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UNDERSTANDING THE EFFECTIVE FACTORS OF KNOWLEDGE MANAGEMENT SYSTEM USAGE IN PETROLEUM INDUSTRY IN DEVELOPING ECONOMY

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ABSTRACT

Knowledge management system (KMS), as a class of information system, is the backbone of organization that supports the implementation of KM practices. KMS usage contributes to competitive advantages. In the context of oil and gas industry in developing economy, there are reports of KMS usage failure; however, little knowledge is available about antecedents of KMS usage. The extant studies investigating the effective factors of KMS usage have yielded inconclusive findings. In oil and gas industry, there is a paucity of study on determinants of KMS usage. Our research addresses this issue by identifying the determinant factors of KMS usage in the context of oil and gas industry in developing economy, Pakistan. The study adopted cross-sectional survey involving 813 knowledge workers through clustered random sampling and 428 workable responses were returned. Drawing upon the theories of planned Behavior (TPB), Technology Acceptance Model (TAM) and Task Technology Fit (TTF), the study developed a conceptual model and tested it using SPSS and AMOS, Structural Equation Modeling (SEM). The initial conceptual model encompassed 11 hypotheses from which 7 hypotheses were accepted, while the rest were rejected. Thus, the constructs of commitment, subjective norms, perceived usefulness (PU), perceived ease of use (PEOU), Task-KMS-Fit, leadership and knowledge characteristics were accepted as determinants of KMS usage, while the variables of trust, socio-political influences, KMS-self-efficacy, and organizational structure were found to be insignificant. The results of this study have theoretical, practical, and methodological implications. This study bridges the knowledge gap between research and practice of KMS usage in oil and gas industry.

Keywords: *Knowledge Management, Knowledge Management System, Information System, Developing Economy*

1. INTRODUCTION

Organizations in knowledge-based economy are no longer entirely reliant on natural resources and properties to increase their competitive advantages (Abbas 2012). Knowledge, as tangible (i.e., knowledge in databases) and intangible assets (knowledge resident in the minds of individuals) in organizations, is growingly becoming more significant than the natural resources with crucial role in contributing to the objectives and competitive advantages of organizations (Hwang 2008; Omotayo 2015; Ramanigopal 2012; Wu & Wang 2006). It enables the organizations to have a better evaluation of their capabilities in productivity and profitability than conventional approaches (Trejo et al. 2016). To reap the benefits of knowledge, organization need to set up knowledge management (KM). Findings show that KM helps organizations enhance their competitive advantages through using their both tangible and non-tangible knowledge resources more effectively (Alavi & Leinder 2001; Wint 2016). KM facilitates knowledge creation, knowledge sharing, knowledge transfer, and knowledge dissemination. KM is applied in all organization's processes and promotes the creation of new products, services, innovation, flexibility, decision making, expanding marketing, finding new customers, maintaining the relationships with the extant customers and so on (Goodman & Chinowsky 1997; Qureshi et al. 2016), which lead to competitive advantages (Ramanigopal 2012). Since the KM itself is a concept, an approach or a theory, to make it practical in organizations, tools and technologies are needed to be developed.

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The advent of new technology that facilitates and contributes to fast information transmission across large geographic areas by means of the information technology supports KM in organizations to bring about better results in the knowledge-based economy (Mallam Musa Rabiu 2009). The knowledge-based economies require that Knowledge Management Systems (KMS) be in place to improve KM practices in organizations to bring about competitive advantages (Alavi & Leidner 2001; Ha et al. 2016; Davison 2013). Empirical finding shows that KMS positively contributes to innovations and competitive advantages (Darroch 2005). Modern age organizations, such as oil and gas industry, working in the context of knowledge-based economy, enhance their competitive advantages through KM practices (Chowdhury & Ahmad 2005; Grant 2013; Gardiner 2014; Mughal & Ahmad 2016). Findings indicate the success story of KMS usage by British Petroleum (BP) and Shell (Akeel 2013; Chuadhury & Ahmad 2005; Grant 2013). For example, in 1998, KMS saved BP 700 million USD and Shell estimates that KMS is saving the company over 100 million USD annually (Grant 2013).

However, despite the success stories, there is a report of KMS failure (Frost 2013; Grant 2013), and it is argued that merely developing the systems sophisticatedly does not guarantee KM practice and usage in organizations (Hester 2012; Wint 2016). When it comes to KMS usage, two broad issues, namely user and system need to be addressed (Baxter & Sommerville 2011; Hester 2012). The users are affected by several issues such as political, religious, psychological, and cultural aspects (Easterby-Smith & Prieto 2008; Elgobbi 2008; Wint 2016). On the other hand, characteristics such as user-friendly, ease of use, job fitting, simplicity, robustness, and customization are associated with system (Jiang & Sinton 2011; Tseng 2008). Further, organization including organizational structure and leadership (Mills & Smith 2011), and knowledge characteristics (Gardiner 2014; Rašu et al. 2012) play important roles in KMS usage. Likewise, in developing economies huge investment is done in KMS development where people come from different psychological, social, political, and cultural backgrounds that could influence KMS usage (Abbas 2012; Akeel 2013). Consequently, user and system along with organizational structure and knowledge characteristics play an important role in KMS usage in developing economies such as Pakistan (Danish et al. 2014; Nawab et al. 2015).

The outline of this research is as follows: this research first discusses the introduction. In section two, the problem statement is presented. In section three, the theoretical background along with hypothesis development is discussed. Section 4 elaborates on the research methodology. Section five presents the results including the measurement model, demographics and structural model. Section six presents the discussion and implications.

2. PROBLEM STATEMENT

Many organizations have designed and developed information system to facilitate KM practices; this is termed as KMS. KMS provides the necessary infrastructure for the organizations to implement KM practices and initiatives. KMS helps perform decision making more effectively with competitive advantages. It assists the organizations in reaching a novel level of quality, creativity as well as efficiency (Chou, Wang & Tang 2015). Despite the great benefits of KMS usage for competitive advantages, it has been underused or even its usage has failed (Frost 2014; Wint 2016). Its real benefit to the organizations remains vague and many cases of KMS failure were reported.

Different organizations are massively investing in KMS development including oil and gas industry. Oil and gas industry has been at the forefront of development and deployment of KMS due to some factors such as: the changes in market and technology, the issue of depletion of established fields, the exploration in frontier locations like deep water drilling, pressure for more environmental responsibility, and drilling technology, to name a few (Cognizant 2012; Grant 2013).

In oil and gas context, KMS usage supports organizations in achieving their objectives and competitive advantages through enhancing circular economy strategy, mega projects, human resource management, teamwork, security, safety, cost reduction, reproduction of mineral and raw material, marketing, innovation, productivity, profitability, decision making support, strategic assets, engineering expertise, forecasting, logistic management, quality, rapid development cycle, mobility, geographic information, communication, real-time collaboration, problem solving, off-shore drilling, quality service, responsiveness, and so on in both upstream and downstream. Nevertheless, to harvest the benefits of KMS, the main determinants of KMS usage need to be identified (Braganza et al.

2008; Grant 2013; Hu et al. 2015; Moffat & Crichton 2015; Oliveira et al. 2013; Ponomarenko & Khaertdinova 2015; Tanaka 2014).

However, literature has evidenced numerous issues of KMS usage in oil and gas industry in developing economy, such as: lack of skilled workforce for using KMS (Chowdhury & Ahmad 2005), telecommunication issues of oil and gas giants like BP (Grant 2013), technical (Matayong & Mahmood 2011) and non-technical problems (cultural and religious) (Al Muzahmi 2015; Mallam Musa Rabiu 2009; Matayong & Mahmood 2011), low system usage and knowledge sharing (Desai & Rai 2016), problem solving issues (Akeel 2013; Ramanigopal 2012). More specifically, in the context of Pakistan, Mughal and Ahmad (2016) highlighted some issues such as: leadership, training, trust, time, and cost. These issues may call for an empirical study in the context of oil and gas industry in developing economy to determine the influencing factors of KMS usage and offer solution to the problem of KMS usage failure.

The findings of previous studies have highlighted some KMS factors in oil and gas industry. Some factors related to the dimensions of human (commitment, trust, political background, culture, & social norms) (Al Muzhami 2015; Li, Liu & Liu 2016; Matayong & Mahmood 2011; Mughal & Ahmad 2016; Ross 2008), technology (system quality factors; KMS self-efficacy; perceived usefulness, perceived ease of use) (Elgobbi 2008; Matayong & Mahmood 2011; Muhamad et al. 2016; Wang & Lai 2014), organization (organizational learning, leadership, organizational structure, organizational rewards) (Chowdhury & Ahmad 2005; Mughal & Ahmad 2016; Wang & Lai 2014), knowledge (tacit and explicit knowledge) (Elgobbi 2008) were investigated. However, very limited number of the main determinants and factors of KMS usage such as human, technology, organization and knowledge in developing economy were identified (Ha et al. 2015).

Few studies on KMS usage in oil and gas companies, particularly, in Western context were reported (Carrillo 2004; Moffat & Crichton 2015; Oliveira et al. 2013). Very limited research, with limited number of factors, in the context of oil and gas in developing countries was reported (Akeel 2013, Mughal & Ahmad 2016; Muhamad Khalil Omar et al. 2016). Limited studies were done on KMS usage and most of them are anecdotal and descriptive (e.g., Moffat & Crichton 2015). Most studies are qualitative (e.g., Ramanigopal 2012), and small scale without theoretical basis (e.g., Gardiner 2014). A small scale descriptive study, in Pakistan, on KMS adoption was performed which theoretically is not supported (e.g., Mughal & Ahmad 2016). In response to KMS failure and lack of KMS usage studies, some scholars call for studies on KMS success factors in the context of oil and gas industry (Ha et al. 2016). Dickel and Moura (2016) noted that social and cultural aspects of KMS usage were underexplored and call for further study.

The most recent studies call for casual quantitative studies with the involvement of the main success factors of KMS usage such as human, technology, organization and knowledge (Dickel & Moura 2016; Wint 2016). The objective of the current study is to investigate the main dimensions and determinants of KMS usage, which are important, yet neglected (i.e., human, technology, organization and knowledge characteristics), as they are argued to be the main drivers of KMS usage.

This research will have contribution to advancing literature through presenting how using a causal relationship analysis in an empirical study deepens our understanding of the determinant factors of KMS usage in oil and gas industry in the context of developing economy.

3. THEORETICAL BACKGROUND AND HYPOTHESIS

Knowledge management system (KMS) refers a technology employed to support and increase organizational KM for the purpose of obtaining competitive advantage. KMS supports the application of both explicit (codified) and tacit (non-codified) knowledge (Alavi & Leidner 2001). KMS refers to a class of information system to support creation, transfer, and application of knowledge in organizations. KMS usage is associated with the implementation, analysis, and development of knowledge in such a way that the organization can learn and create knowledge to promote better decision making (Kulkarni et al. 2006). In order to understand the effective factors of KMS usage in the context of oil and gas industry, the current study adopts and integrates the theories of TPB, TTF, and TAM, which are discussed in the following sections respectively.

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3.1 Theory of Planned Behavior

Theory of planned behavior (TPB) posits that the factors of perceived behavioral control (PBC), subjective norms (SN), and attitudes directly determine behavioural intention, which in turn predicts the actual usage behavior. Attitude draws on the evaluation of a psychological object connected with the attributes of good to bad, pleasant to unpleasant, like to unlike, or harmful to beneficial (Ajzen 1991). PBC refers to individual's views of effortlessness or difficulty of carrying out a behavior reflecting the previous experience as well as predicted obstacles. Subjective norm refers to a person's perception of social norms and pressure to perform or not to perform an action (Fishbein & Ajzen 1975). Therefore, the more favorable the attitudes towards a behavior, and the motivation to follow social norms as well as the greater perceived behavioral control lead to stronger behavioral intentions to perform a particular behavior. TPB provides a well-designed framework to identify the determinants of behavioral intention towards actual behavior. This model has been extensively adopted in various fields such as e-commerce adoption (Pavlou & Fygenson 2006), conversation technology adoption (Lynne et al. 1995), knowledge sharing behavior (Ryu et al. 2003), and so on.

In the context of KMS usage, when individuals perceive KMS usage as favorable in organizations, they will definitely have intention to use it. Finding indicated that there is a significant relationship between individuals' attitudes and behavioral intentions to use systems for knowledge sharing (Hsu & Lin 2010). Consistently, Chen & Chen (2009) and Fang et al. (2009) found that attitude is a determinant of KMS usage. PBC controls the behavior based on past experiences, easiness and difficulty of KMS usage (Armitage & Conner 2001; Chen & Chen 2009; Fang et al. 2009; Fielding et al. 2008; Mathieson 1991). Fang et al. (2009) showed that PBC directly predicts KMS usage and also mediates the effects of trust. Due to proximity of PBC and self-efficacy in terms of attributes of easiness, prior experience, difficulty, and capability, this model supports the incorporation of self-efficacy (Armitage & Conner 2001).

Behavioral intention directly determines KMS usage (Chandio 2011; Chen & Chen 2009). Chandio (2011) found that behavioral intention significantly predicts online banking system usage. TPB postulates that subjective norms influence human decision to employ technology. Subjective norms, rooted in the social, cultural and political factors, compose the context of technology usage (Goh & Sandhu 2013; Kankanhalli et al. 2005; Viswanath et al. 2003). Subjective norms have widely been investigated in the study of system usage (Abdur-Rafiu & Opesade 2015).

This suggests that the effect of subjective norms be investigated on KMS usage in the context of oil and gas industry. Hence, based on the success stories of the prior studies concerning the adoption, expansion and integration of TPB, this research adopts TPB along with its core construct 'subjective norms' and integrates it with the other well-acknowledged information system theories to develop a model representing the socio-psychological and technical constructs affecting KMS usage in the context of oil and gas industry.

3.2 Task Technology Fit

Theory of task-technology fit (TTF) is referred to as the extent to which the features of a technology fit the specific task it has been designed to support (Goodhue & Thompson 1995). TTF is founded on the fit between technology functionality and the task requirements (Goodhue & Thompson 1995). TTF claims that when IT tools match the desired task in the organization, there will be significant positive impact on performance (El Said 2015; Goodhue & Thompson 1995). Based on TTF, it is argued that the value of technology of information system such as KMS relies on how efficiently and effectively the system supports its users to complete a task or sets of tasks (Mathieson & Keil 1998; Turner et al. 2008).

The core components of TTF include technology characteristics, task characteristics, individual performance and system utilization. Technology characteristics and task characteristics are independent variables, while individual performance and system utilization are dependent variables (Goodhue & Thompson 1995). As such, KMS, as a technology, supports organizations' tasks (El Said 2015). Findings show that task characteristics and technology characteristics directly affect task-KMS-fit and indirectly impact performance (El Said 2015; Yen et al. 2010). System utilization predicts performance impact (ElSaid 2015; Huang et al. 2007). Task-KMS-fit directly significantly influences the KMS usage (Dishaw & Strong 1999; Hunag et al. 2008;

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Kankanhalli et al. 2005; Klopping & McKinney 2004).

Literature evidences the impact of task and technology on task-KMS-fit and KMS usage, and their positive relationships with performance and competitive advantages (El Said 2015; Im & Raven 2003; Moreno & Cavazotte 2015). Huang, et al. (2008) extended TTF and found that the integrated model accounts for 50% of variance in KMS usage. Studies also confirm the positive effect of KMS characteristics on KMS usage (El Said 2015; Hossein et al. 2013).

El Said (2015) found that intention to share knowledge, task-KMS-fit, task characteristics, utilization and KMS characteristics have strong impact on KMS usage, and his model accounts for 70% of variables in KMS usage impact. However, we have to caution about generalizing these findings to the context of oil and gas industry. Therefore, the present study adopts task-KMS-fit to investigate its effect on KMS usage in oil and gas industry, where the other factors such as subjective norms, social, political, and cultural factors may play critical roles in KMS usage (Gardiner 2014; Grant 2013). However, insufficiency of TTF in explaining the effects of social factors and behavior in relation to KMS usage persuades this study to evaluate the appropriateness of TAM, as a candidate to be integrated with TPB and TTF.

3.3 Technology Acceptance Model

The theory of technology acceptance model (TAM) was developed by Davis (1989) to predict and explain technology acceptance and usages. TAM proposes PU and PEOU as the main factors for explaining and predicting technology acceptance. The construct 'system use' is indirectly and directly determined by PU, PEOU, attitude, and behavioral intention (Davis 1989; Wentzel et al. 2013). PU reflects the degree to which a person believes that using a particular system will enhance one's function or benefit one's respective organization (Davis 1989). PEOU refers to the degree to which an individual believes that using a particular system would be easy and free of efforts (Davis 1989). PU and PEOU and attitude are the main determinants of behavioral intention. Behavioral intention is associated with the individual's willingness to take a particular action leading to actual system use (Davis et al. 1989).

Being widely adopted in the studies of IS, TAM has undergone several changes upon the research objectives and requirements; however, PU and PEOU have survived the test of time and are still the primary determinants of technology acceptance (Venktash et al. 2003). TAM has been adapted to predict users' technology acceptance in different fields and contexts such as: on-line tax utilization (Dishaw & Strong1999), technology adoption in e-commerce (Klopping & McKinney 2004), perceptions of automotive telematics (Chen & Chen 2009), acceptance of online banking (Chandio 2011) and KMS development for online education (Saade et al. 2011), etc.

Numerous studies have used TAM and shown that PU and PEOU beliefs impact user's perceptions of KMS usage (Saade et al. 2011; Yen et al. 2010). PU and PEOU are directly related to the intention to use KMS, which in turn determines actual KMS usage (Jamil & Nik Mat 2012). It is argued that PEOU affects PU (Al-Khateeb 2007). Previous studies have investigated different constructs of TAM in the context of KMS usage: PU and PEOU (Chandio 2011; Chen & Chen 2009; Dishaw & Strong 1999; Klopping & McKinney 2004; Wu et al. 2006; Yen et al. 2010). Dishaw and Strong (1999) declared that PU and PEOU strongly affect intention to use system and indirectly predict actual KMS usage. Chandio (2011) showed their direct effect on online banking system usage as well as their mediator role in system usage. The impact of external variables through PU and PEOU on user's intention to use system has extensively been examined and found that external factors such as culture, trust, religion, political mindset, governmental policies, system design features, personal characteristics, and system-self-efficacy affect KMS usage (Davis et al. 1989; Hossein et al. 2013; Saade, Nebebe & Mak 2011; Gefen 2003).

Several studies have recounted the success stories of TAM in predicting user's actual KMS usage (Chandio 2011; Chen & Chen 2009; Gefen et al. 2003; Saade et al. 2011), which stimulate the current research to adopt TAM along with its two key constructs: PU and PEOU. Nonetheless, due to its limitations, TAM cannot explain the user's behavior intention alone effectively (Dishaw & Strong 1999). Although it establishes a good model for predicting acceptance of new technology, TAM constructs are inadequate in predicting the socio-technical systems in which the user has co-created values (Mathieson 1991). One of the primary issues of TAM is ignorance of individual differences

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(Agrwal & Prasad 1999). Basically, previous experiences, commitment, subjective norms, self-efficacy, and many other human characteristics are not taken into account by TAM; however, these features may affect the attitude towards technology, in turn about intention to use KMS (Goh & Sandhu 2013; Straub 2009). Hence, TPB, TTF and TAM will be integrated to develop a parsimonious conceptual framework determining success factors of KMS usage in the context of oil and gas industry. Table 1 summarizes the relevant studies on information system theories.

The study identified some gaps. Firstly, majorities of the studies in oil and gas are not theoretically supported; there is no consensus on the use of theory; however, the studies in the general context have mostly adopted information system theories such as TPB, TAM and TTF. Secondly, it is noted that generally the use of quantitative approach is common, while in the context of oil and gas qualitative study is prevalent; thirdly, the previous studies have put less emphasis on human factors such as commitment, subjective norms, trust and socio-political influences, particularly, in the context of oil and gas, where the research has mainly focused on the technology and the human dimension has been marginalized (Grant 2013).

3.4 Integration of Theories

Literature has evidenced numerous studies on KMS in which the theory of technology acceptance model (TAM), theory of planned behavior (TPB) and Task-Technology-Fit (TTF) were mostly adopted to create models with strong explanatory and predictive power (Liao et al. 1999; Matayong & Mahmood 2013). TAM and TPB, as socio-psychological theories, are employed to predict and explain user's behaviors towards system acceptance and usage (Ajzen 1991; Davis 1989; Kuo & Lee 2009). The main constructs of TAM are perceived usefulness (PU) and perceived ease of use (PEOU), which are context free and flexible and have been used in different system usage contexts (Mathieson 1991). It is argued that TPB might provide more accurate explanations concerning user's system usage (Mathieson 1991). However, studies have extended TAM with variables from TPB and vice versa. For example, the impact of SN on KMS usage was mediated by PU and PEOU (Bih Yaw et al. 2012) and extension of TPB by PEOU (Kankanhalli 2005) were evidenced. The integration of TAM and TPB provides a stronger predictive and explanatory means than using each theory alone (Saade et al. 2011).

Perceived TTF refers to the match among the capability of technology, task requirements and the competency of users concerning the task and technology (Goodhue & Thompson 1995). The integration of TTF and TAM generates a model with a stronger explanatory and predictive power than each model alone (Dishaw & Strong 1999). These theories provide different but overlapping perspectives of using system. Both of them agree upon the facilitative power of technology for job performance even though they adopt different approaches to the use of KMS (Huang et al. 2008). As such, integration of these theories provides a significant improvement over a single model alone (Dishaw & Strong 1999). Likewise, an integration of TPB and TTF also establishes a model with a strong predictive and explanatory means (Kankanhalli et al. 2005). The positive attitudes towards the match between technology and task requirements can significantly affect system usage (Kankanhalli et al. 2005). Previous study found that knowledge sharing intention positively influences task-KMS-it towards KMS usage (El Said 2015). Hence, integration of TAM, TPB, and TTF builds a parsimonious model which could strongly predict and explain antecedents of KMS usage.

Literature on KMS lends support to theory integration and several studies integrated TAM, TPB and TTF: integration of TAM and TTF to examine utilization in system use (Dishaw & Strong 1999) and technology adoption in e-commerce (Klopping & McKinney 2004), TAM and TPB in online tax study (Wu & Chen 2005) and antecedents of using online learning (Saade et al. 2011), TPB and TTF to study online system and knowledge seeking behavior (Kankanhalli et al. 2005), TRA, TAM , and TPB to explore the use of online banking system (Chandio 2011). Drawing on literature stream, it is found that the integration of these models is promising for explaining the dimensions, factors, and determinants of KMS usage. Each theoretical model has its own distinctive advantage and each theory complements and supports other theories. Hence, the current study, based on the scope, objectives and analysis level, adopts, integrates and extends the theories of TAM, TPB, and TTF to test the research hypotheses in the context of oil and gas industry in Pakistan.

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3.5 Hypothesis Development

In this section the development of hypothesis and construction of research conceptual framework are presented.

3.5.1 Commitment and KMS usage

Commitment (CT) refers to a person's involvement in and identification with a particular organization (Steers 1977). CT is one of the significant, effective, and stimulating factors that enhance users' motivational and intentional behaviors (John et al. 2004). CT represents compliance (external reward), identification (social reference) and internalization (self-generation) where at the self-generation level, the individual invests in using system genuinely (Malhotra & Galleta 2003). CT to organizations induces responsibility or obligation to perform a particular behavior (Steers 1977). This is applicable to KMS usage in organization which requires collective work and collaboration (Malhotra & Galleta 2003).

In oil and gas industry context, CT has a critical role in KMS usage (Arafa 2015; Elgobbi 2008). Leadership has a crucial role in boosting employees' CT to system usage (Arafa 2015; Chowdhury & Ahmad 2005). A study by Arafa (2015) in developing economy, showed that management support, integration of work practices, and incentives increase knowledge workers' commitment. There is a rich literature on the influence of CT on KMS usage (Chen & Lee 2009; Goh & Sandhu 2013; Abdur-Rafiu & Opesade 2015). Consistently, this research hypothesizes that the individuals working in oil and gas industry in Pakistan will probably show involvement in and commitment to the use of KMS in their respective organizations, which is well-expressed in the following hypothesis: *H1. Commitment has a significant and positive effect on KMS usage*

3.5.2 Subjective norms and KMS usage

Subjective norms (SN) refer to a person's perception of social norms and pressure to perform or not to perform an action (Fishbein & Ajzen 1975). Based on SN, an individual will intend to use a system and share knowledge when conformity to social norm is valued (Goh & Sandhu 2013; Hsu & Lin 2008). Concerning KMS, SN is connected with others' thoughts, appreciations and individual's motivation (Viswanath et al. 2003). Ong et al. (2005) found that superiors and knowledge workers' relationships affect KMS usage. The ideas and actions of superiors affect employees' intention to use system (Taylor & Todd 1995). When leadership and peers highly value and appreciate KMS usage, the individuals will show intention to KMS usage (Goh & Sandu 2013; Viswanath, et al. 2003). Motivation to use KMS depends on the importance of others' expectations and thoughts regarding a behavior (Mathieson 1991).

Study findings on the impact of SN on KMS usage are inconsistent and inconclusive as some have shown the significant influence of SN on KMS usage (Goh & Sandhu 2013; Kuo & Young 2008; Lee 2004; Pamela et al. 2012), while others indicated that SN is not the main antecedent of KMS usage (Abdur-Rafiu & Opsade 2015; Huang & Chen (2015). However, in the context of oil and gas industry, it is not clear how social norms and workers' motivations to adhere to those norms affect their KMS usage. Consistent with the main literature of KMS, the current research hypothesizes that SN such as the social, cultural norms, influences, and pressure will probably affect knowledge workers' intention to KMS usage in the context of oil and gas industry in Pakistan, which is well-reflected in the following hypothesis: *H2. Subjective Norm has significant and positive effect on KMS usage*

3.5.3 Trust and KMS usage

Trust is defined as "a psychological state comprising the intention to accept vulnerability based upon positive expectation of the intentions or behaviour of another (Rousseau et al. 1998:395). Trust is one of the important mechanisms of reducing complexity and risk of using system through positive system outcome (Abdur-Rafiu & Opesade 2015; Goh & Sandhu 2013; Grabner-Kraeuter 2002; Gefen 2004). KMS implementation and development does not guarantee users' intention to use it unless the human factor such as trust is taken into account (Hester 2012; Wu & Wang 2006). Trust is an important antecedent of KMS usage (Tatcher et al. 2010; Ming-Hsiung & Chia-Yi 2005).

Literature demonstrates that trust has been extended to TPB, TAM and TTF (Abdur-Rafiu & Opesade 2015; Goh & Sandhu 2013; Tung et al. 2008; Wu & Chen 2005). Wu and Chen (2005) extended TAM and TPB with trust and investigated users' online tax system usage. Trust was found as an antecedent of PU, PEOU and SN (Abdur-Rafiu & Opesade 2015; Goh & Sandhu 2013; Jarupathirun & Zahedi 2007; Pavlou 2003). Extending TAM by adding trust and risk factor, Pavlou (2003) showed that trust and risk factor were strong determinants of purchasing online. Jarupathirun and Zahedi (2007) extended TTF by trust and found that trust and Task-KMS-Fit strongly predict system usage. Goh and Sandhu (2013) extended TPB using trust and showed the significant influence of trust on online learning system usage. Kankanhalli et al. (2005) studied knowledge seeking behavior using electronic-knowledge-repositories and found that trust was an effective factor of online system usage. In conformity with previous studies, the current research hypothesizes that knowledge workers' trust in KMS will increase their system usage in oil and gas industry, in Pakistan. This is well-reflected in the following hypothesis: *H3. Trust has a significant and positive effect on KMS usage*

3.5.4 Socio-Political Influences (SPIs) and KMS usage

Based on socio-political influences, an individual's behavior is mainly affected by others in society, community or work place, which may involve political, cultural and religious influences (Schneider 2005; Cialdini1994; Judge & Bretz 1994; Kahan 1997). Recent literature indicates the growing socio-political influences of system usage (Easterby-Smith & Prieto 2008; Matten & Moon 2008; Weiwu et al. 2010). In the context of oil and gas industry, technology and system usage has turned out to be a central issue (Grant 2013; Kenneth 2006). In a study, Grant (2013) found that oil and gas companies are developing KMS with the focus on human dimension such as social and cultural factors. This means that KMS adoption needs to cater to the social, cultural and political factors as effective factors of KMS usage (Clay 2011; Gardiner 2014).

Findings show the effect of social and cultural factors on KMS usage (He et al. 2009; Hsu & Lin 2008). He et al. (2009) found that social relationship based on shared norms, values and expectations can establish positive attitude towards KMS usage. This reflects the influence of social, political, cultural value which could affect system usage behavior in the context of oil and gas industry as well. In a survey of 212 blog users, Hsu and Lin (2008) found that users' attitude and social influences such as social norms and community identification strongly predict intention to use weblogs. It is argued that human attitude, perception and social norms are shaped by social, political and cultural values (He et al. 2009; Hsu & Lin 2008), suggesting a study of effect of SPIs on KMS usage in oil and gas industry. Hence, the knowledge workers working in oil and gas industry in developing economy may be affected by socio-political influences and this in turn will probably affect their KMS usage, which is well-versed in the following hypothesis: *H4. Socio-political influences have significant and positive effect on KMS usage*

3.5.5 PU and KMS usage

Perceived usefulness (PU) refers to an individual's belief that utilizing a particular system will increase his job performance (Davis 1989). PU reflects a person's attitude towards the function of system in enhancing job productivity (Alsajjan & Dennis 2010). PU is a significant determinant of system usage (Davis et al. 1989). In the context of oil and gas industry, PU is one of the main motivations of using KMS for enhancing job performance and productivity. Several researchers have investigated the influence of PU on KMS usage (Alsajjan & Dennis 2010; Hsu & Lin 2008; Pikkaranian et al. 2004).

In a survey of 618 students, Alsajjan and Dennis (2010) adopted TAM and found that PU and trust strongly predict system usage, suggesting that the function of system in job performance encourages users to use it (Alsajjan & Dennis 2010; Hsu & Lin 2008; Pikkaranian et al. 2004). In a study, Yu et al. (2010) found that PU significantly predicts knowledge sharing and system usage. There is a relationship between PU and task-KMS-fit as both posit that knowledge workers use KMS because of its benefit for job performance and productivity even though Task-KMS-Fit has no account of user's attitude towards information system (Huang et al. 2008).

Therefore, as oil and gas companies' investment in KMS development is skyrocketing (Grant 2013), perception of usefulness of KMS usage in job performance, productivity, and effectiveness is crucial to persuade the knowledge workers in oil and gas industry to use KMS in performing their daily tasks, suggesting a study in this vein. Consistently, in the light of the research findings on the significant predictive power of PU on KMS usage, the present study, in the context of oil and gas industry, hypothesizes that the

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employees' PU of KMS usage may influence their KMS usage, which is well-expressed in the following hypothesis: *H5. Perceived usefulness has significant and positive effect on KMS usage*

3.5.6 Perceived ease of use (PEOU) and KMS usage

Perceived ease of use (PEOU) refers to an individual's belief that utilizing a particular system will be easy and free of effort (Davis 1989; Gefen et al. 2003). Findings show that PEOU positively affects a user's intention to system usage (Shih Bih-Yaw et al. 2011; Davis 1989; Pikkarainen et al. 2003). PEOU directly and indirectly influences system usage (Davis et al. 1989; Mathieson 1991). PEOU is a factor that supports understanding how easy one can learn and use a particular system (Jennex 2005). PEOU is represented by easiness, clarity and flexibility. PEOU is associated with user's self-efficacy that determines his judgment of how to perform the designed tasks through system usage (Davis 1989; Jennex 2005).

Findings of previous studies indicate that PEOU has a strong impact on system usage (Chandio 2011; Chu & Lee 2004; Chau 1996). Consistently, the current research hypothesizes that if the developed KMS in oil and gas industry is appropriate, easy, flexible, and clear to use, the knowledge workers in oil and gas industry will probably use more effectively. This is well-expressed in the following hypothesis: *H6. Perceived ease of use has significant and positive effect on KMS usage.*

3.5.7 KMS-self-efficacy

Self-efficacy refers to an individual's capabilities to perform courses of action to achieve specific objectives (Bandura 1997). It is a kind of self-assessment that affects decision about conducting certain behavior. The more the self-efficacy, the higher the motivation to carry out assigned tasks. As such, self-efficacy may affect KMS usage, particularly in oil and gas industry (Sigurd et al. 2013).

Huang et al. (2008) conducted a survey involving 192 KMS users and found that task-technology-fit, task interdependence, and KMS-self-efficacy significantly affect KMS usage, which is consistent with the findings of previous studies (Chen et al. 2012; Elayne et al. 2013; Faisal et al. 2013; Lin & Huang 2008; Yew 2005). Nevertheless, in the context of oil and gas industry, Wang and Wu (2014) indicated that KMS-self-efficacy has no significant effect on KMS usage. This calls for a study to re-examine the effect of KMS-self-efficacy on KMS usage in the context of oil and gas industry. Therefore, the current study hypothesizes that the KMS-self-efficacy of knowledge workers working in oil and gas industry in Pakistan will probably influence their KMS usage. This is well-expressed in the following hypothesis: *H7. KMS-Self-Efficacy has significant and positive effect on KMS usage*

3.5.8 Task-KMS-fit

Task-technology-fit refers to the congruence and fit between technology and the assigned task which will have positive effect on individual's performance (Goodhue & Thompson 1995). Technology utilization relies on the fit between technology and the designed task. User's satisfaction of system usage positively influences the behavior of recipient in using KMS (Huang et al. 2008). In the context of this study, Task-KMS-Fit is driven from TTF, in which KMS is regarded as a technology with more specific meaning. Different studies have adopted TTF constructs based on their objectives (Dishaw & Strong 1999; El Said 2015).

Several studies have discussed the role of task-KMS-fit in the intention of users to use technology (El Said 2015; Dishaw et al. 2002). In oil and gas industry, social gathering among employees may result in discussion about KMS fitness in their daily tasks which might result in feedbacks for management concerning KMS usage. KMS and task fitness have significant positive influences on users' intention to use KMS (Huang et al. 2008; Im & Raven 2003); however, there is a paucity of study on the effect of task-KMS-fit on KMS usage in the context of oil and gas industry. Hence, consistently, the current study hypothesizes that task-KMS-fit will probably influence knowledge workers' KMS usage in the context of oil and gas industry in Pakistan, which is well-reflected in the following hypothesis: *H8. Task-KMS-Fit has significant and positive effect on KMS usage*

3.5.9 Organizational structure

Organizational structure is associated with the activities like task allocation, coordination and supervision which contribute to achieving the

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objectives of organizations (Spender 1994). Several studies were conducted on the effect of organizational structure on system usage and showed its predictive power of KMS usage (Elgobbi 2008; Mills & Smith 2010; Raisch et al. 2009; Zheng, Yang & McLean 2010). In the context of oil and gas industry, where the organizations are scattered in upstream and downstream sectors, the congruence and fitness between assigned tasks and technology is critical (Devold 2013).

Previous studies have shown the relationship between task-KMS-fit and organizational structure (Im & Raven 2003). Studies discussed the role of human in organizations with the focus on the social, political, cultural, and religious factors (Belias & Koustelios 2014; Kouabenan 2009; Mullins 2005). Another study found close relationships between organizational structure, organizational approach, human, and performance (Baruch & Brooks 2008). Findings of some studies indicated that the organizational structure has a strong impact on user's attitude, mindset and behavior (Kuruppu et al. 2013; Liao, Toya, Lepak & Hong 2009; Nishii, Lepak & Schneider 2008). Finding also shows the relationship between organizational structure and technology in terms of coordination and networking (Damanpour & Arvind 2006). Therefore, organizational structure might shape the attitudes of knowledge workers concerning KMS usage in oil and gas industry. Consistently, the current research postulates that organizational structure will probably influence knowledge workers' behavioral intention to KMS usage in oil and gas industry context in Pakistan, which is well-reflected in the following hypothesis: *H9. Organization structure has significant and positive effect on KMS usage*

3.5.10 Leadership

Leadership is a crucial success factor of system usage with different managing styles to run KM to achieve organization's objectives and competitive advantages (Yukl 2002). Finding reveals that leadership has a strong influence on KMS usage but its role has been discussed superficially (Kuo et al. 2011). Leadership influence on KMS usage is also mediated by task-KMS-fit. So, the positive impact of leadership on task-KMS-fit results in the positive influence of leadership on KMS usage. The relationship between leadership and subordinates may have both direct and indirect influence on KMS usage (Ren-Zong Kuo et al. 2011). Without considering the role of leadership, even the most sophisticated KMS will not exert its real benefits. Top management involvement with proper leadership style is very important for providing supportive atmosphere and required resources for KMS usage (Al-Busaidi et al. 2010; Bueno & Salmeron 2008).

Mangers contribute to KMS usage through involvement, support, commitment, and leadership styles (David et al. 2007; Kim et al. 2007; Neufeld et al. 2007). Consistently, in the context of oil and gas industry, Akeel (2013) noted the role of leadership in augmenting commitment among employees. It is suggested that adequate authority, power and responsibly be bestowed to a user to be persuaded to use the system (Archie & Shabana 2010; Qiao & Wei 2009). Further, sharing KMS-relevant decision making processes with employees will affect their intention to use KMS (El Said 2015; Martin & Bush 2006). Therefore, due to the significant role of leadership in using KMS in the context of oil and gas industry (Al Busaidi 2010), the current research postulates that leadership will probably affect employees' KMS usage in oil and gas industry context in Pakistan, which is well-expressed in the following hypothesis: *H10. Leadership has significant and positive effect on KMS usage*

3.5.11 Knowledge characteristics

Knowledge is an essential strategic resource for a company for retaining sustainable competitive advantages (Choi et al. 2008). Knowledge is the main commodity and the flow of knowledge is the most important factor of knowledge-based economy (Abbas 2012; Sunassee & Sewry 2002). Knowledge has two forms: tangible (explicit knowledge) and intangible (tacit knowledge). The features such as knowledge types, source, quality, and knowledge tacitness represent knowledge characteristics (Kumar Singh 2008; Grant 1996). Knowledge, in oil and gas industry, is a vital asset that contributes to achieving the companies' objectives and competitive advantages (Charles et al. 2005; Elgobbi 2008).

Recent studies indicated that knowledge characteristics affect KMS usage since the higher quality of knowledge persuades the users to employ the system (Tsai & Chen 2007; Wu & Wang 2006). Knowledge quality is positively significantly correlated with individual learning through KMS usage (John & Tang 2011). Findings show that knowledge characteristics significantly influence KMS characteristics and KMS-self-efficacy which in turn persuade knowledge workers to use KMS (Wu & Wang 2006). This calls for a study on the effect of knowledge characteristics on KMS usage in oil and gas context, where such a study is rare. Therefore, the current study hypothesizes that knowledge characteristics will probably influence KMS usage by employees in oil and gas industry in Pakistan, which is well-expressed in the following hypothesis: *H11. Knowledge characteristics has significant and positive effect on KMS usage*

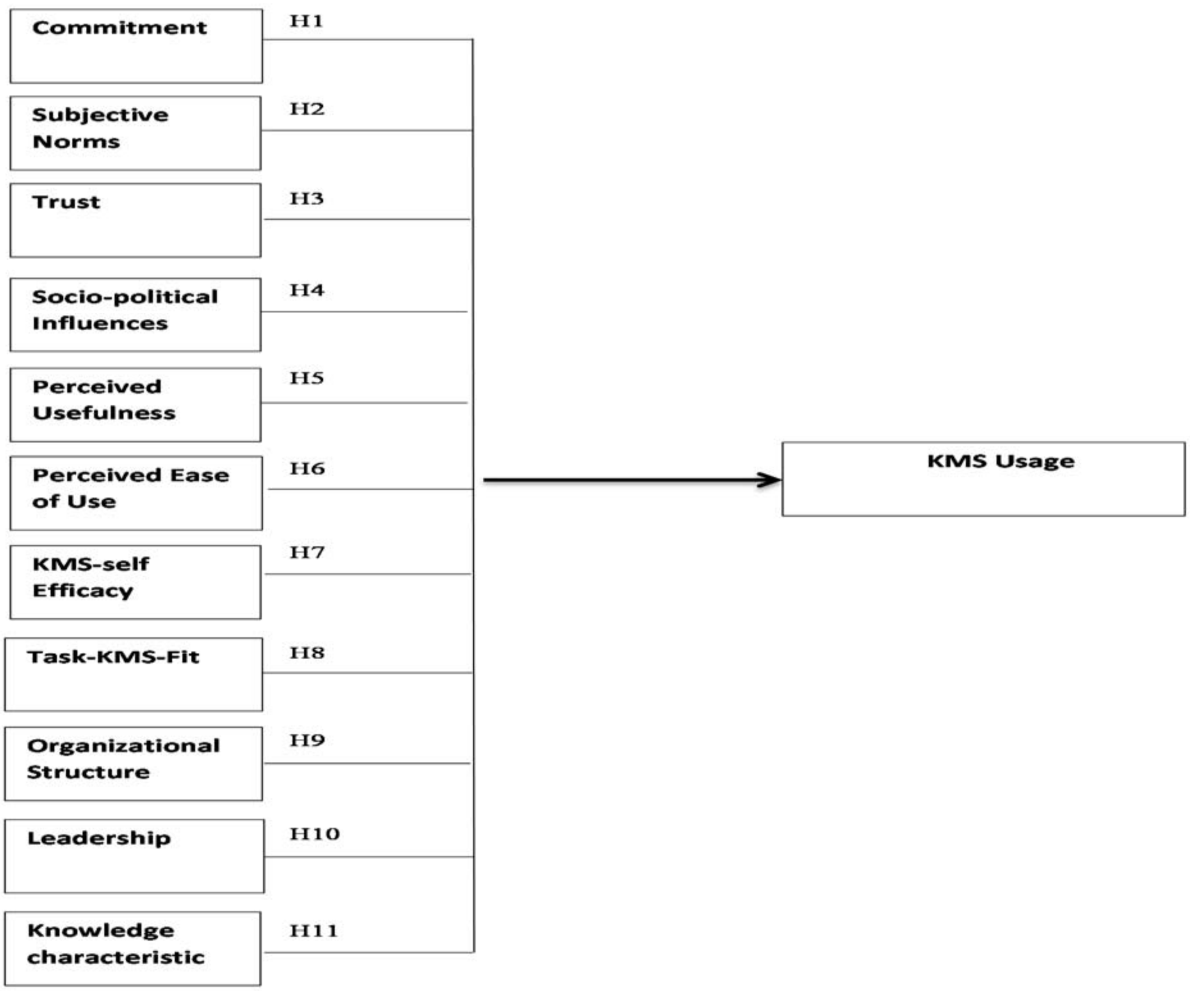

Figure 1: The proposed conceptual model

Figure 1 illustrates the proposed conceptual model. The current study proposes identifying the dimensions of human, technology, organization and knowledge in relation to KMS usage in the context of oil and gas industry. The study has established the theory-based model for the adopted constructs from the literature and to avoid bias, the valid constructs from the literature were linked to the well-acknowledged information system theories. Consequently, the theories of TPB, TAM, and TTF were adopted to lay the foundation of the study. The factors extracted from the literature were grouped under the dimensions of human, technology, organization and knowledge. The human factors refer to commitment, subjective norms, trust, and socio-political influences. The technology factors contain PU, PEOU, KMS-self-efficacy, and Task-KMS-fit. The organization factors comprise organizational structure and leadership. The knowledge factor represents the knowledge characteristics.

The proposed conceptual model is composed of independent variables and dependent

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variable. Independent variables comprise of commitment, subjective norm, trust, & socio-political influence, perceived usefulness, perceived ease of use, KMS-self-efficacy, task-KMS-fit, organizational structure & leadership, and knowledge characteristics. The dependent variable is KMS usage.

4. METHODOLOGY

The present study aims at identifying the effective factors of KMS usage in oil and gas industry in developing economy, Pakistan. To establish the generalisability and replicability with statistical power, the study adopted a cross-sectional survey.

4.1 Participants and Sampling Procedure

The population framework comprised of the knowledge workers in oil and gas industry in Pakistan. The sampling method adopted for this paper is clustered random sampling. Unit of analysis is the individual who uses KMS in oil and gas industry. The sampling framework and participants consist of the employees who are involved and experienced in using KMS in oil and gas companies in three states, namely Send, Karachi, and Baluchistan in Pakistan. A total number of 813 participants were selected through clustered random sampling.

4.2 Procedure of Data Collection

To collect data for this research, survey questionnaires were administrated personally as well as with the aid of the willing participants who helped to distribute questionnaires among the employees using KMS in their respective organizations. Email was also used to distribute questionnaire for economic and efficiency reasons since the companies are scattered across the country. Based on the suggestions of advisors, online survey was not employed since the participants are not used to responding questions online. The respondents were selected from both public and private companies from upstream and downstream sectors.

In the present study, 813 questionnaires were administered among participants and they returned 467 responses, indicating a response rate of 57.4%. Out of these returned questionnaires, 21 respondents provided incomplete questionnaires (i.e. some parts such as demographic, background detail, and measurement items were left blank). 13 participants had selected the same response rate for all items on the Likert scale (1-7), and 8 participants returned completely blank copies of the questionnaires. As a result, 428 questionnaires were considered as usable questionnaires and were used for further data analysis. Therefore, the final response rate in the present study was 52.6%.

4.3 Data Analysis

The study first validated the measurement model using AMOS, Structural Equation Modeling (SEM). The collected data was also analyzed using SEM. Confirmatory factor analysis and SEM was performed to validate the measurement model and structural model. The data analysis involved some analyses such as demographic analysis, descriptive statistics, confirmatory factor analysis, correlation, regression analysis and hypothesis testing.

4.4 Measurement development

The survey questionnaire was organized in three parts: the first part of the questionnaire consists of background information regarding KMS usage. The second part provides the demographic data such as age, gender, education and specialization. The third part presents the constructs of the conceptual model along with their respective items subsequently in which the independent variables precede the dependent variable. The items combination of constructs was suggested by previous scholars to reduce the biases and promote response consistency (Venkatesh & Davis 1996).

The current study used Lazarsfeld's Scheme for Measuring Concept to operationalize the measurement of variables. Lazarsfeld's Scheme for Measuring Concept encompasses four stages: initial imagery of concepts, concepts specifications or specification of dimensions, selection of indicators and construction of indices. In stage one, the researchers of the current study identified four dimensions, namely human (commitment, subjective norms, trust, & socio-political influences), technology (PU, PEOU, KMS-Self-efficacy & Task-KMS-Fit), organization (organizational structure & leadership), and knowledge (knowledge characteristics), which were partly adapted from the works of (Oyebisi 2012; Blakeley 2005). In stage 2, clear definitions of the dimensions were determined. Further, the constructs of each dimension were identified and defined. In stage 3, the appropriate indicators were selected for each construct by determining the best indicators based on the literature stream about KMS. In stage 4, the researcher developed the indices for each construct using 7-point Likert Scales with strongly disagree to strongly agree. As indicated in Table 2, 12 constructs: Commitment (5items), Subjective Norms (5 items), Trust (5items), Socio-Political Influences (6 items), PU (6 items), PEOU (6 items), KMS-self-efficacy (4 items), Task-KMS-Fit (8 items), Organizational Structure (6 items), Leadership (8 items), Knowledge Characteristics (7 items), and KMS Usage (9 items). However, the researcher has not found any indicators for the construct 'Knowledge Characteristics'. Thus, the indicators for this construct were developed by the researcher based on the concept of knowledge, its source, type, and quality explained by (Oyebisi 2012; Blakeley 2005). After measuring all constructs, the questionnaire was designed and submitted to 2 experts to determine its face and content validities.

As a part of pre-testing, the questionnaire was distributed to PhD scholars who had passed their viva in the relevant area of research in several Malaysian (UKM, UPM, USM, & UM), British (Brunel, Lester, London & Saos), and Pakistani leading universities (University of Send, University of Karachi & University of Punjab) and to domain experts who are working in oil and gas companies in Pakistan and Malaysia. Thirty-five questionnaires were returned out of 40, showing a worthy response rate of 83%. The data was analyzed using SEM.

5. RESULTS

This section presents the result of data analysis using AMOS, SEM. First, assessment of measurement model and the demographic characteristics of the participants are presented. Then, the result of reliability of the constructs is demonstrated. Subsequently, Structure Equation Modelling (SEM) and Hypotheses Testing are discussed.

5.1 Assesment of Measurement Model

This section presents the assesment of the mesurment model. First, the reliablity of the constructs is demonstrated. Second, the results of structural equation modeling (SEM) for obtaining validity measurments are presented.

5.1.1 Reliability of constructs

The internal consistency of the constructs was examined by the Cronbach's Alpha coefficient. This is a test of the consistency of the respondents' and referes to all items in the measurement. According to Nunnally (1978), if the Cronbach's alpha coefficient is above 0.70, it is considered as acceptable. Table 3 indicates the Cronbach's alpha coefficients for all constructs. As shown in the table, all coefficients are greater than 0.80; hence, all constructs have good internal consistency.

Table 3: Cronbach's Alpha coefficients for all constructs

Construct	Cronbach's alpha coefficient
Commitment	0.92
Subjective Norm	0.85
Trust	0.91
Socio-Political influences	0.86
Perceived Usefulness	0.90
Perceived Ease of Use	0.90
KMS-Self Efficacy	0.85
Task-KMS-fit	0.91
Organization Structure	0.88
Leadership	0.92
Knowledge Characteristic	0.88
KMS Usage	0.87

5.1.2 SEM analysis for measurement model

A two-step method was used to conduct SEM analysis as suggested by Anderson and Gerbing (1998). In the first step, the measurement model was determined by virtue of the interrelationships between indicator (observed) and latent (unobserved) constructs. As for the measurement model, CFA was conducted using Analysis of Moment Structures (AMOS) software vesrion 22. In the second step, the structural model pertaining to dependent and independent constructs was determined in order to test the hypotheses.

5.1.3 Validity

The results of CFA are shown in Table 4. Structural equation modeling (SEM) includes three primary types of fit measure indices: absolute fit indices, incremental fit indices, and parsimonious fit indices. The results of fit measures obtained in this study and their recommended levels (Hair et al. 2006) are indicated in Table 4. In order to validate the relationship among constructs and measurement items, confirmatory factor analysis (CFA) for the

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entire set of constructs was run. Four items were deleted due to low factor loadings (less than 0.50), which led to a satisfactory fit to the data. In this study, construct validity is assessed through examining convergent validity and discriminant validity

.

Table 4: Goodness of Fit Statistics for CFA

	χ^2	Df	$\left(\frac{\chi^2}{df}\right)$	Absolute Fit Measures		Incremental Fit Measures		Parsimony Fit Measure
				GFI	RMSEA	NFI	CFI	AGFI
Criteria			$< 1\left(\frac{\chi^2}{df}\right) < 3$	≥ 0.90	≥ 0.90	≥ 0.90	≥ 0.90	≥ 0.90
Obtained	6757.5	2759	2.45	0.92	0.06	0.93	0.95	0.92

Note: χ^2 = Chi-square; **df**=degree of freedom; **GFI**=Goodness of Fit Index; **RMSEA**=Root mean square error of approximation; NFI=Normated fit index; CFI=Comparative fit index; AGFI=Adjusted goodness of fit index

5.1.4 Convergent validity

Average variance extracted (AVE) and composite reliability (CR) estimation were used to assess the convergent validity of each construct. A minimum cut-off criteria for AVE > 0.50 and CR > 0.70 were used to assess convergent validity. Results of calculated CR and AVE are presented in Table 5. As indicated in Table 5, the cut-off criteria for both AVE and CR are met, indicating that the convergent validity is satisfied.

5.1.5 Discriminant validity

In order to assess discriminant validity, the AVE for each construct was compared to the highest corresponding squared inter-construct correlation (HSIC). The criterion to meet discriminant validity is that AVE must be larger than HSIC. AVE and HSIC values for each construct are indicated in Table 5. As indicated in the Table, the AVE estimates of the constructs were greater than their HSIC, which demonstrated a high level of discriminant validity of the constructs.

5.1.6 Nomological validity

Nomological validity was assessed by considering whether the correlations between the constructs in the proposed model make sense (Hair et al. 2006). The correlations between constructs were employed to examine the nomological validity of the model and results are indicated in Tables 6 and 7. As indicated in Tables 6 and 7, all correlations were positive and significant except for PU < -- > CT (t=1.03, p=0.30) and TR < -- > SPI (t=0.12, p=0.90), which were positive but not significant. Overall, the correlations were consistent with the theoretical model and met the nomological validity assumption (Hair et al. 2006). To sum up, the CFA results showed that the measures used in the measurement model have adequate reliability, convergent, discriminant, and nomological validities.

5.2 Demographic Characteristics of Participants

The demographic information of respondents encompases gender, age, education, being familiar with IT tools, using KMS for company tasks, place of access to KMS, and duration of using KMS, which are shown in Table 8. As illustrated in Table 8, the demographic information of respondents covers gender, age, education, being familiar with IT tools, using KMS for company tasks, place of access to KMS, and duration of using KMS. It was shown that 332 participants (77.6%) were males and 96 (22.4%) were females. Concerning age, 36 respondents (8.4%) are less than 20 years old, 168 participants (39.3%) are at the age of 20-30, 135 (31.5%) of participants are at the age of 31-40, 34 respondents (7.9%) are at the age of 41-50, 40 (9.3%) are at the age of 51-60, and 15 participants (3.5%) are at the age of above 60 years old. In terms of education level, 129 (30.1%) participants are less than high school, 113 (26.4%) have high school certificates, 88 (20.6%) have bachelor certificate, and 98 (22.9%) have post graduate certificates. Concerning IT familiarity, 370 (86.4%) of participants are familiar with IT tools and 58 (13.6%) are not. 167 respondents (39%) have access to KMS at their work, 155 (36.2%) have access to KMS at home, and 106 participants (24.8%) have access KMS at public places. 175 participants (40.9%) use KMS

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Table 7 AMOS output – Construct Correlations: (Group number 1 – Default model)

	Estimate
SN < -- > CT	0.14
TR < -- > CT	0.18
SPI < -- > CT	0.11
PU < -- > CT	0.15
PEOU < -- > CT	0.08
KSE < -- > CT	0.19
TAK < -- > CT	0.10
OS < -- > CT	0.10
LDR < -- > CT	0.06
KC < -- > CT	0.12
SN < -- > TR	0.10
SN < -- > SPI	0.03
SN < -- > PU	0.12
SN < -- > PEOU	0.11
SN < -- > KSE	0.20
SN < -- > TAK	0.13
SN < -- > OS	0.13
SN < -- > LDR	0.14
SN < -- > KC	0.11
TR < -- > SPI	0.18
TR < -- > PU	0.18
TR < -- > PEOU	0.11
TR < -- > KSE	0.12
TR < -- > TAK	0.19
TR < -- > OS	0.15
TR < -- > LDR	0.13
TR < -- > KC	0.32
SPI < -- > PU	0.06
SPI < -- > PEOU	0.05
SPI < -- > KSE	0.13
SPI < -- > TAK	0.19
SPI < -- > OS	0.13
SPI < -- > LDR	0.11
SPI < -- > KC	0.12
PU < -- > PEOU	0.17
PU < -- > KSE	0.12
PU < -- > TAK	0.07
PU < -- > OS	0.09
PU < -- > LDR	0.52
PU < -- > KC	0.07
PEOU < -- > KSE	0.11
PEOU < -- > TAK	0.09
PEOU < -- > OS	0.09
PEOU < -- > LDR	0.13
PEOU < -- > KC	0.11
KSE < -- > TAK	0.13
KSE < -- > OS	0.07
KSE < -- > LDR	0.18
KSE < -- > KC	0.06
TAK < -- > OS	0.10
TAK < -- > LDR	0.17
TAK < -- > KC	0.05
OS < -- > LDR	0.12
OS < -- > KC	0.24
LDR < -- > KC	0.03

for less than one year, 119 (27.8%) use KMS for 1-2 years, 42 (9.8%) use KMS for 3-4 years, 42 (9.8%) use KMS for 5-6 years, and 50 respondents (11.7%) use KMS for more than 6 years.

As indicated in Table 9, all hypotheses (i.e. H1, H2, H5, H6, H8, H10, & H11) in the modified structural model were statistically significant. The standardized regression weight and the critical ratio values for the hypotheses indicated that all of them are statistically significant, and thus they receive strong support. More specifically, H1 (□=0.58, CR=16.41, P<0.001), H2 (□=0.45, CR=10.48, P<0.01), H5 (□=0.67, CR=19.14, P<0.01), H6 (□=0.74, CR=16.39, P<0.001), H8 (□=0.65, CR=19.94, P<0.01), H10 (□=0.28, CR=6.07, P<0.001), and H11 (□=0.50, CR=19.50, P<0.01) were statistically significant.

Therefore, the majority of the participants are males (77.6%). Concerning age, 39.3% belong to the age group 20-30, while 3.5% are 60 and above. Regarding education level, 30.1% had the education level of less than high school, whereas 20.6% had bachelor certificate. The majority of employees are familiar with IT (86.4%). The highest rate of accessibility place is 39%, which belongs to workplace. The experience of using KMS varies between less than a year (27.8%) to more than six years (11.7%).

5.3 Structure Equation Modeling and Hypotheses Testing

To examine the hypothesized relationships, SEM with the maximum likelihood estimation method was performed. First of all, the overall model fit was examined The fit indices presented in Table 10 showed that the hypothesized structural model provided the better fit to the data after removing none-significant paths (i.e. H3, H4, H7, & H9). Even though the likelihood ration chi-square (□□3723.05, df=1438, P=0.00) was still significant, other fit measures indicated that the model is adequately fitted to the data. GFA and RMSEA which belong to the absolute fit measures were 0.94 and 0.05, respectively, showing a good fit of the model. NFI and CFI which belong to incremental fit measures were 0.95 and 0.93, respectively, which were above the minimum requirement and therefore showed the adequate fit to the data. Finally, AGFI, belonging to parsimony fit measure, was 0.95, which was above the cut-off point. Besides these indices $\frac{\chi^2}{df} = 2.59$, which was within the threshold level ($1 < \frac{\chi^2}{df} < 3$), and thus supported these findings. To sum up, the results suggested that after omitting four none-significant paths (i.e. H3, H4, H7, & H9), a best parsimonious model was obtained. In additon, the modified model adequately fitted to the observed data. The final modified model is illustrated in Figure 1.

Table 10: Goodness of fit indices modified structural model

	χ^2	Df	$\left(\frac{\chi^2}{df}\right)$	Absolute Fit Measures		Incremental Fit Measures		Parsimony Fit Measure
				GFI	RMSEA	NFI	CFI	AGFI
Criteria			$1 < \left(\frac{\chi^2}{df}\right) < 3$	≥ 0.90	< 0.08	≥ 0.90	≥ 0.90	≥ 0.90
Obtained	3723.05	1438	2.59	0.94	0.05	0.95	0.93	0.95

Note: χ^2 = Chi-square; **df**=degree of freedom; **GFI**=Goodness of Fit Index; **RMSEA**=Root mean square error of approximation; NFI=Normated fit index; CFI=Comparative fit index; AGFI=Adjusted goodness of fit index

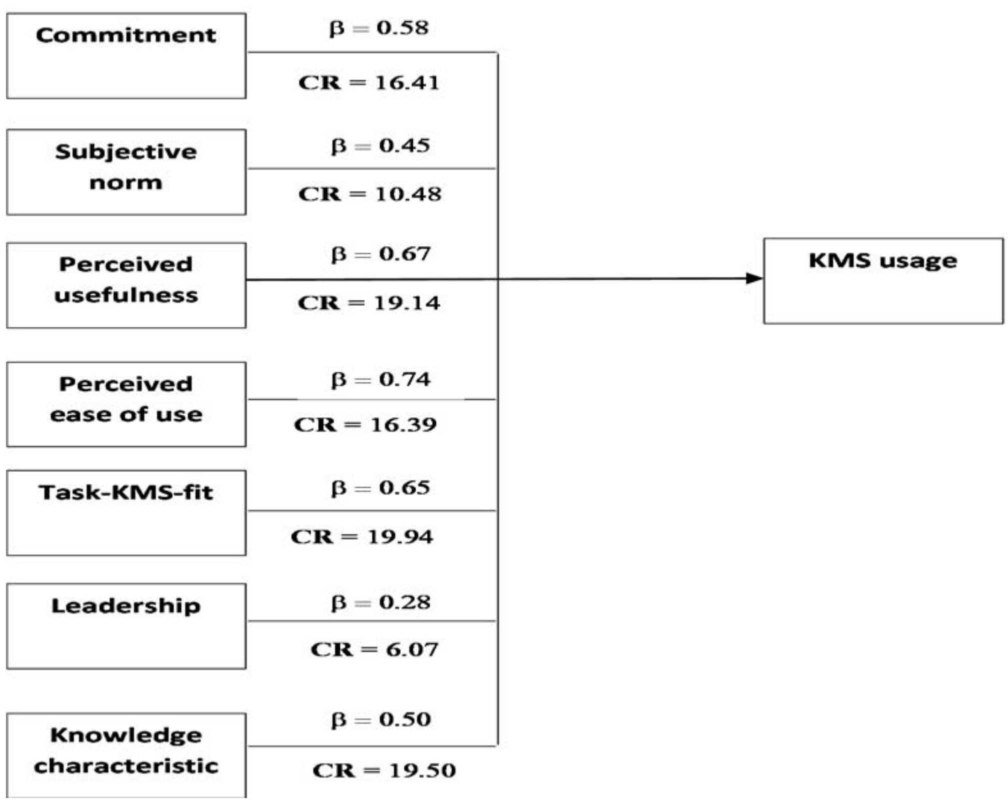

Figure 2: The KMS Usage Model in Petroleum Industry

6. DISCUSSION

KMS that provides the necessary infrastructures for organizations to implement KM practices and processes constitutes the backbone of organizations. The purpose of this study is to understand the main determinants of KMS usage in oil and gas industry in developing economy. The findings of the study show that KMS usage is significantly affected by commitment, subjective

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norms, PU, PEOU, Task-KMS-Fit, leadership and knowledge characteristics. However, trust, socio-political influences, KMS-self-efficacy and organizational structures are not significant antecedents of KMS usage. These findings are discussed in details as follows.

The results show that CT was a main determinant of KMS usage. This is in conformity with the literature findings and several researchers have provided empirical evidence on the significant effect of CT on KMS usage (Abbas 2012; Abdur-Rafiu & Opsade 2015; Goh & Sandhu 2013; Tseng & Lee 2011; Wasko et al. 2009). It implies that sense of commitment to the organization motivates the employees in the oil and gas industry to use KMS for performing their tasks and activities. This finding validates the pervious evidence on the impact of commitment on system usage. It also demonstrates the applicability and validity of integrating well-known information system theories for predicting user's behaviour in relation to KMS usage.

The findings suggest that individuals' commitment to KMS usage is attributed to compliance to obtain reward, identification with the system to build or maintain relationships and internalization where the behaviour of the individual is congruent with the value of the system (Malhotra & Galleta 2003). This shows that commitment needs to be seriously considered to promote KMS usage. Hence, these areas need to be focused by the leadership to enhance commitment of knowledge workers to the KMS usage. Top management may increase user's commitment through active support to KMS, communicating organization's KMS values, innovative supportive culture, giving formal and informal recognition of KMS, and training (Keramati & Azadeh 2007; Tseng & Lee 2011). They may invest more in the fitness between IT and the user's tasks to enhance commitment among staff (El Said 2015; Peng et al. 2016).

The findings indicate that subjective norms have strong positive influence on KMS usage in oil and gas industry. Thus, along with CT, SN was found to be a significant determinant of KMS usage in oil and gas industry; however, it was found to be relatively less influential than CT ($\square_{CT}=0.57 > \square_{SN}=0.44$). This supports the theory of TPB in predicting the effect of SN on KMS usage. This finding is consistent with literature on KMS usage (Goh & Sandhu 2013; Kuo & Young 2008; Lin & Lee 2004). The finding is also partially in agreement with the findings of some studies (Chow & Chan 2008; Huang, Davison & Gu 2008; Pamela et al. 2012), as they reported that SN indirectly affects system usage. However, it contradicts with findings of some studies (Abdur-Rafiu & Opsade 2015; Huang & Chen 2015). The findings of the study suggest that perceived social pressure and the intention to conform to the surrounding social, cultural pressure persuade the employees in oil and gas industry to use KMS for performing their tasks and activities. This suggests that the workers in oil and gas industry in Pakistan are under the influence of superiors, supervisors, and peers in their behavioral intentions, which in turn affect their use of technology such as KMS. Thus, to increase KMS usage among the workers in oil and gas industry, the top management may create the positive atmosphere of appreciation and collaboration in KMS usage in organizations. Norms of collaboration, teamwork, and valuing diversity among the employee can contribute to the exchange knowledge and KMS usage (Goodman & Darr 1998; Jarvenpaa & Staples 2000; Leonard-Barton 1995; Kankanhalli et al. 2005). Also, they should be attentive to SN and should proactively cultivate the good norms and culture, and solidify favorable feeling towards knowledge sharing.

Consistently, the results suggested that PU has a strong significant effect on KMS usage in oil and gas industry. This implies that an increase in PU would positively impact the acceptance of KMS usage in oil and gas industry. This also supports the proposition of TAM in predicting the influence of PU on KMS usage. These results further suggest that PU was a significant determinant of KMS usage. This finding is in agreement with the empirical evidences in literature (Davis 1989; Pikkarainen et al. 2004; Wang et al. 2003; Chan & Lu, 2004; Chandio 2011). The result of the study suggests that the employees in oil and gas industry hold the view that KMS is useful for enhancing their job performance, productivity, fastness and effectiveness, which in turn encourages them to use KMS while performing their activities and tasks. It may be recommended that the management adopt and implement systems which enhance job performance and productivity more effectively and take less time to persuade the users to use KMS more frequently.

The results demonstrated that PEOU strongly and positively affects KMS usage in oil and gas industry. It is implied that the greater the

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PEOU, the higher degree of the KMS usage. This also supports the theory of TAM in predicting effect of PEOU on KMS usage. PEOU was found as a significant determinant of KMS usage in oil and gas industry. Previous research provides empirical evidence on the effect of PEOU on user's system usage (Adams et al. 1992; Alsajjan & Dennis 2010; Bih-Yaw et al. 2012; Clay et al. 2005; Davis 1989; Gefen et al. 2003; Igbaria et al. 1997; Im & Raven 2003; Mathieson 1991; Pikkarainen et al. 2004; Wang et al. 2003). The current study found that both PU and PEOU as core constructs of TAM strongly predict users' behaviour concerning KMS usage (Tatcher et al. 2010). Like the findings of previous literature (Wang et al. 2003), this study found that PEOU is slightly stronger in influencing KMS usage. The findings of the study suggests that the workers in oil and gas industry in Pakistan perceive KMS tool as easy, effortless, flexible, clear and understandable to use, which increases their intentions to use KMS while performing their tasks. The management might develop, implement or adopt systems considering the attributes of easiness, flexibility, and clarity to increase KMS usage among the personnel.

Consistently, it is shown that task-KMS-fit positively and significantly affects KMS usage in oil and gas industry. This indicates that an increase in the level of task-KMS-fit increases the KMS usage, supporting the proposition of TTF. The finding of this study is in conformity with the empirical evidence in literature (Goodhue & Thompson 1995; Lin & Huang 2006; Mark et al. 2002; Turner et al. 2008; Wint 2016). The result is also partially in agreement with that of Im and Raven (2003), who showed that Task-KMS-Fit affects performance through task characteristics and technology characteristics.

The finding of the study suggests that when the employees in oil and gas industry in Pakistan find that the KM technology fits their task requirements, including promotion of collaboration, distributed learning, knowledge discovery, knowledge mapping, data location and opportunity generation, they will be encouraged to use the system to enhance their performance. The implication for management may be that they develop, adopt and utilize the KMS system that strongly fits the task that is designed for (El Said 2015), whereby the KMS usage will enhance competitive advantage. Besides, as task-KMS-fit was found a strong antecedent of KMS usage, it is suggested that management involve the employees in the analysis and design phase of KMS. Correspondingly, El Said (2015) recommends: "By bringing their understanding of the business process and task characteristics, this would more likely result in successful KMS implementation and ensure that the resulting system would fit the task need (86)". This means that by involving the employees in the process of planning and analysis, they will build understanding of the system alignment with tasks which in turn their use of system is facilitated.

The findings indicated that leadership positively and significantly affects KMS usage in oil and gas industry. It is shown that if the leadership plays more important roles, KMS usage in oil and gas industry would increase. The findings of the study is consistent with the empirical evidences in literature (Bueno & Salmeron 2008; Kim et al. 2007; Politis 2001), and particularly with the findings of the studies in the context of oil and gas industry (Al-Busaidi et al. 2010; Gardiner 2014; Mughal & Ahmad 2016; Wan & Lai 2014). However, the result of the study is partially in agreement with the findings of some past studies (Kuo et al. 2011; Srivastava et al. 2006), in which Kuo et al. (2011) reported the role of leadership through task-KMS fit and Srivastava et al. (2006) indicated the role of leadership through team-self-efficacy. The finding suggests that leadership can play a crucial role through intervention, support, developing and implementing KMS, supporting teamwork, meeting organizational business requirement, and accomplishment of KM activities. It is safe to say that the role of leadership in KMS usage is as important as technology itself (Kuo 2011). Similarly, poor leadership could debilitate KMS usage (Humayun & Gang 2013). Thus, the findings of the study suggest that the employees in oil and gas industry are influenced by their managers in using KMS for performing tasks and activities, knowledge creation, knowledge sharing, etc. This means that leadership needs to play more important roles by building constructive, friendly, and collaborative environment for KMS usage.

Consistently, the results indicate that knowledge characteristics have a significant positive impact on KMS usage. This implies that if the level of knowledge characteristic increases, the level of KMS usage would increase as well. Thus, knowledge characteristic is considered as a significant determinant of KMS usage. The findings of the study are consistent with the results of previous studies on the effect of knowledge

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characteristics on KMS usage (Albusaid et al 2007; Jen-Her & Wang 2006; John & Tang 2011; Tony et al. 2007; Tsai & Chen 2007; Wu & Wang 2006). The findings suggest that knowledge characteristics such as understandability, sharability, accessibility, filtering mechanism, source and type determine users' knowledge sharing and KMS usage. It is shown that the employees in oil and gas industry in developing economy consider the importance of knowledge characteristics and it will in turn affect their KMS usage. The management should attempt to provide the high-quality knowledge to encourage the employee to use KMS.

However, the data analysis revealed that four hypotheses, namely trust, socio-political influences, organizational structure, and KMS-self-efficacy were not supported, and thus rejected. The following sections present the discussion on these hypotheses. The results show that trust does not significantly affect the use of KMS in oil and gas industry, so, it is not a determinant factor of KMS usage. This may need to be re-examined in the future studies in the context of oil and gas industry. Literature provides empirical evidences on the effect of trust on system usage though the findings are mixed and inconclusive. Some studies highlight the significant impact of trust on KMS usage (Alsajjan & Dennis 2010; Chandio 2011; Thatcher et al. 2010; Zainab et al. 2011), while some disagreed (Abdur-Rafiu & Opsade 2015). Looking at the nature of these studies reveals that those studies that report the significant impact of trust on KMS usage were mainly in the context of banking system or online purchase where the user needs to trust the transaction of money; however in the other contexts like academic (Abdur-Rafiu & Opsade 2015) or oil and gas industry (Albusaidi et al. 2010), trust may not play a key role in KMS usage.

One possible explanation may be that, here, the user will not face the issue of monetary loss. A study by Al Busaidi et al. (2010) in the context of petroleum industry in Oman, a developing economy, also shows that trustworthy has no significant effect on KMS usage. Therefore, in the context of oil and gas industry, trust does not significantly affect users' KMS usage. One possible explanation for their use of KMS may be the interaction among staff, fairness in exchanging knowledge, strong positive feeling towards online community, without trusting others. Thus, trust may give way to the other influencing factors such as commitment and subjective norms.

The study findings indicated that socio-political influences have no significant impact on KMS usage in oil and gas industry. It is argued that the previous studies on the effect of socio-political influences on KMS usage were mostly descriptive (Akhavan et al. 2006), theoretical (Easterby-Smith & Prieto 2008; Prieto & Easterby-Smit 2006), qualitative (Charnkit 2011), out of the context of oil and gas industry (Nai & Gill 2007), and those in the context of oil and gas industry were not empirically and theoretically supported (Akeel 2013; Desai & Rai 2016; Gardiner 2014; Grant 2013).

Therfore, the present study has tested emperically, theoretically the construct 'socio-political influence' and shown that this variable does not significantly affect KMS usage in the context of oil and gas industry in Pakistan. This may need to be re-evaluated in further studies.The justification is that despite the socio-political issues in this country, the oil and gas industry including international companies has attempted not to be influenced by socio-political issues or the employees are reluctant to share their political views. Or they may hide their political views for the sake of job security.This is because oil and gas plays a critical role in the economy of the country and involvment in socio-political activities may jeorpardise the fututre buiness of this industry. This also implies the strong role of leadership in pursuading the employees to focus on the main business of their respective organizations. However, as discussed, subjective norms covers social, political, cultural, and management factors influntial in KMS usage. This implies that there is a trace of social and political inflences in KMS usage though slight influence. This is because social norms are shaped by social, political, cultural influences.

It was shown that KMS-self-efficacy does not significantly impact KMS usage in oil and gas industry. The finding of the present study is in agreement with some literature (Wint 2016), particularly in the context of oil and gas (Wang & Lai 2014), and is partially in agreement with (Muhamad Khalil Omar et al. 2016), who focused on team-efficacy and knowledge sharing. However, it contradicts with the findings of some studies that reported the significant effect of technology self-efficacy on system usage (Akinbobola et al. 2013; Chandio 2011; Chu & Lee 2004; Chen et al. 2012; Lin & Huang 2008). Therefore, the participants' perceptions of their capability in using KMS technology have not significant effect on their system usage in the context of oil and gas industry in developing economy. The justification might be attributed to the fact that using manual, emulating others, built-in assistance, and acquisition are not effectively done by the employees in the process of using KMS. Or the employees are familiar with the system and its usage is not a challenge for them. Another possible explanation is that self-efficacy is mostly significant in using networking websites, where the users seek for sharing knowledge as well as online socialization (Huang et al. 2008); however, in the context of oil and gas industry, the users may use KMS for job performance in organizations.

The findings indicated that organizational structure has no significant influence on KMS usage in oil and gas industry. This suggests that organizational structure such as task allocation, coordination and supervision has no significant effect on KMS usage. The findings of this study contradicts with the literature stream (Chen et al. 2012; Damanpour et al. 2009; He et al. 2009; Kuruppu 2013; Liao, Toya et al. 2009; Nishii et al. 2008; Raisch et al. 2009; Zheng et al. 2010). However, the finding of the study is consistent with that of Olham and Cummings (1996) and Singh (2008) who found that organization supervision negatively affects KMS usage. The explanation may be that due to the development of infrastructure and high-speed internet, department connectivity is facilitated and is taken for granted by the staff. The findings suggest that the department interactions, collectivism approach, and strategic alliance with other companies and knowledge creation facilitation have no effect on KMS usage in oil and gas industry.

8. SUGGESTION FOR FUTURE RESEARCH

This research has integrated three well-known information system theories (i.e., TAM, TTF & TPB), their core constructs and external variables and established a comprehensive, parsimonious model to systematically investigate users' intention to KMS usage through identifying the key determinants of KMS usage. However, a lot of beneficial areas concerning KMS usage in oil and gas industry have remained unexplored. The study focused on KMS usage in oil and gas industry in a developing economy and it may call for a replicating study in a developed economy. A research with mixed mode approach benefiting from both quantitative and qualitative data collection and analysis may be suggested to address the breadth and depth of the study phenomenon. Since the robustness of a model can vary across cultures and contexts (Segars & Grover 1993), the study suggests that this model be tested by conducting studies in the other Asian counties or in the Western countries to see the validity and applicability of the model. Such a study can show which determinant factors in the present study (commitment, subjective norms, PU, PEOU, task-KMS-fit, leadership & knowledge characteristics) will be confirmed or rejected in the new context, while integrating the three theories (TAM, TPB & TTF) and their respective core constructs.

The current study employed a cross-sectional survey to collect data. A longitudinal study may be of interest to explore which factors among the determinant factors of KMS usage cause the continuance of using KMS. This is because the user's perception and consistency in using system can be affected by experience, time and feedback. Thus, a longitudinal in-depth qualitative study is suggested to be conducted to address this issue. Further, future study may involve those staff, who withdrew or stopped using KMS, to find the issues and barriers to KMS usage. Lastly, future study may extend the proposed model by adding additional external variables to identify the other determinant factors of KMS usage in the context of oil and gas industry.

9. CONCLUSION

The current research was motivated by different factors to be carried out. The ever-growing information technology and its effect on KMS in organizations, particularly in the context of oil and gas industry where a lot of investment is done, have stimulated this study to be undertaken. Lack of comprehensive study using an integration of the well-acknowledged theories of information system in a developing economy particularly Pakistan is also another motivation for this research. Despite the introduction of KMS usage by previous researchers and highlighting its benefits and potentials, the underusing of this technology by the potential users particularly in oil and gas industry is still a major problem. Hence, it is important to understand why employees do not accept or reject using KMS and what the determinant factors of KMS usage are.

To address this issue, the present study developed a model by integrating three well-known information system theories, namely TPB, TAM and TTF and incorporating the constructs from the theories and KMS usage research stream. The developed comprehensive, parsimonious model was tested against data obtained from 428 respondents working in oil and gas industry in Pakistan. The usable data was analyzed using AMOS version 22.

The study investigated the effect of four main dimensions of KMS usage, namely human (commitment, subjective norms, trust & socio-political), technology (PU, PEOU, task-KMS-fit & KMS-self-efficacy), organization (organizational structure & leadership) and knowledge (knowledge characteristics). The study established 11 hypotheses from which 7 hypotheses were accepted and the rest were rejected. The study found that the constructs of commitment, subjective norms, PU, PEOU, task-KMS-fit, leadership and knowledge characteristics significantly influence KMS usage. Besides, the findings of the research provide strong validity to the developed model through integration of these theories (TAM, TTF & TPB), particularly in the new context, oil and gas industry. Apart from the external factors (commitment, leadership, & knowledge characteristics), the core constructs of TPB (subjective norms), TAM (PU & PEOU), TTF (task-KMS-fit) were found to be significantly predictive of KMS usage. However, the present study found that the variables of trust, socio-political influences, KMS-self-efficacy, and organizational structure are not significant determinants of KMS usage. This calls for another study in the context of oil and gas industry to re-evaluate the significance of these constructs in KMS usage. The study also found that some variables are more significant and stronger in predicting KMS usage. The findings of this study may be generalized, interpreted and translated in the lights of the limitation of the study.

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Table 1: Summary of relevant studies on the information system theories

Author (s) & Year	Approach (s)	Respondents	Theories	Findings	Gap
Klopping & McKinney (2004)	Quantitative	263	TAM & TTF	•PEOU is not linked to PU •PU is directly linked to actual use of e-commerce	Limited variables, theory
Kankanhalli, Tan & Wei (2005)	Quantitative	160	TPB & TTF	•perceived output quality directly affects EKR. •resource availability affects EKR usage when task tacitness is low and •incentives affect EKR usage when task interdependence is high.	Limited variables, theory,
Huang et al. (2008)	Quantitative	195	TTF & Social cognitive theory	•TTF and personal outcome expectations have direct impacts on KMS usage. •Task tacitness has negative relationship & KMS characteristics have positive relationship with perceived TTF.	Limited IS theory, variable,
Turner, Biros & Moseley (2008)	Qualitative / Interview	7	TTF	•social characteristics of knowledge-based work have important role in determining the degree of fit relative to a KMS; •the social ecology has significant impact on KMS Fit.	Not quantitative, process vs. variance,
Choi et al. (2010)	Quantitative	743	TAM model	•Knowledge sharing affects knowledge application • knowledge application contributes to team performance; • knowledge sharing is a mediator	Not IS theory, limited variable,
Chandio (2011)	Quantitative	375	TRA/TPB /TAM	•The relationships between PU, PEOU, trust, technology-self-efficacy, BI, & accessibility towards online banking system are significant.	Limited technology theory, not performance,
Chen et al. (2012)	Quantitative	134	TAM	•attitude is the key factor influencing intention to engage in knowledge sharing. • KMS self-efficacy and organizational climate positively contributes to attitude, and indirectly contribute to knowledge sharing.	Limited theory, respondents
Akinbobola et al. (2013)	Quantitative	61	Self-efficacy	•usability, supportive management, and computer self-efficacy are important determinants of actual system use	Limited theory, variable, participants,
Moreno & Cavazotteb (2015)	Quantitative	117	TTF	• Task-KMS-fit leverage the acquisition, transfer and reuse of knowledge; through characteristics of jobs, & work contexts	Limited theory, limited variables
El Said (2015)	Quantitative & qualitative	95	TTF	•Intention to share knowledge, task characteristics, perceived TTF, KMS characteristics, and utilization have substantial influences on KMS usage	Limited theory, participants, variables

Wint (2016)	Quantitative	96	TTF/social capital	•most important concerns for increasing KMS usage were system quality, information quality, and technology fit. • People-oriented factors (self-efficacy, social ties, and ease of use/usefulness) and organizational process factors (leadership, organizational culture/climate, and governance) were not critical factors directly responsible for increasing KMS usage.	Limited theory, dimension,
The current study	Quantitative	-----------	TPB/TAM/TTF	•Human, technology, organization, knowledge, KMS usage	---------------

Table 2: Formal definitions of constructs

Construct abbreviation	Defenition	No. of items	Reference
Commitment (CT)	KMS User Commitment is the degree of commitment of the knowledge worker to the KM program and related systems and processes based on the effect of social influences on his or her behavior.	5	Malhotra, 2003; O'Reilly & Chatman 1986
Subjective norms (SNs)	Individual's perception of social pressure to perform or not to perform the behaviour.	5	Ajzen 1991; Davis et al. 1989; Fishbein and Azjen 1975; Mathieson 1991; Taylor and Todd 1995a, 1995b
Trust (TR)	The willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party.	5	Rousseau, Denise et al. 1998; Mayer et al. 1995; Chandio 2011; Morgan & Hunt 1994; Doney & Cannon 1997; McKnight et al. 2002;Gefen et al. 2003
Socio-political influences (SPI)	Social influence refers to the obvious but important fact that much of individuals behavior is affected by others in society, community and job place in which individual belongs to, it may involve political, religious and cultural influences.	6	Schneider 2005;Cialdini 1994; Judge & Bretz 1994;Kahan 1997
Pecived Usefulness (PU)	Refers to the degree to which a person believes that using a particular system would enhance his or her job performance.	6	Davis 1989; Davis et al. 1989; Venkatesh et al. 2003
Percived Ease of Use (PEOU)	The degree to which a person believes that using a particular system would be free of effort.	6	Davis 1989 ; Davis et al. 1989; Venkatesh et al. 2003
KMS-self-efficacy (KSE)	Technological self-efficacy is an individual's judgment of efficacy across multiple computer application domains. So, KMS self-efficacy, then, refers to the perception of personal capability in performing KMS-related tasks within the domain.	4	Bandura 2006; Chen et al. 2012; Compeau 1995
Task-KMS-Fit (TAK)	Task-technology-fit (TTF) is the degree to which a technology assists an individual in performing his or her portfolio of tasks.	8	Goodhue &Thompson

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	More specifically, Task-KMS-Fit is the correspondence between task requirements, individual abilities, and the functionality of the KMS.		1995; Dishaw & Strong 1998
Organizational Structutre (OS)	An organizational structure defines how activities such as task allocation, coordination and supervision are directed towards the achievement of competetive advantages.	6	Pugh, Derek Salman, 1971;Spender 1994
Leasdership (LDR)	Leadership refers as an important critical success factor of KM, which have different styles to manage organizational knowledge to achieve competitive advantages.	8	Gray 2002
Knowledge Characteristic (KC)	Knowledge is referred to as a clear and certain perception of something – the act, the fact, or the state of understanding it involves both knowing how, which is generally more tacit knowledge, and knowing about, which is more explicit knowledge and its features or quality referred to as knowledge characteristics.	7	Kumar 2008; Grant 1996
KMS Usage (KMSU)	KMS referred as a class of information system, to support creation, transfer, and application of knowledge in organizations. Furthermore, two common use types are knowledge sharing and knowledge acquisition & utilization (the active and passive uses). Broadly speaking, the former includes usage behaviors about publishing, contributing to discussions, answering, valuing, and commenting, while the latter includes usage behaviors concerning searching for and reading about knowledge or answers	9	Alavi & Leidner 2001; Wu & Wang 2006)

Table 5: Confirmatory factor analysis: Construct measurement

Construct and Item Description	Standardized Factor Loadings
Commitment (α =0.92, CR =0.90, AVE = 0.64, HSIC =0.26)	
1. I am proud about using the KMS.	.69
2. I feel a sense of ownership for the use of the KMS.	.80
3. In order to get reward, it is necessary to use the KMS.	.81
4. I like using the KMS because its use is similar to my values.	.85
5. What the use of the KMS stands for is important for me.	.84
Subjective Norm (α =0.85, CR =0.86, AVE =0.55, HSIC =0.35)	
1. People who are important to me think that I should use the KMS. 2. People who influence my behavior think that I should use the KMS.	.62 .82
3. My friends in company think that I should use the KMS.	.87
4. My supervisor would think that I should use the KMS.	.71
5. Using KMS at work is highly appreciated.	.66
Trust (α =0.91, CR =0.91, AVE =0.68, HSIC =0.43)	
1. The KMS in my company is trustworthy.	.84
2. I am quite certain what to expect from the given KMS.	.82
3. I trust the online KMS provided by company.	.87
4. The KMS in my company has enough privacy options.	.76
5. The given KMS keeps its promises and commitments.	.82
Socio-Political influences (α =0.86, CR =0.87, AVE =0.53, HSIC =0.38)	
1. Political competition in my company affect on my KMS usage.	.64
2. Global politics have effects on my company's technological advancement.	.83
3. I am very concerned about my social values while using KMS.	.71
4. I do consider my religious beliefs while using KMS.	.70
5. Sometimes political, religious and cultural issues stopped me from using KMS.	.83
6. Having the KMS is a status of symbol in my company.	.63
Perceived Usefulness (α =0.90, CR =0.89, AVE =0.59, HSIC =0.26)	
1. Using the KMS enhances the productivity of my job at company.	.84
2. Using the KMS makes it easier to do my company activities.	.82
3. Using KMS enables me to accomplish my tasks more quickly.	.59
4. Using KMS improves my job performance.	.83
5. Using KMS enhances the effectiveness of my company's activities.	.82

6. Overall, I find the KMS useful for my company activities.	.67
Perceived Ease of Use (α =0.90, CR =0.89, AVE =0.57, HSIC =0.42)	
1. Learning to operate the KMS is easy for me. 2. I find it easy to get the KMS to do what I want it to do.	.82 .80
3. My interaction with the KMS is clear and understandable.	.78
4. I find the KMS to be flexible to interact.	.70
5. It is easy for me to become skilful at using the KMS.	.73
6. Overall, I find the KMS easy to use.	.67
KMS-Self Efficacy (α =0.85, CR =0.86, AVE =0.61, HSIC =0.45)	
1. I could complete my tasks using KMS if there is manual for reference.	.58
2. I could complete my company tasks using KMS if I had seen someone else using it before trying it myself.	.84
3. I could complete my company tasks using KMS, if I had just built-in-help or online assistance.	.85
4. I could complete my tasks via KMS if there is no one around me to tell how to do because every assistance is provided in KMS.	.83
Task-KMS-fit (α =0.91, CR =0.93, AVE =0.63, HSIC =0.33)	
1. My company's KMS covers collaboration.	.83
2. My company's KMS covers distributed learning. 3. My company's KMS covers knowledge discovery.	.84 .82
4. My company's KMS covers knowledge mapping.	.81
5. I do generate opportunity if I use KMS to carry out my tasks.	.84
6. KMS in my company fits to my given task.	.78
7. KMS helps me to determine what data is available and Where.	.78
8. Overall, the available KMS is compatible to handle my daily tasks.	.60
Organizational Structure (α =0.88, CR =0.92, AVE =0.65, HSIC =0.48)	
1.I interact and share knowledge with other departments via KMS.	.76
2. My orgnisations' structure supports collective rather than individualistic approach of doing tasks by use of KMS.	.89
3. Organizational structure could facilitate the creation of new knowledge via KMS.	.83
4. In my organization, managers examine knowledge management activities.	.88
5. My organization has strategic alliance with other companies.	.87
6. My organization has standard reward system for knowledge sharing and creation.	.57
Leadership (α =0.92, CR =0.93, AVE =0.68, HSIC =0.36)	
1. I believe making effective use of KMS requires intervention of leadership.[a]	
2. I believe leadership assumes importance and is a determinant of success as it provides vision and ability to cope with KMS changes.[a]	
3. Leadership plays a critical role in developing and implementing KMSs or initiatives.	.91
4. Leadership is one of the most important enablers of KM.	.85
5. Leadership should convince people to align to new directions by emphasizing on teamwork to achieve objectives.	.71
6. I intend to continuously use the KMS if there is leadership support.	.78
7. Leadership should ensure that KMS meets organizational business requirement.	.88
8. Leadership plays an important role ensuring KM activities to be accomplished.	.81
Knowledge Characteristic (α =0.88, CR =0.89, AVE =0.59, HSIC =0.24)	
1. Knowledge in the KMS is easy to understand.	.69
2. KMS has efficient knowledge filtering mechanism.	.84
3. Codified knowledge is sharable through KMS.	.85
4. Tacit knowledge is sharable through social gatherings.	.59
5. In my company, knowledge can reach to others, who did not create it.	.84
6. The source of knowledge is important for me to accept it.	.76
7. The type of knowledge is important to me to understand it.[a]	
KMS Usage (α =0.87, CR =0.91, AVE =0.53, HSIC =0.15)	
1. I frequently use KMS to search knowledge in my work.	.84
2. I frequently use KMS to contribute knowledge in my work.	.62
3. I regularly use KMS to search knowledge in my work.	.78
4. I regularly use KMS to contribute knowledge in my work.	.77
5. I use KMS to help me make decisions.	.80
6. I use KMS to help me record my knowledge.[a]	

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7. I use KMS to communicate knowledge and information with colleagues.	.61
8. I use KMS to share my general knowledge.	.80
9. I use KMS to share my specific knowledge.	.77

Notes: CR = Composite Reliability, AVE = Average Variance Extracted, HSIC = Highest Squared Inter-construct Correlation.

Table 6: AMOS output-Covariances (Group number 1-Default model)

	Estimate	S.E.	C.R.	P
SN < -- > CT	1.25	0.37	3.38	***
TR < -- > CT	1.21	0.33	3.67	***
SPI < -- > CT	0.75	.25	3.00	***
PU < -- > CT	0.12	0.11	1.03	0.30
PEOU < -- > CT	0.10	0.10	0.98	0.03
KSE < -- > CT	0.19	0.12	1.62	***
TAK < -- > CT	0.41	0.10	3.94	***
OS < -- > CT	0.24	0.12	2.05	***
LDR < -- > CT	0.24	0.12	2.05	***
KC < -- > CT	0.15	0.11	1.32	***
SN < -- > TR	0.03	0.12	0.29	***
SN < -- > SPI	0.23	0.11	2.13	0.03
SN < -- > PU	1.08	0.17	6.35	***
SN < -- > PEOU	1.04	0.16	6.50	***
SN < -- > KSE	0.25	0.11	2.24	***
SN < -- > TAK	0.39	0.10	4.00	***
SN < -- > OS	0.06	0.11	0.56	0.03
SN < -- > LDR	0.07	0.11	0.61	0.03
SN < -- > KC	1.22	0.33	3.70	***
TR < -- > SPI	0.01	0.12	0.12	0.90
TR < -- > PU	0.10	0.12	0.87	0.03
TR < -- > PEOU	1.25	0.37	3.38	***
TR < -- > KSE	1.05	0.18	5.83	***
TR < -- > TAK	0.19	0.11	1.75	0.03
TR < -- > OS	0.39	0.12	3.16	***
TR < -- > LDR	1.09	0.17	6.41	***
TR < -- > KC	0.77	0.12	6.24	***
SPI < -- > PU	1.14	0.20	5.70	***
SPI < -- > PEOU	1.11	0.17	6.53	***
SPI < -- > KSE	1.07	0.12	8.92	***
SPI < -- > TAK	1.19	0.15	7.93	***
SPI < -- > OS	1.06	0.12	8.83	***
SPI < -- > LDR	1.02	0.12	8.50	***
SPI < -- > KC	1.04	0.11	9.45	***
PU < -- > PEOU	0.34	0.10	3.41	***
PU < -- > KSE	0.29	0.11	0.249	0.01
PU < -- > TAK	1.15	0.15	7.67	***
PU < -- > OS	1.22	0.12	10.67	***
PU < -- > LDR	1.24	0.13	9.49	***
PU < -- > KC	1.16	0.12	9.67	***
PEOU < -- > KSE	1.02	0.11	9.27	***
PEOU < -- > TAK	1.17	0.14	8.36	***
PEOU < -- > OS	1.19	0.12	9.92	***
PEOU < -- > LDR	0.27	0.11	2.64	0.01
PEOU < -- > KC	1.10	0.14	7.85	***
KSE < -- > TAK	0.28	0.10	2.71	0.01
KSE < -- > OS	1.16	0.17	6.82	***
KSE < -- > LDR	0.43	0.12	3.57	***
KSE < -- > KC	1.13	0.15	7.53	***

TAK < -- > OS	0.21	0.10	2.03	0.04
TAK < -- > LDR	0.37	0.11	3.51	***
TAK < -- > KC	1.10	0.14	7.85	***
OS < -- > LDR	0.30	0.12	2.46	0.01
OS < -- > KC	0.55	0.12	4.74	***
LDR < -- > KC	1.07	0.11	9.72	***

Table 8: Demographic characteristics of respondents

Variable	Category	Ferquency	Percent
Gender	Male	332	77.6
	Female	96	22.4
Age	<20	36	8.4
	20-30	168	39.3
	31-40	135	31.5
	41-50	34	7.9
	51-60	40	9.3
	>60	15	3.5
Education	Less than high school	129	30.1
	High school	113	26.4
	Bachelor	88	20.6
	Post graduate	98	22.9
Are you familiar with IT tools?	Yes	370	86.4
	No	58	13.6
Do you KMS for company tasks?	Yes	343	80.1
	No	85	19.9
Place of access to KMS	At work	167	39
	At home	155	36.2
	At public location	106	24.8
How long do you use KMS?	Less than one year	175	40.9
	1 to 2 years	119	27.8
	3 to 4 years	42	9.8
	5 to 6 years	42	9.8
	More than 6 years	50	11.7

Table 9: Results of revised structural model

Contruct	Code Name	Hypotheses	Relationship (positive)	Standardized regression weights (□)	CR	Supported
Commitment	CT	H1	CT → KMSU	0.58	16.41	Yes***
Subjective norm	SN	H2	SN → KMSU	0.45	10.48	Yes**
Perceived usefulness	PU	H5	PU → KMSU	0.67	19.14	Yes**
Perceived ease of use	PEOU	H6	PEOU → KMSU	0.74	16.39	Yes***
Task-KMS-fit	TAK	H8	TAK → KMSU	0.65	19.94	Yes**
Leadership	LDR	H10	LDR → KMSU	0.28	6.07	Yes***
Knowledge characteristic	KC	H11	KC → KMSU	0.50	19.50	Yes**

*** Significant at 0.001 level (two-tailed).
** Significant at 0.01 level (two-tailed).