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Relationship between Total Quality Management, knowledge Transfer and knowledge Diffusion in the academic settings

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Abstract

In the emerging knowledge economy, universities play a critical role in knowledge transfer and knowledge diffusion of their research findings to the industry. Using the Total Quality Management opens a new horizon in higher education settings in order to facilitate knowledge transfer process and institutionalize its diffusion in the industrial contexts. In doing so, the main purpose of this study is to investigate total quality management practices affecting knowledge transfer and knowledge diffusion in the academic settings. The method used in this study is a correlation method, and structural equation modeling (SEM) are utilized to analyze the data by means of the path analysis. The research instrument is the questionnaire. The study's participants are a sample of all graduate students, PhD student and Professors of three departments at Shiraz University, Iran; of which 169 persons randomly selected as examples of expertise. The findings of the study indicated a significant relation between learning, Autonomy, as the TQM practices and knowledge transfer, and between knowledge transfer and knowledge diffusion. The study also pointed out that among the TQM practices, learning and Employee Fulfillment, have the significant correlation with knowledge diffusion

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1. Introduction

Broadly speaking, knowledge has been regarded as the very source of achieving, maintaining, and sustaining economic growth and competitive market advantage (Courtney and Anderson, 2009). Modern societies, and generally modern life, are heavily regulated by knowledge, which from a strategic perspective, provides innovation capacities for firms to secure competitive advantages in rapidly developing economic markets (Lazzeretti and Tavoletti, 2005). Meanwhile, the expansion of knowledge-based economy and the increasing need for innovation have resulted in new operational challenges for universities, urging them to take new roles, besides their traditional educational functions, and to initiate associations with industries (Etzkowitz and De Mello, 2003).

One of the important facets enabling universities to take part in industrial activities is technology transfer and commercialization activities. In fact, university-industry knowledge transfer activities involve various institutional/organizational interactions, along with governmental participation, that help create and promote firm competitiveness using an effective generation of knowledge (Wang and Lu, 2007). The majority of advanced economies have witnessed developments in the size and scope of university-industry knowledge transfer activities, especially over the past two-three decades (Rossi, 2010). Universities, as the most important knowledge-generating institutions, are the center of attention for academics (Lazzeretti and Tavoletti, 2005). Although knowledge management seems to be a relatively recent topic for business firms or organizations, the topic has always been a central concern for academia (Gururajan and Fink, 2010). Knowledge generation and knowledge application can only be practically incorporated if effective knowledge transfer is promoted between universities and the industry (Wang and Lu, 2007). As higher education institutions, universities offer centers that generate and distribute knowledge, while their activities should not be limited to mere education or research. In contrast, they will need to prepare for taking new functions in the expansion of national economy (Etzkowitz, 2006).

Incorporating the possible links between TQM practices and KM constructs can help unfold the areas that affect the strategic capacities of organizations (Colurcio and Mele, 2006). Nonaka and Takeuchi (1995) contend that TQM practices provide the foundation of competitive advantage, because such practices make it possible to generate and share knowledge among the members of an organization (Ooi, 2014). TQM, for instance, represents the crucial factor in winning long-term competitive advantage (Yang et al., 2003).

Despite this research variety, few studies have investigated the relationship between the key practices of TQM and KM, although the links between these notions, as mentioned earlier, is important. The qualities of their relationship, one could say, are still far from a universal agreement (Molina et al., 2004). A trend of study could concentrate on the TQM constructs and those of KM, creating an integrative whole enabling firms to implement effective strategic competence (Mele and Colurcio, 2006). For instance, Molina et al. (2007) investigated the relationship between quality management (QM) and knowledge transfer in 197 companies in Spain. Their findings confirmed the significance of QM practices in the internal/external knowledge transfer. Using a structural analysis paradigm, Ooi (2014) scrutinized the multi-dimensional relationships between TQM and KM in services/production companies in Malaysia. The research found that strategic planning and human resource management had a positive and significant relationship with KM elements. Furthermore, process management was found to have a significant effect on knowledge acquisition/distribution. Considering the importance of TQM and Knowledge transfer in the academic environments, the present study seeks to create a ground for understanding TQM and its facilitating role in knowledge transfer, explaining how TQM can enhance the transfer and distribution of knowledge in academic settings.

2. Review of the literature

2.1. Total Quality Management

TQM can be regarded as a holistic approach to management that tries to maintain sustainable improvement in the total performance of an organization. Yet, to gain TQM, the notion of *total quality* has to be considered in diverse aspects of an organization, such as the acquisition of resources or customer service after the sale (Kaynak, 2003). Previously, however, TQM was generally perceived as a mechanism through which an organization could enhance its performance. Nowadays, of course, the competitive environment has brought about a new understanding of the

importance of TQM, because it represents the essential factor in implementing improvement and sustainability in both service and manufacturing companies (Claver-Cortes et al., 2008).

TQM practices have been considerably used in studies that deal with the relationship between TQM practices and various dependent variables. Saraph et al. (1989) first recognized TQM practices in measurement studies (Kaynak, 2003). Inspired by the influential studies of Saraph et al. (1989), numerous researchers have tried to recognize the key TQM practices. Different researchers, of course, have identified different key practices of TQM and have devised measurement tools to analyze the realization of such tool in enterprises, companies, and firms. Up to date, a total of 45 different TQM critical factors have been proposed by 16 groups of researchers who have investigated the notion worldwide (e.g. Adam, 1994; Ahire et al., 1996; Anderson et al., 1994). Along the same lines, many researches have attempted to identify the relationship between TQM practices and organizational performance (Ahire and Ravichandran, 2001). Many researchers have concluded that firms could achieve operational and financial advantage through TQM practices (e.g. Prajogo and Sohal, 2004; Samson and Terziovski, 1999).

Given that every studies in the literature offers and discuss its specific set of critical factors, the present study, following a detailed overview of the literature, relies on six TQM practices, as the key TQM factors, and uses the fuzzy screening method to analyze the opinions of academic experts. Table 1 lists the studies that have observed a relationship between TQM practices and various dimensions of performance.

Table 1 Relationship between TQM practices and performance in the literature review

Practices	Researcher	Practices	Researcher
Process management	Kaynak (2003), Wilson and Collier (2000), Sila and Ebrahimipour (2005), Anderson et al. (1994), Adam et al (1997), Rungtusanatham et al. (1998), Ahire and Ravichandran (2001), Molina et al. (2007) , Sadikoglu and Zehir (2010)	Customer satisfaction	Rungtusanatham et al (1998)
			Anderson et al. (1994) Adam et al. (1997)
Continuous improvement	Rungtusanatham et al (1998), Anderson et al. (1994), Sadikoglu and Zehir (2010), Rahman And Bullock (2005)	Learning	Ahire and Ravichandran (2001), Rungtusanatham et al (1998), Anderson et al. (1994)
Autonomy	Rungtusanatham et al (1998), Ahire et al.(1996), Flynn et al., (1994) , Griffin et al., (2001), Saraph et al. (1989) Molina (2007)	Employee Fulfillment	Rungtusanatham et al (1998) Anderson et al. (1994)

2.2. Knowledge transfer

One of the recent difficulties that organizations confront, especially since the beginning of the twenty-first century, has been the problem of archiving comparative advantage through Knowledge Management (Drucker, 1999). Without a doubt, members of a modern society, especially organizations, have no choice but to rely on the diversity of notions associated with knowledge, including knowledge management, production, and transfer (Santesso and Tugwell, 2006).

Knowledge transfer is considerably important for creating values. According to Ranft and Lord (2002), knowledge transfer involves the acquisition and application of a set of sources regulated by knowledge (Ahammad et al. 2016). According to a definition proposed by the United Nations Work Regulations, knowledge transfer involves the transfer of systematic knowledge for a product manufacturer or provision of services. In fact, what knowledge transfer denotes is a cycle in which knowledge is generated and distributed for a given user, such as individual or organization, by the experience or ability of a knowledge producer (Courtney and Anderson, 2009).

One of the significant areas in which studying knowledge is strongly relevant due to its nature is higher education, which generates and transfers scientific knowledge. Even governments attempt to provide necessary facilities and causes, directing academic research toward the needs found in industrial sectors and services/production organizations (Owen et al., 2005). The term “university-industry knowledge transfer” refers to a broad spectrum of exchanges, engaging multifarious activities with the purpose of knowledge/technology exchange between universities and firms (Rossi, 2010).

Universities are being converted from mere research and education institutions into hubs promoting knowledge transfer between and among partner universities, industry, and the government (Courtney and Anderson, 2009). The

majority of empirical studies have demonstrated that knowledge transfer activities implemented through engaging industry and universities have brought about a positive impact on the both sides. Yet, in many organizations are still ambivalent about taking part in such mutual engagements (Anatan, 2015). What makes the situation even more ambiguous is the underdeveloped nature of empirical research into the success of knowledge transfer in higher education (Li-Hua, 2007). In some studies, it has been demonstrated that the development of approximately 10% of new products/processes promoted by firms directly depended on the involvement of academic research (Bekkers and Bodas Freitas, 2008). As a strategy suggested by a related study, academic researchers could be hired to effectively transfer knowledge from universities to firms (Zucker et al., 2002).

A variety of dimensions shaping knowledge transfer between universities and firms have been examined in a number of empirical studies (McMillan and Narin, 2000). For instance, Meyer-Krahmer and Schmoch (1998), surveying university researchers, observed that *collaborative research* was the most pervasive mode of knowledge transfer in academia. It has also been suggested that firms are especially interested in such academic productions as publications and patents, which are the most frequently cited modes of accessible knowledge (Bekkers and Bodas Freitas, 2008). Investigating the US industry patents, Narin et al. (1997) observed that 73% of the papers cited in the industry patents were produced by researchers affiliated with public research organizations. Industrial scientists, on the other hand, published the remaining percent of the researches in the industry. Cohen et al. (2002) similarly concluded that industrial research and development (R&D) could be most vitally influenced by published academic papers/reports.

2.3. Knowledge Diffusion

One of the effective processes that basically complete knowledge transfer is called *knowledge diffusion*. The purpose of this notion is to help achieve the key knowledge-related goals of an organization. A society can be specifically benefited, especially in terms of economic performance, by delving into the processes through which knowledge transfer and knowledge diffusion work. There are, however, many gaps to be filled, as far as the interconnections between the two processes are perfectly identified and well researched (Klarl, 2014).

A basic problem, for instance, is that transfer of scientific knowledge, perhaps due to the shortcoming of strategies employed, has not been capable of guiding decision-making for practical purposes (Kitson et al., 1996). To solve this problem, a union must be established between academic researchers and practical decision-makers in firms. Through constructive communication, academic knowledge can be easily and effectively “diffused” between and among decision-makers (Thompson et al., 2006). Considering these concerns, in this study, the notion of knowledge diffusion, with its role in operationalizing research findings, was investigated as an important process, along with knowledge transfer.

3. Methodology

This study was a descriptive research, in terms of data collection and data analysis, using structural equation modeling (SEM) for interpreting correlation measurements. More specifically, as the research relied on SEM to test the hypotheses, it used the correlation matrix or covariance matrix. To collect data, questionnaires were utilized. The population included all of the MA students, PhD candidates, and professors of three colleges in Shiraz University, Iran. Among the population, 186 individuals were selected as the sample through the random stratified sampling method and Krejcie and Morgan’s table. Table 2 shows the distribution of the data obtained.

Table 2 Demographic information of the respondents (N = 331).

Demographic characteristics	Frequency	Percentage	Sample	Receiving questionnaire
M.Sc. students	227	68%	126	117
PhD Students	71	%22	41	30
Professors	33	%10	19	22
Total	331	%100	186	169

4. Research findings

4.1. Finalizing the factors

To finalize the research variables and identify their related items, fuzzy screening was used. After the original questionnaire was formulated, its copies were submitted to 30 professors as the University’s experts. The findings obtained from this methodology confirmed the validity of all of the variables.

4.2. Test of the model and hypotheses

Means, standard deviations, and correlations between the factors are presented in Table 4. According to Table 4, the values observed revealed that among the TQM variables, Employee Fulfillment (3.12) showed the maximum mean value, whereas Autonomy (2.62) showed the minimum mean value. Furthermore, Knowledge Diffusion (2.25) revealed the least mean value, with respect to all of the variables considered in the research. As Table 3 lists the findings, the correlations of all of the variables at the 0.01 level were found to be positive and significant. The maximum correlation was observed in the relationship between Knowledge Diffusion and Knowledge Transfer (r=0.687), whereas the minimum correlation was found in the relationship between Process Management and Learning (r=0.274). Among TQM variables, Autonomy (r=0.541) showed the strongest relationship to Knowledge Transfer, while Employee Fulfillment (r=0.499) was most strongly associated with Knowledge Diffusion.

Table 3. Mean, standard deviation, and correlations between factors

	Mean	SD	1	2	3	4	5	6	7	8
Learning	2.84	.65	1							
Continuous improvement	2.75	.89	.386**	1						
Employee fulfillment	3.12	.73	.377**	.572**	1					
Customer satisfaction	2.75	.75	.446**	.473**	.486**	1				
Autonomy	2.62	.82	.420**	.442**	.424**	.541**	1			
Process management	2.94	.70	.274**	.312**	.352**	.337**	.350**	1		
knowledge transfer	2.53	.59	.435**	.344**	.331**	.403**	.541**	.306**	1	
knowledge diffusion	2.25	.83	.489**	.339**	.499**	.379**	.423**	.374**	.684**	1

** . Correlation is significant at the 0.01 level (2-tailed)

4.3. SEM and model application results

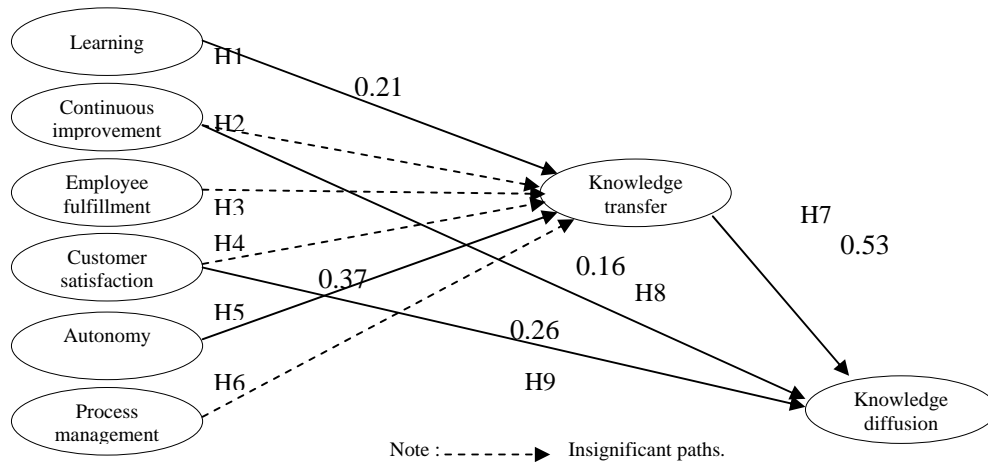
To test the model proposed, SEM and the path analysis method were used. The purpose of path analysis was to identify causal relations among the variables embedded in the conceptual framework of the research. To investigate detailed relationships between the factors, the gamma and beta values of the paths were presented (Table 4).

Table 4 Gamma and beta values in the hypothesized model

Hypothesis	Gamma	Standardized loading
H1	γ knowledge transfer-Learning	0.21(2.50)
H2	γ knowledge transfer-Continuous improvement	ns
H3	γ knowledge transfer-Employee Fulfillment	ns
H4	γ knowledge transfer -Customer satisfaction	ns
H5	γ knowledge transfer-Autonomy	0.37(4.07)
H6	γ knowledge transfer-Process management	ns
H8	γ knowledge diffusion-Learning	0.16(2.38)

H9	γ knowledge diffusion- Employee Fulfillment	0.26(4.11)
Hypothesis	Beta	Standardized loading
H7	β knowledge diffusion-knowledge transfer	0.53(7.96)

Results show that $\gamma_{\text{transfer-Continuous improvement}}$, $\gamma_{\text{transfer-Employee Fulfillment}}$, $\gamma_{\text{transfer-Customer satisfaction}}$, and $\gamma_{\text{transfer-Process management}}$ are not significant at .05 confidence level (t-values fall between ± 1.96). With the significant correlations between knowledge transfer and Continuous improvement (.344), Employee fulfillment (.331), Customer satisfaction (.403), Process management (.306), so we can say that H2, H3, H4 and H6 were partly supported. Other γ s and β s are significant at .05 confidence level, so H1, H5, H7, H8, H9 are supported in this study. In summary, five (H1, H5, H7, H8, H9) of the nine hypotheses were supported, four (H2, H3, H4 and H6) of them were partly supported (correlated with each other but not directly related). Figure 1 illustrates the structural model of the research, as well as relationships observed among them.



Note : - - - - -> Insignificant paths.

Chi-square=4.87, df=4, P-value=0.30040, RMSEA=0.042

Fig 1. Structural model with standardized loading

In the current study, the model fit was evaluated according to the guidelines for an acceptable model fit. For a good model fit, $\chi^2/d.f$ should be less than 3.0 (Bollen, 1989), the goodness of fit index (GFI) should be close to 0.90 (Doloi et al., 2010; Singh, 2009), the normed fit index (NFI) more than 0.9 (Doloi et al., 2010), the comparative fit index (CFI) more than 0.9 (Bagozzi and Yi, 2012; Chinda and Mohamed, 2008; Doloi et al., 2010), and the root mean square error of approximation (RMSEA) less than 0.07 (Bagozzi and Yi, 2012; Chinda and Mohamed, 2008; Singh, 2009). As shown in Table 5, the fit indices for the structural model were within accepted thresholds: ($\chi^2 = 4.87$; $df = 4$; $GFI = 1.00$; $NFI = 0.99$; $CFI = 1.00$; and $RMSEA = 0.042$). Hence, this model fitted the data reasonably well.

Table 5 Good model fit

df	χ^2	RMSEA	GFI	CFI	NFI
4	4.87	0.042	0.99	1.00	0.99

5. Conclusion

This research investigated the relationship between TQM, knowledge transfer and knowledge diffusion in Shiraz University, Iran. The findings, which were based on correlation analysis, showed a positive and significant relationship between the dependent variables “Knowledge Transfer and Knowledge Diffusion” and TQM practices

(learning, continuous improvement, Employee Fulfillment, student satisfaction, autonomy, and process management). The maximum correlation was found in the relationship between Knowledge Diffusion and Knowledge Transfer ($r=0.687$), whereas the minimum correlation was found in the relationship between Process Management and Learning ($r=0.274$).

Given that the relationships between and among all of the TQM practices and Knowledge Diffusion and Knowledge Transfer were found to be positive and significant, further interesting questions could inspire future studies, especially with the purpose of filling the existing gaps. Improving TQM through providing favorable grounds in universities, especially by internalizing knowledge diffusion in societies and industries, can promise a bright future for university-industry knowledge transfer activities.

The results of the SEM revealed that knowledge transfer ($\beta=0.53$) had the strongest impact on the variable knowledge diffusion. Furthermore, the findings showed that among TQM practices, the two variables Autonomy ($\gamma=0.37$) and Learning ($\gamma =0.21$) influenced knowledge transfer. The interesting fact was that the two variables Learning ($\gamma =0.16$) and Employee Fulfillment ($\gamma=0.26$) directly (without the mediatory role of knowledge transfer) influenced knowledge diffusion.

Considering the results, the significant role of TQM in achieving knowledge transfer and knowledge diffusion was emphasized. As a result, universities' policy-makers are recommended to implement long-term operational plans for empowering professors and students in the field of knowledge transfer. Additionally, university students can be motivated to focus their research projects on social needs by making them aware, in special courses, of the significance and value of academic knowledge transfer in improving the production system

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