

The Influence of Socio-technical Factors on Knowledge-based Innovation in Saudi Arabia Firms

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Abstract

The Saudi Arabian Government has recognised the need for an alternative path to national development in the form of a knowledge-based economy. It is important to understand the socio-technical enablers and processes towards organization innovation capability to help contribute to knowledge based economy initiative, in particular with regard to the phenomenon of knowledge sharing in Saudi firms. A conceptual model developed in the study contains four construct domains: socio-technical enablers; Diffusion of Innovation dimensions; knowledge sharing processes; and organizational innovation capability to examine depicts the relationships between the enablers, processes and outcome constructs within Saudi Arabia firms. From the empirical findings, the study has been able to offer a number of implications, which are beneficial to towards adoption of knowledge base economy seeking to enhance the Saudi organisations towards enriching the organisational innovation capability.

INTRODUCTION

This paper investigates how the influence of socio-technical factors on knowledge sharing can support or limit the innovation capability of an organisation, in particular, in Saudi Arabia organizations. The paper describes a multi-site case study of Saudi organizations to examine the influence of social-technical factors of knowledge sharing towards innovation. By studying the relationships between knowledge-sharing critical factors, processes and organisational innovation capability, this research investigates how Saudi Arabia organisations can promote a knowledge-sharing environment that will sustain their innovation capabilities. The contribution of this paper is to test a research model that shows a relationship between knowledge sharing enablers, process towards organization innovation capability in Saudi firms context, which helps to contribute to Saudi knowledge based economy initiative.

Innovation has been defined in many ways to confine to new goods, services, precludes, processes and organisational applications (Darroch and McNaughton 2002). However, regardless of what definition is used, innovation is generally viewed positively because of its association with the creation of value for firms and individuals (Brown, Fazzari and Petersen 2009). Governments have a key role in increasing the ability of innovation for both private and public companies (Ellin 1981). This is due to the perception that innovation not only enriches firms but also has a positive economic return on the host state (Ellin 1981). The Kingdom of Saudi Arabia is one state whose government has identified that increasing innovation is required in order to meet the strategic economic goals of the government (Alothman & Busch 2009). Saudi Arabia's participation in the World Trade Organisation is a clear indication that it wishes to be a major participant to the other economies. The transition from a natural resource-based economy to a knowledge-based economy is not automatic. It can only occur if it is supported by careful policies constructed on the basis of access to information about how other countries engaged in similar processes of change. Other countries will mostly have developed a knowledge-based economy from a far more balanced and strong foundation in terms of social, technological and economic development than exists in Saudi Arabia. Saudi Arabia should examine the successes and failures other countries experienced in their transition to a knowledge base. However, research specifically oriented to

the problems of Saudi Arabia is also a precondition for success in restructuring Saudi Arabia to compete internationally.

One of the factors that have been positively associated with innovation is knowledge (Darroch and McNaughton 2002). Knowledge can be simply defined as information that enables action to be taken (Alavi and Leidner, 2001). Although there are other definitions, this definition is sufficient for the purpose of understanding knowledge and attempting to develop tools that increase the level of knowledge within a firm or a society. Knowledge has been shown to evolve in a cyclical fashion (Boisot 1999) and can be the result of interaction between agents (such as, individuals or firms) (Preece et al., 2001). Thus, the interaction of agent-specific knowledge cycles may be influential in the development of knowledge within a society. Business firms in today's globalised world must innovate to compete, such that the firm innovation capability may provide an indication concerning how companies can foster knowledge-sharing culture to maintain their innovation performance (Lin 2007).

The government of Saudi Arabia has associated the development of a knowledge economy with increasing innovative output from that society (Alothman and Busch 2009). Although knowledge has been studied at inter-firm (Rivkin 2001) and intra-firm levels (Grant 1996), the association of the level of knowledge in the wider community with the innovativeness of firms is not clear. It may be posited that a society with a higher level of knowledge will be more innovative than a society with a lower level of knowledge (Evangelista et al. 1998); however, it is not clear how knowledge within a society contributes to increasing innovation by firms that exist as part of that society. Specifically, it is not clear how the knowledge cycles of individuals within a society interact in order to positively influence the innovative output of firms and individuals within that society.

The study focuses on the influence of knowledge-sharing factors from a socio-technical perspective, using a diffusion of innovation framework to examine staff preferences on knowledge-sharing processes with the aim of sustaining organisational innovation capability in the context of organisations in Saudi Arabia. The following research questions have been formulated to address the research gaps related to the current study. (1) How does socio-technical-cultural factors influence knowledge sharing in Saudi organizations? (2) In what way and to what extent do the affected knowledge-sharing processes influence Saudi organisational innovation capability?

PREVIOUS STUDIES

Knowledge-Sharing

According to Nonaka (1994) knowledge is both tacit and explicit. Tacit knowledge is unarticulated and based on actions and experiences in context, while explicit knowledge is articulated in in some symbolic form. Knowledge-sharing has become a key concern for organisations because of the growing recognition that tacit knowledge is more valuable than explicit knowledge (Marouf 2007). Recently, many companies have recognised that the tacit knowledge of their employees represents invaluable organisational intellectual capitals (Riege 2005). The literatures usually identify socio-technical factors in the area of knowledge sharing, such as, "Top Management Support": Top management has a close relationship to KS (Knowledge Sharing). Many researchers have acknowledged that the success of sharing knowledge or experiences among staff fundamentally depends on the support of the senior managers' adoption of knowledge-sharing initiatives (Gupta and Govindarajan, 2000; Hislop 2003). "Rewards system": The existence of an organisational reward system it is seen as important in supporting KS activities by the organizations (Lin 2007). Smith and McKeen (2003) state that incentives, a bonus system and promotion that are based on knowledge sharing will strengthen attitude towards sharing knowledge within an organisation. Interpersonal or co-worker trust is vital to successful knowledge-sharing. In addition, according to Kim and Lee's (2006) research, IS/IT infrastructure positively influences significantly on the knowledge-sharing process and the application of the company.

Diffusion of Innovation

A comprehensive definition that adequately addresses the intangible aspect of innovation as well as its physical manifestations is given by Salvendy (1992), who says that innovation is a multifaceted process implying creative activity and involving new understanding and insights, the development of a new product or process or the creation of new capital and markets. Frank et al. (2006) argue that before it can judge how an innovation is working in practice, management should keep in mind two factors: the pre-existing business structure and operation and the business strategy it is adopting to drive the innovation. In addition, apart from the focus on the needs of the enterprise for innovation, there also is an external

context related to whatever level of open competition exists for a company's operations. The Diffusion of Innovation (DOI) model provides an understanding of how the diffusion of innovation process works as a result of the four elements: an innovation; communication channels through which the idea is communicated; the time required for this communication process; and the members of a social system between whom the communication takes place (Rogers 2003). Innovation diffusion theory posits that there are five perceived innovation characteristics that influence adoption (Rogers 2003): relative advantage, compatibility, complexity, observability and trialability. Of these characteristics, only relative advantage, compatibility, complexity were included in the research model. Firstly, since knowledge-sharing has a long-term impact, management is less concerned with observability of knowledge-sharing. Secondly, knowledge-sharing involves significant organisational change and it is difficult to reverse its effects. Thus, trial ability is unlikely be a major managerial consideration. Thirdly, these three characteristics have consistently been found to be important influences on behavioral intention (Verhoef and Langerak, 2001; Sia et al., 2004). Innovation capability refers to the ability to generate innovations at a fast rate, achieving competitive advantages for the organisation concerned (Hurley and Hult 1998). Another definition of innovation capability is "the ability to create innovations in responding to contextual changes and opportunities without organisational disruption, excessive time and costs, or loss of performance" (Buganza and Verganti 2006).

RESEARCH MODEL AND HYPOTHESIS

The relevant literature on different success factors towards organization innovation capability is reviewed in order to enable development of the research conceptual model and hypothesis. Frequently cited theoretical models or frameworks on knowledge-sharing enablers and processes and innovation or innovation capability are investigated. Finally, the relevant constructs and sub constructs are identified, with justification of their selection with the current study's research model. However, the existing research models prevent a comprehensive understanding towards organization innovation capability in Saudi firms context, which helps to contribute to Saudi knowledge based economy initiative.

Liao et al. (2006) investigated the relationships between knowledge-sharing, absorptive capacity and innovation capability in Taiwan's knowledge-intensive industries. The study found that absorptive capacity is the intervening factor between knowledge-sharing and innovation capability. Lee and Choi (2000) examined the relationship between knowledge management processes and enablers such as organisational structure, culture, and information technologies. The study finds that knowledge management processes are significant predictors for organisational creativity, meaning that business organisations can achieve the strategic and economic benefits of knowledge management by utilising organisational creativity in an effective manner. Alothman and Busch (2009) designed a model to investigate how knowledge management (KM), national culture (NC) and other country-specific factors are influencing Saudi Arabia's efforts to develop a knowledge economy.

Wang and Wang's (2012) presented the relationship between knowledge-sharing, innovation and performance in an organisational setting. The model was empirically tested using data collected from 89 high technology firms in China. The study found that both explicit and tacit knowledge-sharing practices support innovation and performance. Explicit knowledge-sharing has more significant effects on innovation speed and financial performance while tacit knowledge-sharing has more significant effects on innovation quality and operational performance. Martiradonna (2014) proposed a model designed to examine the influence of individual, organisational and technology factors on knowledge-sharing processes and whether having more processes leads to superior firm innovation capability. The results show that organisational factors significantly influence knowledge-sharing processes. Table 1 summaries previous research models.

The proposed model comprises of four constructs

1. Socio-Technical Factors (STF)
2. Diffusion of Innovation (DOI)
3. Knowledge-Sharing Processes (KSP)
4. Organisational Innovation Capability (OIC).

Each of these constructs is briefly explained below (Figure 1):

Socio-Technical Factors (STF)

Socio-technical factors are the factors from social and technical dimensions that provide the support needed to increase the ability to share knowledge. The four STF constructs examined in this research

are:

Table 1: Summary of the previous research models

Source	Examined factors	Method	Constructs relationship
(Liao et al. 2006)	<ul style="list-style-type: none"> Knowledge-sharing processes (donation and collection) Innovation capability 	Quantitative surveys of Taiwanese employees	Knowledge donating and knowledge collecting → Innovation capability
(Lee and Choi 2000)	<ul style="list-style-type: none"> KM enablers (trust) KM processes 	Quantitative surveys in Korea organisational settings	Trust → KM processes
(Wang and Wang 2012)	<ul style="list-style-type: none"> Knowledge sharing (tacit and explicit) Innovation 	Quantitative surveys of firms in China	<ul style="list-style-type: none"> Knowledge-sharing Innovation
(Alothman and Busch 2009)	Knowledge-sharing factors	Development of KE model of Saudi Arabia	Knowledge-sharing factor → knowledge
(Lin 2007)	<ul style="list-style-type: none"> Organisational factors (TMS) Organisational reward Knowledge donating Knowledge collecting Firm innovation capability Trust (trustworthiness of e-government) 	Quantitative surveys of 172 employees from different organisations in Taiwan	<ul style="list-style-type: none"> TMS → knowledge donating TMS → knowledge collecting Rewards → knowledge donating Rewards → knowledge collecting Knowledge donating → innov capability Knowledge collecting → innov capability
(Tohidinia and Mosakhani 2009)	<ul style="list-style-type: none"> Level of ICT usage Knowledge donation Knowledge collection 	Quantitative study of 502 respondents from an Iranian petroleum firms	<ul style="list-style-type: none"> ICT → Knowledge donating ICT → knowledge collection
(Aulawi et al. 2009)	<ul style="list-style-type: none"> Senior Management Support Trust Knowledge based rewards System Technological condition Knowledge sharing behaviour Individual innovation capability 	Quantitative surveys for 125 Indonesian telecom companies	<ul style="list-style-type: none"> Management support Trust Rewards → knowledge-sharing technology but it were mediated by the intention of sharing knowledge usage Knowledge sharing → innovation capability

- *Top management support* (TMS) refers to the degree to which the top management support the organisational climate of knowledge-sharing by providing sufficient resources and influencing the employee willingness to share knowledge.
- *Information Systems infrastructure* (IS) refers to the level to which facilitating knowledge-sharing through knowledge repositories, an integrated set of components for gathering, storing and disseminating information to enhance the collaboration and communication around the organisation.
- *Interpersonal trust* (trust) refers to the degree to which the trust between co-workers exists concerning sharing feelings and perceptions, sharing personal information and experiences and the level of trust between employees and their trustworthy relationships. It also includes the existence of trust policies and procedures to protect the action of sharing the knowledge between co-workers.
- *Reward system* (Rew) refers to the degree to which an individual gains benefits by collaborations and team-working rather than individual effort.

Diffusion of Innovation (DOI)

Diffusion of innovation characteristics refers to the seven identified dimensions that can be used to analyse the characteristics of new phenomena in the organisation (Rogers, 2003). These are:

- *Perceived relative advantage* (RA): The degree to which encouraging knowledge-sharing is perceived to benefit the conduct of business.
- *Compatibility* (Com): The degree to which encouraging knowledge-sharing fits into existing business process.
- *Complexity* (Cox): The degree to which encouraging knowledge-sharing is difficult or an effort.

Knowledge-Sharing Processes (KSP)

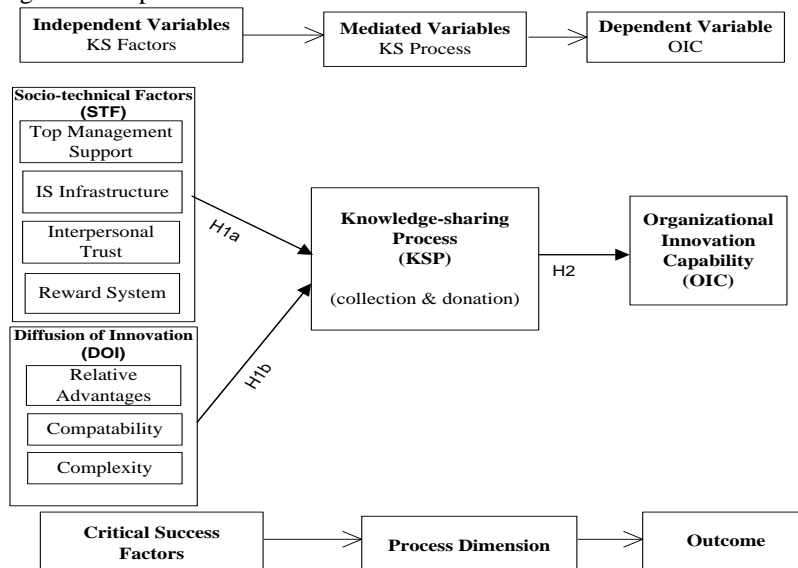
Knowledge-sharing processes are the processes of donating and collecting knowledge. These are defined as:

- *Knowledge donation* (Don) refers to the action of employees to pass on their intellectual capital in an organisation.
- *Knowledge collection* (Col) refers to the action of employees asking for advice from each other in order to build intellectual capital.

Organisational Innovation Capability (OIC)

The organisational innovation capability is the organisation's intention of increasing their ability to develop new and creative ideas in order to bring new innovative products or services that will increase the organisation's competitive edge.

Figure 1: Proposed research model



Hypotheses Development

The proposed conceptual model, presented in Figure 1, depicts the possible relationships connecting the four constructs (STF, DOI, KSP and OIC). To confirm these relationships, a literature search was conducted to find the theoretical evidence through which the hypothetical relationships of the above constructs were linked. These relationships were proposed as a set of research hypotheses to address the research questions. The conceptual model (Figure) indicates the potential relationships between STF and DOI to KSP (donation and collections) towards OIC. However, these relationships were based on a theoretical understanding from the literature review and there is limited direct empirical evidence that examines this. The literature review helped to formulate three research hypotheses linked to research questions:

H1a: Socio-technical factors (STF) positively influence knowledge-sharing processes (donation and collection).

H1b: Diffusion of innovation (DOI) positively influences knowledge-sharing processes (donation and collection)

H2: Employees' willingness to share knowledge (donation and collection) positively influences organisations' innovation capability and knowledge-sharing processes (KSP) and acts as a mediator for the relationship between knowledge-sharing factors (STF and DOI) and organisational innovation capability (OIC).

The purpose of this study is to investigate how the influence of socio-technical factors on knowledge sharing can support or limit the innovation capability of an organisation, In particular in Saudi Arabia organizations. The paper describes a multi-site case study of Saudi organizations to examine the influence of social-technical factors of knowledge sharing towards innovation. By studying the relationships between knowledge-sharing critical factors, processes and organisational innovation capability, this research investigates how Saudi Arabia organisations can promote a knowledge-sharing environment that will sustain their innovation capabilities.

APPROACH

The survey was distributed to employees in different organisations from the selected industries in Riyadh, Saudi Arabia between July 2011 and February 2012. A total of 20 organisations were randomly selected from the top 1000 firms lists in Saudi Arabia's Ministry of Labor. 600 questionnaires has been distributed, 257 completed and returned, which represents a response rate of 42.83%. The scales implemented in this survey were developed originally in English. However, it was necessary that they were translated in Arabic to be used in Saudi Arabia's organisations. Two certified translators translated the English version to Arabic.

All constructs were measured using five-points Likert-scale statistical measures (ranging from 1=strongly disagree to 5=strongly agree). Measurement items operationally adapted from previous studies. Top management support was measured using four items derived from Tan and Zhao (2003). Reward system and IS infrastructure was measured using two-item scale adapted from Al-Alawi et al. (2007). Perceived relative advantage was measured using a three-item scale adapted from Song (2002), Lee and Choi (2003) and Lin and Lee (2006). Perceived compatibility was measured using three items that were adapted from Chow et al. (2000), Sia et al. (2004) and Lin and Lee (2006). Perceived complexity was measured by using three items adapted from Huysman and de Wit (2004), Sia et al. (2004) and Lin and Lee (2006). Knowledge-sharing processes was measured using ten items adapted from Bock et al. (2005), Yeh et al. (2006) and Lin (2007) and most of the items adapted from Van den Hooff and Van Weenen (2004) and Lin (2007). Organisational innovation capability was measured using eight items derived from Calantone et al. (2002) and Lin (2007).

The structural equation modelling (SEM) technique was used to investigate the causal relationships of the model (Hair et al., 2006). SEM was used as an extension of the previous technique factor analysis. Relatively, the SEM helps to integrate path analysis and factor analysis by involving two steps in this process: validating the measurement model; and fitting the structural model after the CFA and through path analysis (Garson 2006). The SEM was performed on SPSS-AMOS. A pre-test recommended by Burns and Bush (2003) was conducted in order to identify issues that needed to be revised before executing the major questionnaire.

DATA ANALYSIS

The measurement models in AMOS were evaluated by examining internal consistency, convergent validity and discriminant validity. Internal consistencies (Cronbach's alpha) of all variables were higher than the adequate benchmark of 0.70. According to Pallant (2005), a value of the corrected item-total correlation scale of lower than 0.30 indicates that the variable is measuring something different from the construct as a whole. All items-total correlations were greater than 0.30. Table 2 shows reliability analysis.

The assessment of the model fit, the convergent and discriminant validity were based on the following rubric:

- *Model fit indices:* $\chi^2/df < 3.00$; GFI, TLI, CFI, and IFI > 0.90 ; and RMSEA < 0.08 (Garson, 2006; Hair et al., 2006; Hoyle and Panter, 1995; Kline, 2005);
- *Convergent validity:* factor loadings > 0.50 ; *t*-values > 1.96 (significant at $p < 0.05$ level); and $R^2 > 0.50$ (Bollen, 1989; Hair et al., 2006; Koufteros, 1999);

The results derived to a not acceptable level of fit: $\chi^2 = 2886.516$; $df = 816$; $\chi^2/df = 3.537$; GFI = .62; TLI = .66; CFI = .67; IFI = .67; RMSEA = .10 and one construct with three factors, DOI, was not significant with a high errors level and a T-value of 0.77, which is not accepted as it leads to insignificant path and needs to be removed. It was recommended to removed the DOI construct to increase the level of significance and the values of fit indices as all the indicators (factors) had a significant loading ($p < 0.001$) on their respective constructs.

Table 2: Reliability analysis

Measurement Scale	Number of Variables	Corrected Item-Total Correlation	Cronbach's Alpha
Socio-technical factors			
Top management support	5	0.618	0.728
IS infrastructure	3	0.656	0.734
Interpersonal trust (STF)	5	0.672	0.723
Rewards systems	2	0.516	0.744
Diffusion of Innovation			
Relative advantage	4	0.468	0.738
Compatibility	3	0.595	0.739
Complexity	3	0.348	0.744
Knowledge-sharing process			
Donation	5	0.691	0.717
Collection	5	0.620	0.725
Organisational Innovation Capability	8	0.723	0.695

The effect of STF and DOI positively influence on knowledge-sharing processes, therefore H1a is supported. However, hypothesis H1b is not supported as the results show that DOI had no significant relationship with KS. Although, the impact of a firm's innovation capability was found to be strongly positively associated with employee willingness to donate and collect knowledge, the relationship showed that KSP has a mediating role on the OIC construct via the STF construct; hence, H2 is strongly supported. Figure 2 and Table 3 show hypothesis testing.

Figure 2: Path testing

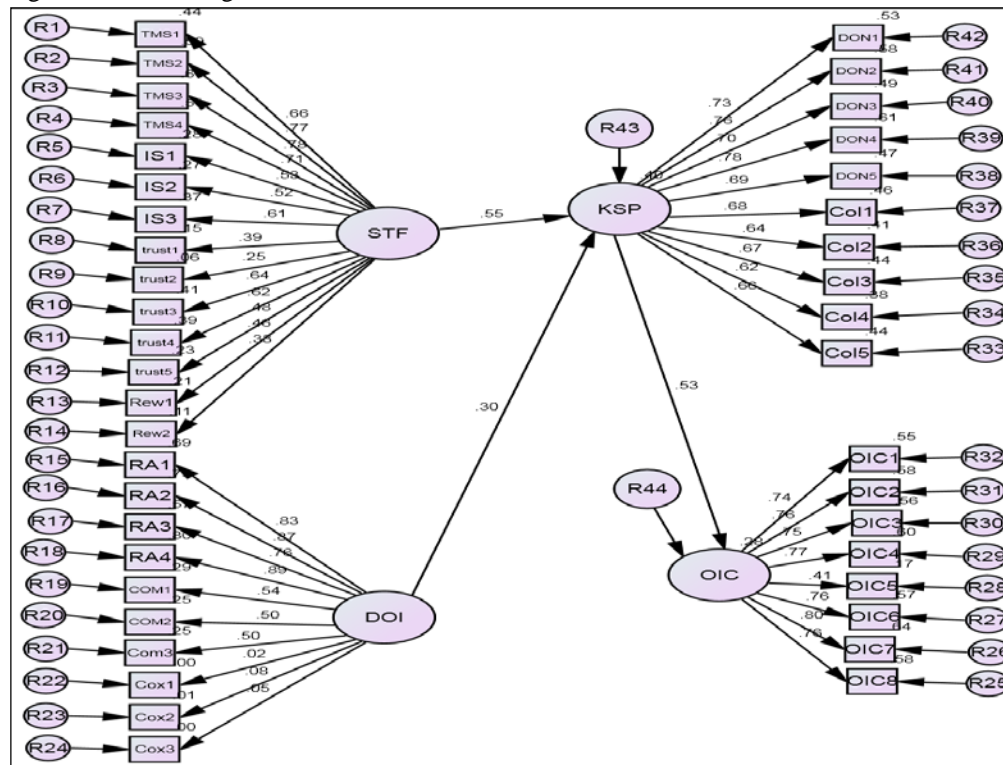


Table 3: Hypothesis testing

Path (Hypothesis)	Standardised path Coefficient	t-value	Hypothesis testing Result
STF → KSP	.551	4.459	Supported
DOI → KSP	.303	.771	Not Supported
KSP → OIC	.526	7.392	Supported
$\chi^2 = 2886.516$; $df = 816$; $\chi^2/df = 3.537$; $GFI = .62$; $TLI = .66$; $CFI = .67$; $IFI = .67$; $RMSEA = .10$			

DISCUSSION AND CONCLUSION

The current research study was conducted to provide a theoretical progression in the area of knowledge-sharing and innovations together, as well as to identify practical contributions for the management of knowledge within Saudi Arabia from organisational prospective. The study provides empirical evidence of the socio-technical factors have an influence on staff preferences concerning knowledge-sharing processes. Further, the socio-technical factors (STF) (top management support, IS infrastructure, interpersonal trust and reward systems) that are statistically significant influence knowledge-sharing processes (KSP) (donation and collection).

Study Implications

It is very important to understand and assess the existence of important factors influence knowledge-sharing toward adopting innovation capable organisations that will contribute to any country welfare. The current study developed a measurement model that can understand the socio-technical factors that most effectively positively influence or enable knowledge-sharing towards organisational innovation capability in Saudi firms. The following remarks summarise the research implications of the current research:

- Top management facilitation of knowledge-sharing is important to enable a firm with the superior competence in knowledge-sharing that will allow them to succeed in innovation performance.
- Reliance on only a techno-centric approach to knowledge-sharing is insufficient for achieving the social relationships and interpersonal communications between employees that is necessary to motivate employee willingness to share knowledge. Therefore, all transitional elements, top management support and technology use should always be considered together when promoting knowledge-sharing initiatives towards innovation capability.
- Reinforcing trust between coworkers through arranging social events and outdoor discussions occasionally is vital. Such events could play an important role in helping staff overcome work stress through building informal friendships.
- Increasing the knowledge sharing between organisational levels enables easier vertical information flow.
- Addressing all the recommended theories to foster knowledge-sharing and support diffusion of innovation.

Limitations for Future Research

The current study has used a mix-method research approach. However, as with all studies, the findings should be understood in the knowledge of the limitations that were faced by the researcher and research. The limitations of this study and recommendations for future research studies directions are listed below:

- The study focused on knowledge-sharing practices and innovation capability in selected organisations in Saudi Arabia. It addressed the extent to which the knowledge-sharing factors from a socio-technical perspective influence the preferences of staff to share knowledge on increasing the ability of organisations to be innovative. However, due to time and financial restrictions, no comparative study was undertaken for any other similar or different sittings in other developing or developed country. Therefore, further research is recommended in this area.
- The data analysis of the current study shows a demand for deeper research at the organisational level. Further investigations are needed to examine the differences between staff roles with respect to innovation initiative experience, such as policymakers, strategic managers and IT experts. The outcome would provide further understanding of this study's main concepts.

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