Exploration of multi-layered knowledge sharing participation: the roles of perceived benefits and costs

1. Introduction

Knowledge sharing has been part of research and practical studies in different domains in different societal contexts for many years (Witherspoon et al., 2013, Hwang et al., 2015). One of the important societal factors that affect knowledge management (KM) processes and procedures is the economic situation of a society (Sedighi et al., 2015). This paper focuses on knowledge sharing in a resource-constrained economy, i.e. economies characterized by inefficiently working technological, legal and governance systems as can be found in many developing countries. The inefficiency increase transaction costs for organisations in their production and business processes. In order to deal with the uncertain economic environment in resource-constrained economies, organisations should have a more flexible internal organisation as compared with similar organisations in resource efficient economies. In order to make the flexible internal organisation, managers in the resource-constraints environments invest more on internal knowledge sharing among employees to increase organisational competitiveness (Osei-Bryson et al., 2014). Knowledge sharing among employees to exchange knowledge and experiences is a meaningful improvement for organisations with limited resources (Asrar-ul-Haq et al., 2016).

Knowledge sharing in knowledge management (KM) systems is the central issue of this paper (Agichtein et al., 2008). Knowledge sharing as a sustained activity of transferring experiences and knowledge through knowledge exchange channels, allows experts to exploit knowledge-based resources (Wang et al., 2014b, Oyemomi et al., 2016). Electronically enabled knowledge networks have been shown to facilitate knowledge sharing and retrieving within organisations in today's networked society (Amine Chatti, 2012). Recent years have witnessed a fast-growing body of research on such knowledge networks (Phelps et al., 2012). Electronic knowledge networks, defined as self-organizing systems that enable users to share interests or practices through a computer-mediated system (Faraj et al., 2008), support social interaction and knowledge exchange within enterprises with unrestricted time and space constraints. Such knowledge networks have been shown to support innovation activities (Paruchuri and Awate, 2016).

The viability of knowledge networks strongly depends on employees' voluntary participation not only with regard to the volume of knowledge, but also with regard its quality (Lou et al., 2013). The contribution quantity refers to the volume of shared knowledge in knowledge networks, while the quality aspect of participation signifies the helpfulness of shared knowledge (Wasko and Faraj, 2005). Several psychological, social and technological factors influence the extent to which employees participate in a knowledge sharing system (Wu and Zhu, 2012, Clayton et al., 2016). Therefore, it is essential to explore how enablers and barriers simultaneously influence both participation quantity and quality in knowledge networks.

Several approaches can be used to explore these enablers and barriers. This paper pursues the socio-economic perspective, in which employees participate in knowledge sharing if their expected benefits outweigh the costs (Bock et al., 2005). It is assumed that each participant assesses his or her own benefits

and costs locally, based on potentially partial and incomplete information. Two terms "*perceived benefits*" and "*perceived costs*" are used for cost-benefit analysis of individual participants. Self-determination theory (Deci and Ryan, 2002) is used to determine individuals' perceived benefits, while adaptive cost theory (Cohen and Lambie, 1978) is employed to assess individuals' perceived costs. This study combines these theories to explore how different perceived benefits and costs influence both quality and quantity of participation. The central research question of the present study is *how do individual benefits and costs affect both quality and quantity of participation in organisational knowledge networks in a resource-constrained economy?*

This study explores complex influences of knowledge sharing benefits and costs concurrently on participation in knowledge sharing. Although these factors have been employed separately to examine knowledge contribution in different domains (Kwahk and Park, 2016), this research considers both sides and empirically explore how these factors exert various influences on two distinct aspects of participation in knowledge networks. Second, this study considers both quality and quantity aspects in relation to participation. This contribution aims to provide insight on the effects of perceived benefits and costs on quantity aspects versus quality aspects of participation in knowledge networks.

The next section is a review of the concepts of knowledge sharing, participation, knowledge network and influencing factors that affect knowledge sharing. Section 3 presents the conceptual model of knowledge sharing on which the research hypotheses explored in this paper are based. Section 4 describes the research methodology and survey instrument. Section 5 focuses on data analysis results, while Section 6 discusses the theoretical and practical implications of the research results.

2. Theoretical Background

This section reviews relevant studies on knowledge sharing, participation, knowledge network and the factors that affect knowledge sharing. The scope of this section is the exploration of the influence of perceived benefits and costs of participation in knowledge networks in a resources-constrained economy.

2.1. Knowledge Sharing

Knowledge sharing is an essential activity for knowledge application, organisational innovation, intellectual capital and ultimately the competitive advantage of enterprises (Wang et al., 2016). Knowledge sharing is defined as a sustained process of transferring experiences and organisational knowledge to business processes through communication channels between individuals, groups and organisations (Oyemomi et al., 2016, McAdam et al., 2012). Sharing of knowledge between employees and across teams allows professional experts to exploit and capitalize on knowledge-based resources (Wang et al., 2014b). Studies have shown that knowledge sharing can improve organisational efficiency, reduce costs, improve development time of new products, reduce overall project time and improve capacity for business innovation (Wang and Noe, 2010, Mesmer-Magnus and DeChurch, 2009, Lin, 2007a). Knowledge sharing in which an employee voluntarily provides other employees with access to his or her knowledge and experience, is often addressed from the perspective of an individual's willingness, intention, or propensity to share knowledge with colleagues (Ahmed et al., 2016).

Organisational KM studies distinguish two generations of knowledge sharing. The first, traditional KM, fostered by the computer growth and information technology (Huysman and Wit, 2004), concentrates on centralised knowledge repositories and codified knowledge. Knowledge is seen as objects that can be

saved, disseminated, and retrieved using IT (van den Hooff and Huysman, 2009). Both in practice and academic research, this approach has not yielded the results expected, due to its focus on explicit knowledge and not on the social interaction needed to exchange tacit knowledge (Huysman and Wit, 2004). The second generation of KM recognises the need for rich social interaction and participants' engagement in practice to enable both explicit and tacit knowledge to be shared (van den Hooff and Huysman, 2009) in networked environments (Ellison et al., 2014). Indeed, improving employee participation and engagement is key to contemporary knowledge sharing technologies (Chang and Chuang, 2011).

2.2. Participation in Knowledge Sharing

Participation is defined as being part of a specific larger whole with reciprocal relations and the capability to act and take responsibility (Brazier and Nevejan, 2014) in today's networked society in which realities merge. Participation in an organisation's KM requires the ability to create, share and use knowledge within the context of an organisation's goals. Knowledge sharing is an open, voluntary activity that supports social processes, for which individual participation plays an important role, even more than for other regular organisational activities (Choi et al., 2014, Llopis and Foss, 2016). Thus, knowledge sharing needs employee participation to form and evolve knowledge networks within companies (Bolisani and Scarso, 2014).

Different levels of participation contribute to different degrees of knowledge contribution (Chang and Chuang, 2011). Employees' participation can be measured by evaluating the level of knowledge contribution; a higher level of participation indicates a higher degree of knowledge contribution. Two main directions have been followed by researchers to determine the level of participation in the KM systems. First, a significant number of studies consider the volume of shared knowledge (Sun et al., 2012) to assess the level of users' contributions (Chen and Hung, 2010). Second, a certain number of KM studies has focused on the quality aspect to examine the value of knowledge contributions (Lou et al., 2013). Wasko and Faraj (2005) have studied social capital dimensions and motivational factors in relation to the quality of shared knowledge, as well as the quantity of knowledge contribution. Both sides of knowledge sharing performance can be improved if all participants have both motivation and opportunity to participate.

2.3. Knowledge Networks

Earlier studies considered knowledge networks' definitions by exploring structures of nodes as knowledge sources and paths as knowledge relations. For instance, Hansen (2002) employed knowledge network analysis by considering business units and task relations between business units. Recent knowledge networks' definitions include KM technologies within organisations. This approach attempts to show how knowledge contribution is improved by interactions between individuals, between organisational units, and also between businesses (Krätke, 2010). A comprehensive definition of electronically enabled knowledge networks is proposed by Faraj et al. (2008), whom identified knowledge network as self-organizing socio-technical systems designed to share and create knowledge links among participants. Knowledge networks are inherently multi-levelled. This paper considers knowledge networks from the interpersonal level viewpoint (Amine Chatti, 2012), with which participants get opportunities to share knowledge with others.

Knowledge networks are developed using a spectrum of different layers of knowledge exchange channels, including individual knowledge sharing between two participants (e.g., instant messaging), group knowledge sharing (e.g., electronic networks of practice), and organisational knowledge sharing within organisations (e.g., enterprise discussion forums) (Phelps et al., 2012). Indeed, knowledge networks reduce the weaknesses of centralised KM systems (i.e. central repositories) by supporting knowledge sharing through different knowledge exchange channels rather than through static repositories (Faraj et al., 2008). Multi-functional knowledge networks allow participants to select the partners with whom they wish to communicate, as well as the appropriate system.

2.4. Participants' Perceived Benefits and Costs

Many KM studies have investigated influencing factors that affect knowledge sharing (e.g., (Cyr and Wei Choo, 2010, Hung et al., 2011, Sedighi et al., 2015)). KM studies have classified these factors into meso, macro, and micro levels (Sedighi and Zand, 2012). In general, all factors are clustered in a range from technological elements such as information technology to non-technological elements like benefits and individual costs (Wu and Zhu, 2012). This study discusses different participants' perceived benefits and costs that influence participation in knowledge networks.

Several social theories have examined individual perceived benefits and costs to interpret knowledge sharing. Social Cognitive Theory (SCT) discusses a phenomenon that people observe and remember the consequences of their own behaviour before engaging in the same behaviour again (Bandura, 1986). Therefore, favourable behavioural consequences promote people to exhibit the same behaviour repeatedly. Further, social exchange theory examines individual behaviour as a rational social phenomenon based on the subjective cost-benefit analysis (Yan et al., 2016). In the KM context, the participants' behaviour is significantly influenced by the process of comparing perceived benefits with perceived costs of knowledge exchanges (Yan et al., 2016). Individuals' perceived benefits refer to reciprocating knowledge, collective reputation, and enjoyment from helping colleagues, while effort and time can be considered by participants as perceived costs of knowledge sharing (Lin, 2007a, Hung et al., 2011). Few studies have recommended financial rewards for knowledge sharing (Bartol and Srivastava, 2002) and the KM incentives have most often been psychosocial and intangible in nature. This is consistent with the social exchange concept that presupposes that participants engage in a social process such as knowledge sharing if and only if the benefits of the social interaction exceed costs.

2.4.1. Perceived Benefits

Self-Determination Theory (SDT), an important psychological theory about individual motivations, distinguishes two types of individual benefits: intrinsic and extrinsic benefits (Ryan and Deci, 2000). This distinction has been used in the KM literature (e.g., (Kankanhalli et al., 2005)) to classify participants' perceived benefits. Intrinsic motivation is defined as the sharing of knowledge for its inherent satisfaction rather than for tangible and intangible rewards. Altruism and knowledge efficacy have been determined as two main intrinsic motivations for participation. Altruism represents a perception of gratification achieved by helping co-workers in knowledge sharing (Wasko and Faraj, 2005). Besides, knowledge self-efficacy represents participants' confidence in their competency to prepare knowledge for other employees (Bandura, 1994).

Extrinsic motivation includes tangible and intangible rewards for knowledge sharing often regulated by external reward, (Lou et al., 2013). Two main clusters of extrinsic rewards are distinguished in the

literature: external regulation and internalized extrinsic rewards (Deci and Ryan, 2002). Self-cognition, reputation and material rewards have been identified as external regulation in the extrinsic rewards taxonomy (Deci and Ryan, 2002). (Hsu and Lin, 2008). Material rewards include non-monetary rewards such as promotion and job security to compensate knowledge sharing (Lou et al., 2013). Studies have specified that extrinsic motivations affect participants' willingness to voluntarily share knowledge in a knowledge network environment (Hung et al., 2011, Wang et al., 2014a). The SDT positions reciprocity as an internalized extrinsic motivation, because reciprocity is internally determined by users from an environment, but is not a natural intrinsic reward (Lou et al., 2013). It can be observed as a combination of intrinsic motivations and external benefits because it is not intrinsic inherently and is also different from the external regulation. Two kinds of reciprocal behaviours are distinguished for a knowledge network environment: direct reciprocity and generalized reciprocity (Wasko and Faraj, 2005). Direct reciprocity is the expectation of knowledge return between any two participants to maintain a mutual knowledge relation within the knowledge network, whereas generalized reciprocity is participants' expectations to future knowledge return from the whole of the community instead of a specific member (Faraj and Johnson, 2011). This paper proposes a conceptual model of the factors that influence quantity and quality of knowledge sharing for three kinds of perceived benefits: material rewards, reputation, and reciprocity.

2.4.2. Perceived Costs

Prior studies examine perceived costs, like participation's perceived benefits, as critical factors to predict individuals' knowledge sharing (Fan et al., 2014). Adaptive cost theory (Cohen and Lambie, 1978) explains when people attempt to react in a stressful situation, cognitive resources are most often limited. People inherently adapt to their environment; reacting comes at a cost: this cost can be expressed by physical or psychological costs (Cohen, 1980). Time and effort are also defined as psychological costs in the adaptive cost theory, and can be used to examine participants' decisions about sharing their knowledge with others (Connelly et al., 2014, Zhou and Chen, 2011). These perceived costs refer to the concerns of taking time and making efforts to participate in knowledge sharing activities. Participants' mental efforts for participation have been defined as cognitive costs of knowledge sharing, while spending time for participation has been identified by executional costs of knowledge sharing (Yan et al., 2016). Studies in the enterprise social media domain examine both time and effort as the most significant barriers to participate in knowledge sharing (Vuori and Okkonen, 2012). From the social exchange theory, participants do not participate if the cost of sharing knowledge outweighs the potential benefits of knowledge sharing (Bock et al., 2005). Increasing perceived costs of participation reduces the participants' voluntary willingness to share knowledge. Table 1 lists the main perceived benefits and costs reported in the literature.

***** Insert Table 1 here *****

3. Hypotheses & Conceptual Research Model

This section develops a research model and hypotheses to examine how different perceived benefits and costs influence the quantity and the quality of knowledge sharing. Knowledge networks provide an opportunity for participants to interact and form relations in different layers of the knowledge exchange

environment. Different knowledge sharing channels influence participants' perceived benefits and costs (Fulk and Yuan, 2013, Zhang et al., 2013). Knowledge networks differ notably from traditional KM systems. Concrete incentive systems to reinforce employees' participation no longer suffice. Participation evolves through a network between participants in which they freely choose the most appropriate knowledge exchange channels. Under such circumstances, a wide spectrum of extrinsic and intrinsic benefits and costs influencing employees' participation has been suggested. These factors are identified below in Table 2.

***** Insert Table 2 here *****

The research hypotheses are organised in accordance with the perceived benefits and cost depicted above in Table 2. From the extrinsic reward viewpoint, participants' behaviours are influenced by perceived material rewards accruing to the knowledge-sharing individual. Material rewards include a spectrum of monetary and non-monetary incentives. A major line of KM research is not in favour of monetary rewards for knowledge sharing because of the emerging role of knowledge sharing in knowledge networks (Lin, 2007b, Bartol and Srivastava, 2002). Thus, this study considers the non-monetary side of material rewards such as job promotions, job security, employees' travel bonuses, flexible work hours, training, and sabbaticals. Non-monetary material rewards have been reported to improve knowledge sharing performance in organisations (Kankanhalli et al., 2005). Moreover, unlike the value of monetary reward's attractiveness that reduces over the time in the resources-constrained economy, non-monetary rewards are expected to have positive effects on knowledge sharing performance. The following two hypotheses relate to this effect of material rewards benefits on performance:

H1a. Material rewards have a positive effect on the quantity of knowledge sharing in a knowledge network.
H1b. Material rewards have a positive effect on the quality of knowledge sharing in a knowledge network.

Reputation can be defined as a degree to which a participant believes that participation in knowledge sharing will enhance individual recognition (Hsu and Lin, 2008). Participants improve their self-image by sharing valuable knowledge. They enhance recognition in the professional network (Chang and Chuang, 2011). Moreover, reputation systems provide track records of participants' contributions that influence members' participation in knowledge sharing (Lou et al., 2013). Reputation as a result of knowledge sharing is most likely a motivating factor for participants to share knowledge as formulated in the following hypotheses:

H2a. Reputation has a positive effect on the quantity of knowledge sharing in a knowledge network.
H2b. Reputation has a positive effect on the quality of knowledge sharing in a knowledge network.

Reciprocity signifies a situation in which network members participate in knowledge sharing because of the expectation of future returns. Participants' contributions are promoted concurrently from both the direct and the generalised reciprocity in different knowledge exchange channels of knowledge networks (Wasko and Faraj, 2005). Therefore, the following hypotheses are shown for reciprocal benefits:

H3a. Reciprocity has a positive effect on the quantity of knowledge sharing in a knowledge network.
H3b. Reciprocity has a positive effect on the quality of knowledge sharing in a knowledge network.

Prior studies have examined altruism (Hsu and Lin, 2008, Chang and Chuang, 2011, Papadopoulos et al., 2013) and knowledge self-efficacy (Tohidinia and Mosakhani, 2010) as two major factors of intrinsic motivations for knowledge sharing. Altruism relates to discretionary actions that benefit others without expecting anything in return (Chang and Chuang, 2011) or gratification in helping others (Wasko and Faraj, 2005). The hypotheses related to altruism are thus:

H4a. Altruism has a positive effect on the quantity of knowledge sharing in a knowledge network.
H4b. Altruism has a positive effect on the quality of knowledge sharing in a knowledge network.

Self-efficacy or competence can be defined as a participant's own evaluation of their own competence to do something or to act to achieve specific levels of performance (Bandura, 1994). KM researchers have found that participants with high confidence in their own capability to create knowledge are more willing to contribute in knowledge sharing activities (Chen et al., 2012) than those with less confidence, often with high quality knowledge (Bock and Kim, 2002). The hypotheses related to the knowledge self-efficacy depict these findings as:

H5a. Self-efficacy has a positive effect on the quantity of knowledge sharing in a knowledge network.
H5b. Self-efficacy has a positive effect on the quality of knowledge sharing in a knowledge network.

Knowledge networks provide knowledge exchange channels to reduce the cost of sharing knowledge, nevertheless employees need to spend resources (time and effort) in the knowledge sharing process (Chang and Chuang, 2011, Davison et al., 2013). The time and effort needed for knowledge contributions are factors that influence knowledge sharing (Kankanhalli et al., 2005). However, although studies examine the impact of perceived costs in knowledge sharing, there are few empirical studies that investigate how participants' perceived costs effect knowledge sharing in knowledge networks. Thus the following hypotheses are:

H6a. Spending effort for participation has a negative effect on the quantity of knowledge sharing in a knowledge network.
H6b. Spending effort for participation has a negative effect on the quality of knowledge sharing in a knowledge network.
H7a. Spending time for participation has a negative effect on the quantity of knowledge sharing in a knowledge network.
H7b. Spending time for participation has a negative effect on the quality of knowledge sharing in a knowledge network.

A conceptual research framework that represents the factors distinguished above and in the hypotheses is proposed. This framework is illustrated in Figure 1. The quantity and quality aspects of participation in knowledge sharing are represented as the endogenous constructs of the model. Both intrinsic and extrinsic participants' benefits are predicted to have positive influences on the endogenous construct variables in the inner model. Two knowledge sharing costs (time and effort) are expected to have negative effects on the endogenous construct variables.

***** Insert Figure 1 here *****

4. Research Methodology

The proposed conceptual research model is evaluated using partial least squares structural equation modelling (SEM-PLS), a contemporary second generation multivariate technique for exploring causal models. The SEM-PLS method is selected because the research model extends the existing KM literature with integrating different theories (Hair et al., 2011). The SEM-PLS examines relationships by evaluating measurement and structural models. A measurement model is evaluated using confirmatory factor analysis (CFA) to check the validity and reliability of the model. A structural model is examined by evaluating the strength of relationships between model constructs using the partial least square method. The SEM-PLS technique has been widely used in recent years in the business disciplines such as management information system, strategic management and marketing (Hair Jr et al., 2014).

4.1. Research Setting

The data is collected from employees working at a corporate group of car industry companies in a resources-constrained economy. The corporate group produces different classes of cars in a resource-constrained economy, i.e. economies characterized by inefficiently working technological, legal and governance systems as can be found in many developing countries. The inefficiency increase transaction costs of the company in their production and business processes. As discussed in the research hypotheses section, material rewards play an important role to stimulate individuals' behaviours in the resource-constrained economy.

The company has an electronic knowledge network between employees, in which they have the opportunity to share their knowledge in individual, group and organisation layers. The knowledge sharing software is supported by a distributed information technology infrastructure. Employees can send their knowledge to other people with who they work in different places with synchronous and asynchronous knowledge exchange channels. Participation through the network is not invisible, so participants' knowledge contribution can be observed by third parties regarding to the knowledge exchange channels. A questionnaire is distributed to 4 clusters of respondents: managers, supervisors, experts and technicians. They use the knowledge network on a regular basis. As all participants of the organisation who have opportunities to contribute to the knowledge network are included in this study, there is no sampling bias.

Authors as independent researchers collected data through a questionnaire. The results are analysed to assess the validity of the hypotheses, and the strengths of relations between the factors visualised in the conceptual model (Figure 1). Different communication levels for knowledge sharing are available to all participants. Since multi-layered communication channels make possibilities to choose the most appropriate knowledge exchange channel for knowledge sharing at any one point in time, the questionnaire is designed regarding to the knowledge exchange channels. Questions relate to three different levels of knowledge exchange (individual, group and organisation) to determine participants' perceptions about perceived benefits and costs. Furthermore, participants are asked to assess both the quality and quantity of knowledge sharing. To measure the quantity of knowledge sharing a five-point scale is used with 5 = daily, 4 = several times per week, 3 = several times per month, 2 = more than one per quarter, 1 = less than once per quarter. The quality of knowledge sharing is evaluated by the helpfulness of the related knowledge contribution (Wasko and Faraj, 2005). The quality of knowledge sharing is evaluated by five-point Likert method by experts in the company to assess how often a participant receives helpful knowledge in different levels. Likewise, other independent variables are

assessed by the five-point Likert scale. The questionnaire is designed using an online survey tool (collector - Survalyzer[1]), was launched on June 15, 2014 during one month. The questionnaire items of the study are designed by factors distinguished in Appendix 1. The questionnaire link sent via email to all network members (approximately 1,700), which 385 participants responded to the survey.

4.2. Evaluation methodology

The research model relationships are tested with the partial least squares (PLS) methodology in the structural equation modelling (SEM). Specifically, the R-code "*plspm*" (version 0.4.2) package (Sanchez et al., 2015) is used to explore the statistical model. PLS is a multivariate analytic technique that supports path analytic modelling with endogenous variables. PLS is a component-based estimation procedure that applies two-stage estimation algorithms (Tenenhaus et al., 2005). In the first step, the measurement model structure (outer model estimation) is evaluated. The second step entails the assessment of the structural model (inner model estimation). Furthermore, the ability of PLS model prediction is assessed by both the coefficient of determination (R^2) and the cross-validated redundancy (Q^2). The minimum sample size needed for a SEM-PLS model is estimated by the 'rule of thumb' of ten times the largest number of inner model connections in a specific construct (Barclay et al., 1995). Thus the minimum sample size of the conceptual research model would be 140 cases. The sample size of 283 respondents is above the recommended threshold of SEM-PLS sample size.

5. Results of Data Analysis

The results of the data analysis are discussed below. First, results of sample characteristic and common bias test outcome are elaborated. The second section represents measurement model results. The third section illustrates structural model and overall research model results.

1.1. Sample Characteristics and Common Method Bias

Out of the 385 respondents 283 respondents submitted complete questionnaires. Table 3 summarizes the characteristics of the respondents.

***** Insert Table 3 here *****

As illustrated in Table 3, while 7.1% of the respondents have less than 8 years work experience, 70.7% have been in the car industry between 9 and 16 years. Some 22.2% respondents have had work experience for more than 17 years and are considered to be senior, while some 7% have had working experience of less than 9 years (juniors). As the identifying enablers and barriers of participation through KM systems depend strongly on the context of industry, the respondents are considered to be competent to create reliable judgments regarding their work experiences.

The Harman's one-factor test is used to test the presence of common method bias on self-reported surveys (Sharma et al., 2009). The common method bias is identified as a potential risk for internal validity of self-reported surveys. The test result does not confirm a unique factor for the majority of variances in all questionnaire items. Thus, the common method bias may not be a serious risk for the survey. Besides,

[1] *http://www.survalyzer.com/en/*

nonresponse bias also is identified as a potential risk of surveys' validity. To address this threat, the demographic information of non-respondents, collected by the Human Resource Department of the company, is used to explore potential bias in the data set. A Chi-square test shows that there is no significant difference between response and non-response employees for: gender ($p = 0.337$), age ($p = 0.413$), position ($p = 0.566$) and work experience ($p = 0.621$). Furthermore, the difference between late-respondents and early-respondents has been evaluated by the MANOVA test to compare cases in the first 15% and last 15% of respondents. The difference between two groups is not significant.

5.1. Measurement Model Results

Confirmatory factor analysis is used to assess the reliability and construct validity, including both convergent and discriminate validity. Reliability of the model tests the consistency of measurement, which is examined by composite reliability. As shown in Table 4, the composite reliability values for each lead variable exceed the minimum acceptance reliability. Convergent validity is tested to identify the degree to which several attempts to compute a same item are in agreement. Convergent validity is verified using average variance extracted (AVE) values. Table 4 presents all AVE values that exceed the recommended 0.5 threshold (Chin, 1998) for which the model's constructs explains more than fifty percent of the indicator's variance. Table 4 also represents the latent factor loadings of the measurement items. The factor loading for all items exceeds the recommended level of 0.6 (Chin et al., 1997).

***** Insert Table 4 here *****

The discriminant validity compares the constructs' shared variances of the model's indicators with other models' constructs (Hair Jr et al., 2014). Therefore, to test this validity, the squared AVE of each leading variable compares with correlation shared between any other exogenous variable. As shown in Table 5, the measurement model has sufficient discriminant validity, as the correlations shared between leading variables are less than the squared AVEs.

***** Insert Table 5 here *****

5.2. Structural Model and Overall Model Results

The outcomes of the structural equation model analysis are presented in Figure 2. In the first step, the inner model is evaluated by assessing its ability to forecast the endogenous constructs (the quantity and the quality of knowledge sharing). The coefficient of determination (R^2) and cross-validated redundancy (Q^2) are used to evaluate inner models (Hair Jr et al., 2014). R^2 is a criterion that identifies the variance explained with each endogenous construct (the factors) to assess a PLS-SEM model's predictive accuracy. The R^2 value of 0.463 for knowledge sharing quantity and 0.525 for quality of knowledge sharing specify that the structural model explain a reasonable proportion of the variances. Hence, the structural model demonstrates a fairly good fit with the data collected. Moreover, blindfolding procedure (Q^2) is calculated to assess the model's predictive relevance for each of the endogenous constructs. Non-zero cross-validated redundancy values (Q^2) indicate that the model's predictive accuracy is acceptable for particular

endogenous constructs (Sarstedt et al., 2014). The blindfolding technique shows both endogenous constructs are well above zero (quantity of knowledge sharing 0.328, quality of knowledge sharing 0.401) which supports the model's predictive relevance.

***** Insert Figure 2 here *****

In the second step, the overall SEM results are calculated by testing the hypothesized relations between the variables. Figure 2 represents significant and non-significant relationships between variables. The results show that material rewards have no direct influence on the quantity of knowledge sharing (β = 0.045, $p > 0.05$) and also have no impact on the quality of knowledge sharing (β = -0.06, $p > 0.05$), both hypotheses H1a and H1b are not supported. Although, reputation has a significant impact on the quantity of knowledge sharing (β = 0.206, $p < 0.01$) and supports H2a, there is insufficient evidence to support H2b (β = -0.007, $p > 0.05$). Reciprocity in knowledge sharing has significant relations to the quantity and quality of knowledge sharing (β = 0.129, $p < 0.05$; β = 0.189, $p < 0.01$), hence H3a and H3b are supported. Furthermore, altruism as an important item of intrinsic rewards has positive effects on the quantity and the quality of knowledge sharing (β = 0.396, $p < 0.01$; β = 0.101, $p < 0.05$), therefore H4a and H4b are supported. Knowledge self-efficacy has no significant relation with the quantity of knowledge sharing (β = 0.043, $p > 0.05$) and doesn't support H5a, however, this item has a positive relation with the quality of knowledge (β = 0.303, $p < 0.01$), thus H5b is supported. Besides, significant negative impacts of efforts and time on the both aspects of participation (β = -0.122, $p < 0.05$; β = -0.167, $p < 0.01$; β = -0.101, $p < 0.05$; β = -0.209, $p < 0.01$) provide supports for hypotheses H7a, H7b, H8a and H8b.

6. Discussion

The analysed data verifies the relations of the research model in which perceived benefits and perceived costs influence participation in knowledge sharing. Although, the beta indexes are not very strong, the R squares represent the model can interpret acceptable proportion of variances. Contrary to our expectations regarding to the resource-constrained economy with a high inflation rate, material (non-monetary) rewards are not shown to have a significant effect on the quantity and quality of participation in knowledge sharing. This finding is somewhat surprising for a company, which is functioning, in the resource-constrained economy. This finding is consistent with Lin (2007b) study, which found employees do not appreciate material rewards, as much as other incentives such as reciprocity. Moreover, this finding is consistent with the results of Osterloh and Frey (2000) which show that intrinsic motivations are more effective for organisational activities than external motivations. In addition, Vuori and Okkonen (2012) have reported that material rewards are shown to have the least priority from an employees' viewpoint. This argument is also consistent with Bock and Kim's (2002) findings in which material rewards are shown to play a temporary role, but do not have a lasting impacts on attitudes regarding knowledge sharing.

Perceived enhancement of one's reputation has a significant positive effect on the quantity of knowledge sharing. This finding suggests that participants are more likely to engage in knowledge sharing with the aim of building their professional reputation. The results are similar to the findings of Wu and Zhu (2012)

and Hsu and Lin (2008) which found that one's professional reputation has a significantly strong effect on workers' attitudes towards sharing knowledge. Wasko and Faraj (2005) also found that individual's professional reputation is a significant factor for individual knowledge sharing in electronic knowledge networks. According Hew and Hara (2007), participants in online environments share their knowledge in order to make themselves more visible and receive recognition through online networks. Nevertheless, the insignificant link between reputational incentives and knowledge sharing quality also illuminates the limitations of recognition benefits.

The statistical results show that reciprocity benefits play a vital role in both the quantity and the quality of knowledge sharing. Consistent with the social exchange theory, reciprocal benefits have a significant effect on the knowledge sharing. The significant effects of reciprocity on participation signify participants' engagement in knowledge sharing significantly depends on expectations to receive help in the future. These findings are consistent with the results of Chang and Chuang (2011) study, which found a significant impact of the reciprocal expectation of participation on the quality and the quantity of knowledge sharing in virtual communities. In addition, Bock et al. (2005) show that participants' attitudes towards knowledge sharing are driven primarily by expectations of reciprocal knowledge exchange.

The results are consistent with prior research, which shows that altruism significantly influences both the quantity and the quality of knowledge sharing. A number of studies testify to the importance of altruism and the enjoyment of helping others among the most positive incentives that support the quantity and quality of knowledge sharing (Kankanhalli et al., 2005, Wasko and Faraj, 2005, Chang and Chuang, 2011, Wu and Zhu, 2012, Lou et al., 2013). One reason for the high impact of altruism is that knowledge sharing behaviour is similar to organisational citizenship behaviour (Wu and Zhu, 2012).

The statistical outcomes show a positive effect of knowledge self-efficacy on the quality of knowledge sharing; however, there is an insignificant relationship between knowledge self-efficacy and the quantity of knowledge sharing. Participants are benefited from confidence in their own ability to create a good quality knowledge object that is valuable. This outcome is in line with the Lin's (2007b) findings that self-efficacy is a significant antecedent to participants' knowledge sharing attitudes and knowledge sharing intentions. Yet, the insignificant relationship between knowledge self-efficacy and the quantity of knowledge sharing clarifies the limitation of this perceived benefit to improve the quantity of knowledge contribution.

The results show the negative and significant relations between effort and time with the quantity and the quality of knowledge sharing. Although, several studies have emphasized relationships between the knowledge sharing costs and knowledge contributions (Davenport and Probst, 2002, Chiu et al., 2006), the impact of knowledge sharing costs on the knowledge sharing performance in knowledge networks has not been measured statistically. These results examine the perceived costs of knowledge sharing significantly diminish knowledge sharing performance. In fact, effort and time consuming to share knowledge with colleagues has a significant negative effect on the quality and the quantity of knowledge sharing. These results are consistent with Connelly et al. (2014) study, which found individuals who perceived time pressure have low levels propensity to share their knowledge with others. Moreover, Vuori and Okkonen (2012) examined both time and effort of participations in knowledge sharing as most significant employees' barrier in enterprise social media platforms.

7. Conclusions

This paper combines several theories and studies from different streams of research such as social psychology and knowledge management in order to understand the paradox between benefits and costs in knowledge networks, in the resource-constrained economy. This paper addresses a significant gap in past research to investigate both the quality and the quantity of knowledge sharing by using an exhaustive set of knowledge sharing influencing factors in knowledge networks. The outcomes of 282 respondents provide practical supports for most of the relations of the conceptual research model. Results demonstrate that reputation, reciprocity and altruism stand out as significant perceived benefits for the quantity of participation, while reciprocity, altruism, trust and knowledge self-efficacy have significant impacts on the quality of participation in knowledge networks. Both effort and time, two aspects of KM costs, have significant negative impacts on both the quantity and the quality of participation in knowledge networks. The results also show that predictors explain 46 percent of the variance in the quantity of participation and 52 percent of the variance in the quality of participation. These findings not only improve the previous studies of knowledge networks, but also prepare a meaningful message to knowledge network designers. They can design networks to better promote participation with a better recognition of the strength of influencing factors and design effective tools to enrich specific aspects of participation aligned with their critical knowledge area. This improvement supports organisations to keep their competitive advantages and efficiently prepare products or services for customers. It can help to improve industry sector's performances and the quality of life of a society.

7.1. Theoretical and Managerial Implications

This study contributes to scientific understanding by integrating individual benefits and individual costs with quantity and quality of knowledge sharing in the resource-constrained economy. These factors influence participants in knowledge networks from the interpersonal viewpoint. This study adopts a self-reported questionnaire using measurement items from prior studies. In addition, the research outcome extends understanding of knowledge sharing in knowledge networks by using both quantity and quality aspects of participation.

The findings improve the general understanding of the complex relationship of users' perceived benefits that stimulate participation and users' perceived costs that disrupt participation in knowledge networks. This study uses a new approach to study costs and coincident benefits by measuring their influences on both quantity and quality aspects of participation. Furthermore, prior research classifies influencing factors, whiles this paper goes beyond conceptualizing and identifying perceived benefits and costs in the different levels of knowledge networks.

This study suggests several valuable practical implications for KM designers to foster sustainable knowledge sharing by promoting participation in knowledge networks. Knowledge network designers can promote the quantity of participation by using both intrinsic and extrinsic incentives in different levels of knowledge exchange channels. For instance, Chang and Chuang (2011) suggest organisations can develop recognition systems in visible communication channels to explore users' participation. Transparent environments influence employees' participation levels to nudge participants to share more knowledge because of both reputation and reciprocity. Furthermore, direct reciprocity as well as generalized reciprocity influences the quality of participation through knowledge networks. Therefore, adapting private communication channels (individual level knowledge sharing) as well as public communication channels improves the quality aspect of knowledge contribution.

The second practical implication is that because intrinsic perceived benefits have been shown to be a significant facilitator of both quantity and quality of participation, knowledge network developers should promote gratification in intrinsic incentives as one of the important parts of their organisational culture in resource-constrained economies. Therefore, to ensure quality of participation, knowledge network designers should contemplate how to encourage and satisfy enjoy helping and knowledge self-efficacy.

The statistical outcomes imply that participants are concerned about the knowledge sharing costs in knowledge networks. Both time and effort negatively influence quantity and quality of employees' participation. Indeed, experts need to spend time and energy to prepare knowledge for knowledge recipients because professional experiences are more abstract and need to re-conceptualize in a concrete way for participants (Fulk and Yuan, 2013). Designing informal communities in knowledge networks instead of formal environments, which need to spend cost for codifying formal knowledge, reduce knowledge codification times.

7.2. Limitations and Future Research

The study on which this paper reports has several limitations, which can suggest new opportunities for future research. First, the research scope is restricted to the energy sector, which decreases the generalizability of the research outcome in the resource-constrained environment. Further research is important to test the model in other industries to understand the differences between industrial sectors in the resource-constrained economy.

Second, the study uses a self-reported questionnaire for both independent and dependent constructs. Thus the study does not measure systematic criteria, such as the amount of shared knowledge or systematic quality ranking, to calculate the participants' contributions. Future research should employ systematic criteria to triangulate these findings. Using KM systems' datasets assist future research by using real performance statistics to measure knowledge contributions.

This research uses different levels of knowledge sharing channels to construct the endogenous factors in the outer model. Therefore, effects of knowledge sharing channels on the perceived benefits, costs and participation are not explored directly in the inner model. Future research can discover effects of communications' channels properties on users' participation as one of the main technical features of knowledge networks.

Finally, this research concentrates on the relationships of ten factors that influence individual knowledge sharing. These factors may also influence each other. Future research should survey the interdependency between factors that influence knowledge sharing performance. Moreover, future research should examine changes in motivations and technology usage over time and the impacts of those changes on participation.

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Appendix 1: Measured Items

***** Insert Table 6 here *****

Category	Items	Source
Perceived benefits	Material rewards	(Benbya, 2015, Kankanhalli et al., 2005)
	Reputation	(Lin, 2007b, Chang and Chuang, 2011, Lou et al., 2013)
	Reciprocity	(Wasko and Faraj, 2005, Bock et al., 2005, Lou et al., 2013)
	Altruism	(Wasko and Faraj, 2005, Hsu and Lin, 2008, Papadopoulos et al., 2013)
Perceived costs	Effort	(Kankanhalli et al., 2005, Chang and Chuang, 2011)
	Time	(Kankanhalli et al., 2005, Chang and Chuang, 2011)

Table 1- Perceived benefits and costs items

Perceived benefits and costs	Definitions	Sources
Material rewards	Participants' perception of the value of material rewards (non-monetary) through participation in a knowledge network	(Kankanhalli et al., 2005, He and Wei, 2009)
Reputation	Participants' perception of the value of enhancing respect or earning prestige through participation in a knowledge network	(Kankanhalli et al., 2005, He and Wei, 2009)
Reciprocity	Participants' perception of the value of receiving knowledge in return in a knowledge network	(Wasko and Faraj, 2005, Chang and Chuang, 2011)
Altruism	Participants' perception of the value of gratification in helping other users by sharing knowledge	(Kankanhalli et al., 2005, Lou et al., 2013)
Self-efficacy	Participants' judgement of the value of his/her competency to provide/share knowledge to others users	(Kankanhalli et al., 2005, Lou et al., 2013)
Effort	Participants' perception of the value of the effort that needs to be made to participate in a knowledge network	(Chiu et al., 2006)
Time	Participants' perception of the value of the amount of time needed to participate in a knowledge network	(Chiu et al., 2006)

Table 2- Definitions of perceived benefits and costs

Characteristics	Values	Frequency	Percentage %	Characteristics	Values	Frequency
Gender	Male	225	79.5	Position level	Managers	13
	Female	58	20.5		Supervisors	83
Age	18-28	45	15.9		Experts	158
	29-35	121	42.7		Technicians	29
	36-42	75	26.6	Work Experience	1-Aug	20
	>42	42	14.8		Sep-16	200
					>17	63

Table 3- Demographics of respondents (N= 283)

Percentage %
4.6
29.3
55.8
10.2
7.1
70.7
22.2

Latent Items	Manifest Items	Factor Loading	Composite Reliability	Average variance extracted (AVE)
Altruism	Individual	0.808**	0.827	0.745
	Group	0.906**		
	Organization	0.872**		
Self-efficacy	Individual	0.809**	0.765	0.673
	Group	0.906**		
	Organization	0.872**		
Reciprocity	Individual	0.754**	0.765	0.601
	Group	0.798**		
	Organization	0.765**		
Reputation	Individual	0.802**	0.786	0.702
	Group	0.887**		
	Organization	0.822**		
Material rewards	Individual	0.917**	0.890	0.819
	Group	0.910**		
	Organization	0.886**		
Effort	Individual	0.906**	0.851	0.771
	Group	0.862**		
	Organization	0.867**		
Time	Individual	0.775**	0.832	0.747
	Group	0.893**		
	Organization	0.918**		
Quantity	Individual	0.843**	0.798	0.708
	Group	0.892**		
	Organization	0.787**		
Quality	Individual	0.896**	0.844	0.764
	Group	0.899**		
	Organization	0.825**		

Table 4- Item relevant statistics (* p <0.05, ** p<0.01)

Construct	Mean	S.D	Alt	Self	Rec	Rep
Alt	3,745	0.894	**0.863**			
Self	3,564	0.981	0.302	**0.820**		
Rec	3,389	0.969	0.461	0.447	**0.775**	
Rep	2,942	1,105	0.306	0.267	0.358	**0.837**
Mat	2,187	0.987	0.164	0.045	0.006	0.057
Eff	2,993	1,239	-0.366	-0.288	-0.395	-0.142
Tim	2,419	1,085	-0.403	-0.305	-0.345	-0.124
Qun	3,299	1,125	0.601	0.190	0.454	0.387
Qul	3,692	0.871	0.451	0.524	0.521	0.229

Note1: the bold diagonal elements are the square root of the AVE values

Note2: Alt=Altruism, Self=Self-efficacy, Rec=Reciprocity, Rep=Reputation, Mat=Material rewards, Eff=Effort, Tim=Time, Qul=Quality of knowledge sharing, Qun=Quantity of knowledge sharing

Table 5- AVE and correlation between constructs

Mat	Eff	Tim	Qun	Qul
0.904				
-0.175	**0.878**			
-0.275	0.575	**0.864**		
0.153	-0.407	-0.402	**0.841**	
0.179	-0.510	-0.537	0.457	**0.874**

Construct	Item wording and code	Source
Reciprocity	I share my knowledge with another employee, because she/he will share knowledge if I need it.	(Wasko and Faraj, 2005)
	I share my knowledge with a community, because they will share knowledge if I need it.	
	I share my knowledge with the whole of my organization (intranet), because employees will share knowledge if I need it.	
Altruism	I share my knowledge with another employee, because I enjoy helping another employee by sharing knowledge	(Kankanhalli et al., 2005, Yu and Chu, 2007)
	I share my knowledge with a community of employees, because I enjoy helping community members by sharing knowledge	
	I share my knowledge with the whole of my organization, because I enjoy helping others by sharing knowledge	
Knowledge Self-efficacy	I share my knowledge with another employee, because I have confidence about my ability and experience to share knowledge	(Kankanhalli et al., 2005)
	I share my knowledge with a community of employees, because I have confidence about my ability and experience to share knowledge	
	I share my knowledge with the whole of my organization, because I have confidence about my ability and experience to share knowledge	
Reputation	I share my knowledge with another employee, because I can enhance my reputation in my professional field.	(Wasko and Faraj, 2005)
	I share my knowledge with a community, because I can enhance my reputation in my professional field.	
	I share my knowledge with whole of organization, because I can enhance my reputation in my professional field.	
Material rewards (Non-monetary rewards)	I share my knowledge with another employee, because I receive material rewards (Material rewards is non-monetary rewards, development career, job security, employee travel package, flexible work hours, training, and sabbaticals)	(Lin, 2007b, Wu and Zhu, 2012)
	I share my knowledge with a community, because I receive material rewards.	
	I share my knowledge with the whole of my organization, because I receive material rewards.	
Monetary rewards	I share my knowledge with another employee, because I receive monetary rewards	(Lin, 2007b)
	I share my knowledge with a community, because I receive material rewards.	
	I share my knowledge with the whole of my organization, because I receive material rewards	
	I don't share my knowledge with another employee, because I should takes too much time for sharing knowledge (I have no enough time)	Developed

Time	I don't share my knowledge with a community, because I should takes too much time for sharing knowledge (I have no enough time)	based on (Vuori and Okkonen, 2012)
	I don't share my knowledge with the whole of my organization, because I should takes too much time for sharing knowledge (I have no enough time)	
Effort	I don't share my knowledge with another employee, because I should takes too much effort for sharing knowledge	Developed based on (Vuori and Okkonen, 2012)
	I don't share my knowledge with a community, because I should takes too much effort for sharing knowledge	
	I don't share my knowledge with the whole of my organization, because I should takes too much effort for sharing knowledge	
Quantity of participation	How many times do you share knowledge in the individual layer?	Developed based on (Wasko and Faraj, 2005, Chiu et al., 2006)
	How many times do you share knowledge in the group layer?	
	How many times do you share knowledge in the organization layer?	
Quality of participation	I think knowledge I contributed help my colleagues to solve their problems in the individual layer?	(Wasko and Faraj, 2005)
	I think knowledge I contributed help my colleagues to solve their problems in the group layer?	
	I think knowledge I contributed help my colleagues to solve their problems in the organization layer?	

Table 6 – Measured items

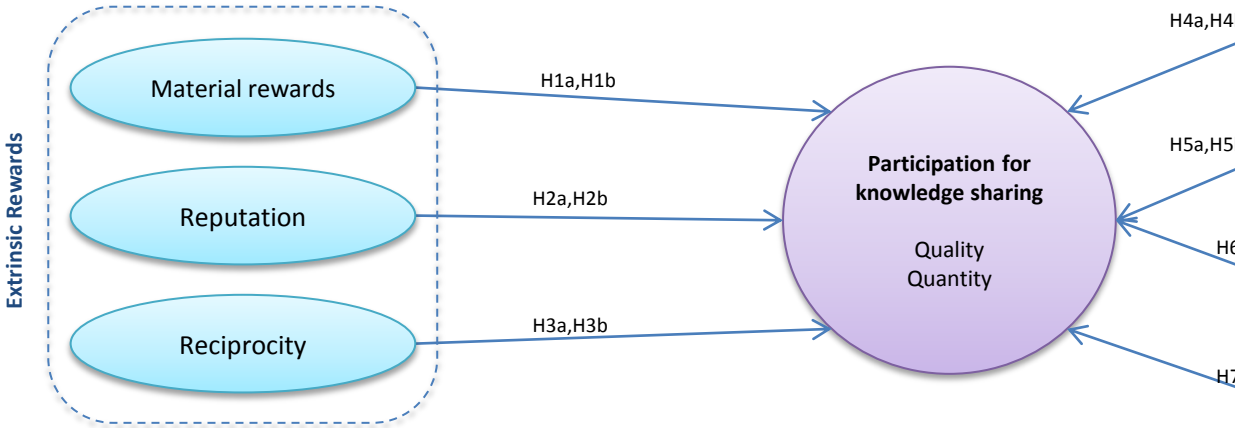

Figure 1- Conceptual Research mod

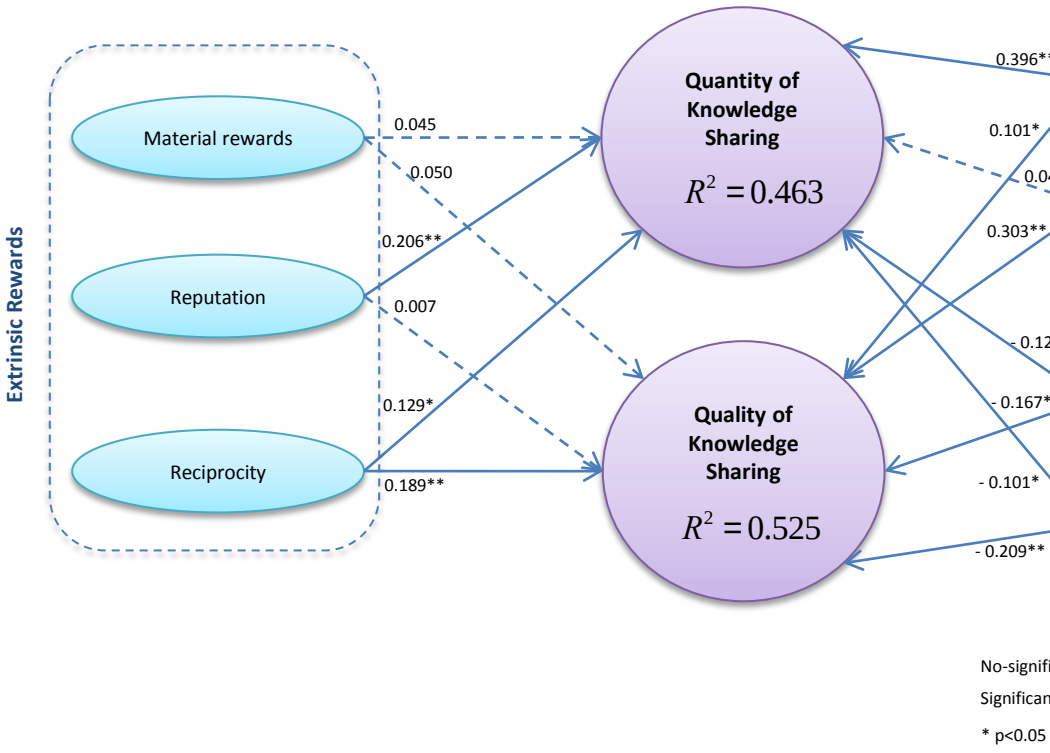

Figure 2- Results of SEM-PLS analy