001; Nilles, 1998; Staples, 2001a, b) and creating trust among employees in turn requires establishing continuous communication (Stales, 2001a) with high quality (Jensen, 2003; Nilles, 1998).

In fact, establishing communication is one of the most concerns of managers and employees in virtual working places (Fritz *et al.*, 1998; Staples, 2001b; Townsend *et al.*, 1998) and usually this is itself one of the impediments of successful implementation of virtual organizations (Ruppel and Howard, 1998). Previous studies regarding establishing communication in virtual organizations indicate that establishing effective communication in virtual organizations show that establishing effective communication in this type of organizations is more important comparing to traditional and common organizations (Conner, 2003; DeSanctis and Mongs, 1999; Engkavanish, 1999; Kayworth and Leidner, 2000; Whiting, 1997).

Many researchers in their previous works have shown that virtual organizations have a negative effect on establishing relationship between employees and managers (Hill *et al.*, 1998; Huws *et al.*, 1990). Hargie *et al.*, (2002) have reached this conclusion that establishing a weak communication leads to lower job commitment, lower returns, more absence of employees and more employee turnover. Staples (2001a) has reached this conclusion that employees in virtual work places suffer from less job satisfaction, lack of trust between managers and employees and more job stress which all of them indicate to poor communication (Akkirman and Harris, 2005).

The main difference between virtual and other organizations is that virtual organizations are in the form of network organizations (usually electronic) which go beyond the restrictions of traditional organizations (Barner, 1996; Berger, 1996; Mowshowitz, 1997). Connection between the members of a virtual organization is temporary and virtual organization is considered for their creating and dissolving relationship with other members of virtual organizations (Palmer *et al.*, 1986; Bleeker, 1994; Nohria and Berkley, 1994; Coylle and Schnarr, 1995). Usual advantages attributed to virtual organizations include adaptation, flexibility and ability to responding quickly to market changes (Grabowski *et al.*, 2006). Although the members of a virtual organization may sometimes meet each other in person in addition to electronically, however the members of this organization do not live in a same geographical location. Success of virtual organizations is dependent on common and related business processes which have been designed for achieving common business goals. Being virtual have two characteristics: creating a chain of common values among different entities of a virtual organization (Benjamin and Wigand, 1995; Rayport and Sviokla, 1995) and business processes which are supported by information technology (Palmer and Speier, 1997; Kumar, 2001).

Some of the researches have studied the effective factors on optimized performance of virtual organizations and have identified factors such as establishing effective communication (Donaldson, 1990; Stanton and Buskirk, 1987; Staples, 1996), previous experience and training regarding virtual organizations (Stanton and Buskirk, 1987; Staples, 1996) and effective approaches of management (Staples, 1996; Gerber, 2000; Greengard, 1994; Illingworth, 1994; Mowshowitz, 1997) (Grabowski *et al.*, 2007).

Research Hypotheses

1) Strategy insight has a significant effect on network structure in virtual organizations.
2) Common fate has a significant effect on network structure in virtual organizations.
3) Desire to change has a significant effect on network structure in virtual organizations.
4) Spirit has a significant effect on network structure in virtual organizations.

5) Alignment and congruence have a significant effect on network structure in virtual organizations.
6) Knowledge application has a significant effect on network structure in virtual organizations.
7) Performance pressure has a significant effect on network structure in virtual organizations.

RESULTS AND DISCUSSION

In data analysis, SPSS software ver. 18 and LISREL ver. 8/72 were used and significance level of 0.5 was considered for testing hypotheses. A summary of correlation values between research variables has been provided in table 1.

Table 1: Correlation matrix of business intelligence and network structure elements

	1	2	3	4	5	6	7	8
1. Alignment and congruence	1							
2. Performance pressure	.819**	1						
3.Desire to change	.809**	.813**	1					
4.Spirit	.824**	.826**	.775**	1				
5.Common fate	.807**	.818**	.793**	.838**	1			
6.Knowldege application	.787**	.800**	.809**	.792**	.786**	1		
7.strategy insight	.816**	.821**	.803**	.830**	.826**	.832**	1	
8.Network structure	.854**	.849**	.838**	.852**	.858**	.844**	.872**	1

Considering figure 1 which presents the estimation of regression coefficients between business intelligence and network structure variables, element of strategy have the most effect on network structure. In this figure, H1 represents alignment and congruence, H2 represents performance pressure, H3 presents desire to change, H4 represents spirit, H5 represents common fate, H6 represents knowledge application, H7 represents strategy insight and S.SH represents network structure. As it can be seen, linear correlation between all the elements of business intelligence have been observed to be significant at the level of 0.05 and this indicates that the effect of each of these factors on network structure to a great extent is under the influence of other elements and as a result so much difference exists between direct and total effects of these variables with the variable of network structure response. Hence, we have these relationships under control through fitting structural equation between elements and variable of network structure.

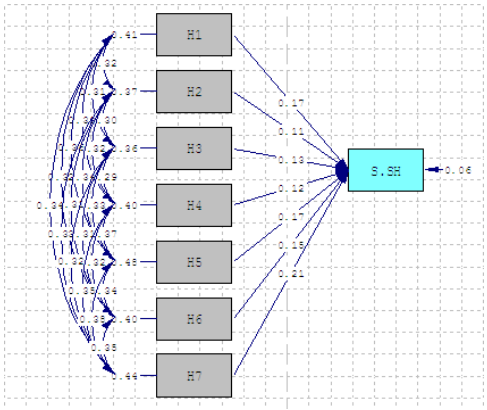

Figure 1: Schematic of structural equation of elements of business intelligence and network structure

In figure 2 which shows regression coefficients in the standard model, no significant change has been occurred in the regression coefficients. This indicates that measurement scale of elements did not have any significant effect on coefficients estimations.

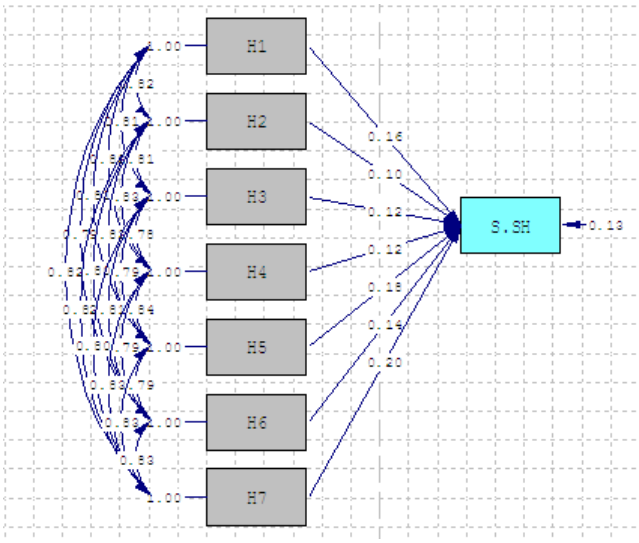

Figure 2: Schematic of standard model in structural equation of the elements of business intelligence and network structure

Finally, in figure 3 which evaluates the student t-test values for significance of model variables, it can be observed that effect assumption of all the elements of business intelligence except performance pressure on network structure have been accepted at the level of 0.05.

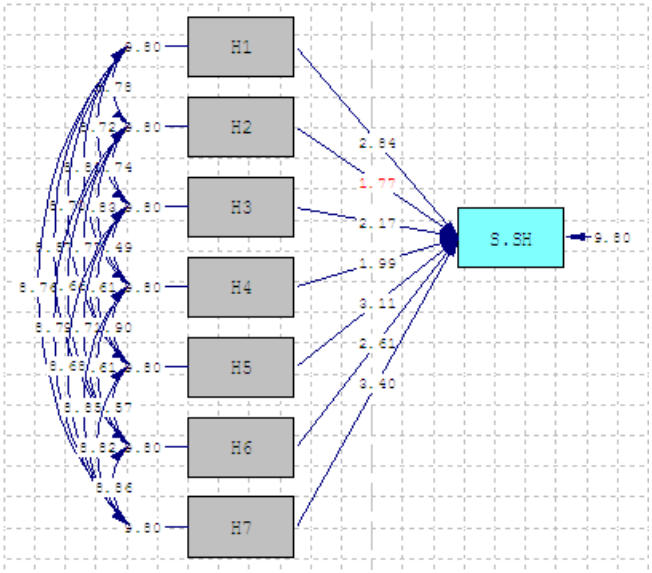

Figure 3: A plan of student t-test in structural equation of the elements of business intelligence and network structure

The value of coefficient of determination of regression model has been calculated to be 0.87. The large value of this coefficient indicate that the fitted regression model have a proper power in predicting the

values of knowledge management scores and as a result the explained changes of network structure by the above mentioned model is significant.
In testing the goodness of fit of the regression model above, the values of total effects and direct effects of elements have been presented in table 2.

Table 2: Total and direct effects and regression coefficients of variables and significance levels of regression model effects

Variable	Total effect	Direct effect	Regression coefficients	Effect level of significance
1. Alignment and congruence	2.84	.059	.168	.005
2. Performance pressure	1.77	.064	.114	.078
3. Desire to change	2.17	.061	.132	.031
4. Spirit	1.99	.062	.124	.048
5. Common fate	3.11	.055	.172	.002
6. Knowledge application	2.61	.058	.151	.010
7. Strategy insight	3.40	.061	.206	.001

Comparing the rate of direct effect of elements and their total effect indicates that high correlation between independent elements of the model has caused most part of the effect of each element on network structure in comparison to other elements and hence their direct effects on response variable will be too small. However, it was observed that due to all the relationship between variables, performance pressure can show its effect on response variable through other elements and hence the presence of this element in the model is not significant. Therefore, the following conclusions can be drawn:

- Strategy insight has a significant effect on network structure in virtual organizations.
- Common fate has a significant effect on network structure in virtual organizations.
- Desire to change has a significant effect on network structure in virtual organizations.
- Spirit has a significant effect on network structure in virtual organizations.
- Alignment and congruence have a significant effect on network structure in virtual organizations.
- Knowledge application has a significant effect on network structure in virtual organizations.
- Performance pressure has a significant effect on network structure in virtual organizations.

In order to test the goodness fit of the above model, the diagram of the values of regression error are fitted to test their normality and for confirming stability of error terms variance. Also, we can draw the standard error changes diagram against the predicted values.

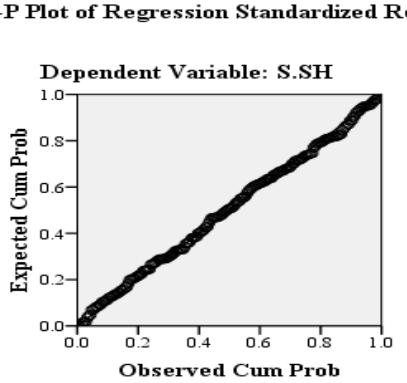

Figure 4: Cumulative distribution models for normally distributed errors

Based on figure 4 and considering lack of distance of Empirical distribution from the normally distributed error terms, the assumption of normal distribution of error terms is accepted and as a result of diagram 5 that also does not show any course between the points, we can accept that the variance of regression error terms are stable and therefore the resulted model have a proper validity.

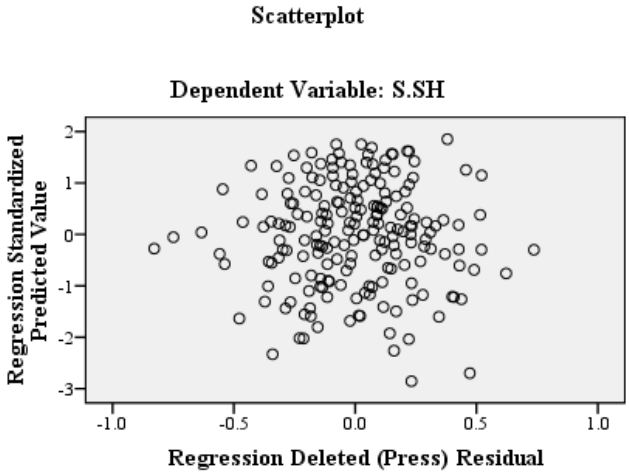

Figure 5: Distribution of standardized predicted values against regression adjusted errors

Now, considering that the above model has the required good fit, we interpret the effect rates of business intelligence elements on network structure based on the standardized model coefficients. Based on this, we can rank the effect rate of business intelligence elements on network structure as per the following:

1. Strategy insight
2. Common fate
3. Alignment and congruence
4. Knowledge application
5. Desire to change
6. Spirit

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