

IT Operations and Firm Performance

Ali Totonchyfardmotlagh
School of Management, Huazhong University of Science and Technology
Wuhan, Hubei 430074, P.R.China

Abstract

This article emphasises the competencies in IT market, and how IT affects the Performance of Firms. We have tested our hypotheses within the structural modeling technique, using data collected from international firms focusing on Chinese manufacturing firms. We conclude with discussion of the results and their implications, accordingly, develop and test hypotheses representing: a) IT operation is positively associated information sharing b) Information sharing is positively associated firm performance. c) (IT) Operation is positively associated firm performance .d) the relationship between information sharing and IT operation is moderated by a human capital human .The results represent a complexity of the relationships between IT operation tasks, information sharing capability, human capital role, and firm performance. This study provides additional Insights that some firms may not be realizing benefits from investing in IT, even with allocating time and money on the human capital if this human capital study is not related to the information technology based context. Firms which allocate money on IT they can have a good ROA if also consider the information sharing factor. The paper proceeds as follows. The first section is about Introduction. Next three sections are Literature Review, Theoretical background and Research methodology respectively. Part five; we will present our analysis of Firm Performance and IT Operation. Finally, Section six concludes.

Keywords: ROA, IT Operations, Information sharing, Firm performance and Human capital

1. Introduction & Literature Review

The digital economy is enacted by the continuous demand and investment by organizations for innovation in information, communication, and Internet technologies. With the help of Information Technology (IT) we can save time, do a more efficient management and improve information, as it facilitates access to critical knowledge (Phiri, 1999). providing information from clients and institutions ensure safer business ,trade and will challenge the weak organizations (Barney, Wright, and Ketchen, 2001).

To boast one firm productivity; organizations need to train their employee's talent and abilities. Most of the firms just invest on IT operation and just focus on new skills by their workforce without caring about other important factors such as the way they should transfer the knowledge, human capitals and organization learning. Improved training programs help employees to be familiar with the new technological advancement (Robert, 2006) A number of studies identify the importance of information in one company which lead us here to see the function of human capital in this competitive process. Using information and human capital in a right way will boast the company productivity (Sampler, 1998). There is no doubt that many companies begin to implement methods to focus on information technology (IT) (Bharadwaj, 2000).(Mata et al., 1995).(Nault and Dexter, 1995).(Powell and Dent-Micallef, 1997).However, although number of companies put much investments on IT, there is no useful solution provided for the IT problems (Bemdt and Morrison, 1995).(Bemdt et al., 1992). According to (lucas, 1991),(Krcmar and Lucas, 1991)with regard to the IT investments, some companies gain profits but others cannot make profits. Human capital is the major parts of modern economy and modern society. It also has a significant role in the growth strategy; information on market and economy, mainly in the international market. Human capitals concerned with education, training, and other professional initiatives contribute to the employees' satisfaction and good performance of the employees, and finally promoting the development of economy. IT is an important part of the core competitiveness and other elements concerned with the corporate competence should be identified (Tippins and Sohi, 2003). People believe companies which do well in acquiring, creating, retaining, deploying and using knowledge in modern society will make a good performance.

2. Performance and IT Operation

Corporate performance is a reflection of the corporate competitiveness in the fierce market. Business refers to the organization or system that goods and services are exchanged for money. Every business requires some form of investment and customers to make profit. Manufacturing performance can be divided into the following parts: processing shift rate, times of production cycle, corporate costs, and customer satisfaction. Process efficiency is firmly concerned with the efficiency and performance of the firm (Lo'pez et al., 2005). Competence is a term has been employed by the scholars. For instance, Boyatzis (1982)(Boyatzis, 1982) claimed that job competency include factors such as employees' motive, traits, skills, social role, and knowledge which are required by the job. Sparrow (1997)(Sparrow and Hiltrop, 1997)introduces the differences between a performer who does well and a

company who does in a common way. Athey and Orth (1999), on the other hand, argued that work competency is firmly linked with observable performance factors, including working skills, working attitudes, and behaviors, team spirit, partnership and organizational capabilities. Regarding with the study by Jackson and Schuler (2003), competencies are “competence, skills, knowledge and other factors make the corporate work smoothly.” It can be concluded that corporate performance and corporate competitiveness are of great importance in these studies. However, studies on organizations and jobs concerned with competitive advantage and corporate performance are limited. Although, there is an empirical study (Wickramasinghe, 2009), (Bali et al., 2009) aiming to point out competencies of a variety of managerial functions, more studies need to be conducted to finish the paper.

Researchers, while trying to identify skills of different administrative roles, focused on future competencies for the job across functions. As for labor capitals, educational background is the element to be explored mostly (Davidsson and Honig, 2003; Brush and Manolova, 2004; Ucbasaran et al., 2008) ...due to the benefits for individuals (Becker, 1993). In addition, labor capitals are thought to be the key components affecting corporate competitive capacities (Alexei V. Bolshov, 2014). In the field of management, performance is a compulsory subject, which is paramount for researchers and managements of enterprises. However, there is rare agreement on its first definition, in spite of the increase of researches on this topic. As a result, the components, such as operational performance, corporate effectiveness and financial performance need to be explored in the scope of performance (Venkatrman & Ramanujam, 1986). In a traditional sense, corporate performance is generally considered as finance performance. Therefore, the overall performance of enterprise is significantly influenced by human capital, service, budget, asset, operation, product, and market (Dixon, 1999; Thurbin, 1994). Similarly, the financial advantage of enterprises is usually correlated with the success of enterprises (Thurbin, 1994). Nonetheless, the concept of performance has a variety of definitions. As for corporate learning, it needs to have a detailed exploration of the performances correlated with it.

There are a variety of systems for the measurement of performances. It needs to demonstrate the way of operation for enterprises, the achievements achieved, and the development made in realizing objectives, which are critical in dealing with corporate changes (Yeo, 2003). As a result, qualitative method is used for the investigation of purposes for making decisions and taking actions (Thurbin, 1994). It is pointed out by (Darroch 2005) that comparison and the measures of internally reflective performance are appropriate, such as “compared with the average figures, we achieve excellent development”, or “we have more profits compared with the conditions three years before”. It can be seen that financial measures and non-financial measures are used in the measurement of performances, such as sale growth and market share. Like other corporate resources, with the improvement of capability, effective knowledge management is beneficial for the achievement of corporate performances (Andrew, 2001). In the meantime, if enterprises improve their ability in knowledge management, customer requirements can be better met with the development of marketing offerings (Hunt, 2000). In addition, with the improvement of ability in knowledge management, enterprises can be more effective and efficient in the application of knowledge, thus bringing excellent performances.

3. Theoretical Background

3.1 IT operation is positively associated information sharing.

IT can deal with an enormous amount of information and knowledge, allowing the process of detailed tracking of task inputs, outputs, and status (Davenport and Short, 1990). It can be used as a tool for communication for individuals all over the world. Further, IT links closely knowledge which can be used by allowing multiple tasks with a number of individuals interact behind the computer (Dewett and Jones, 2001). Hence, IT, with the aids of interaction, information sharing and skills acquired, one can contribute to the development of work efficiency (Carbonara, 2005), resulting in abundant information exchange about task progress, issues relevant to the task. Besides that, some works need to be done with the IT (Moye and Langfred, 2004). It is mutual for the use of Inter-organizational between first-time partners under the given context. Everyone in the process learn from others. With a combination of acquired knowledge and expertise, each partner reinforces its market competitiveness (O'Connor, 2014). (Lucey et al., 2014) This process can amplify the company efforts, contributing to the expansion of market share.

3.2 Information sharing is positively associated with firm performance.

The exchange of knowledge is of great importance for a corporate, which links disparate knowledge sources with other factors, turning it into a driving force for corporate performance.

Employees develop partnership and commitment to the firm in the process of mutual interactions (Yinghong (Susan), 2012). (Wei et al., 2012). There are a number of activities concerned with information sharing, including employees training, development systems, and projects on IT. These projects combine knowledge with the practice through enhancing the goods and services' quality. It also meets the customer needs, strengthening innovation capability, and finally, increasing corporate performance (Wang and Wang, 2012).

3.3 IT operation is positively associated firm performance.

The 'benefits resulting from an innovative application of information technology can be originated from competitors do not fully benefit from imitation.' Support for our claim that intervening factors partially mediate the relationship between IT competency and firm performance stems have the range of profits realized by different companies IT that positively will impact critical outcome measures (e.g., profitability, ROA). Moreover, experienced negative returns from investing in IT—the implication being the answer to enhanced performance, By constant leverage the organizational learning, firms are in a position and investing in IT may lead to the high productivity accordingly. Human capital and information sharing play the significant role on firm performance. IT enables knowledge capabilities (Joshi et al., 2010). Given the increasing importance of information in today's global marketplace (Glazer, 1991), achieving competence with taking the related unique tool NEC icer Ry for technology competency are thought to be in a superior form tp have a strong market leadership (Itami, 1987).

3.4 The relationship between IT operations, information sharing, moderated by human capital.

Techniques or skills, refers to activities that have a specific purpose. They can be skills and techniques which can be used to complete a focal task (Granstrand, 1982). Employees are expected to promote the corporate performance when they know more about the information on corporate innovation and performance. When it comes to tacit knowledge, it refers to the specific activity and under the influence of the actor. In addition, it is difficult to be changed and modified (Peet, 2012). When it comes to the 'creation and innovation through science and technology', tacit KS plays an important role by way of the communication through individuals, groups, and units. In this way, it contributes to the spreading of 'it is important to know more about the employees skills, and information on organization (Nonaka and Takeuchi, 1995; Nonaka and von Krogh, 2009). (Nonaka and Takeuchi, 1995). (Nonaka and Von Krogh, 2009). When firms have abundant market information-sharing systems, they encourage employee's communications in and cross the department. They can share knowledge concerned with organizational movement, which enables employees to develop an enhanced understanding of changes in their customers. They can also solve the problems challenging them efficiently (Lau and Woodman, 1995). (Lau and Woodman, 1995).

Relational capital, employees are encouraged to use the interaction tools within the network, creating measures to contribute the performance of the partners. Firms can be more innovative through the use and introduction of a combination of IT and human capital. Hence, a corporate benefits from stability and credibility from the human capital, enjoying more information of market-sharing activities within the organization (Yinghong (Susan) Wei, Hugh O'Neill, 2012). (Wei, Frankwick and Nguyen, 2012).

4. Methodology

4.1 Conceptual model: (see the figure 1)

4.2 Research Hypothesis

H1-IT Operation is positively associated information sharing.

H2-Information sharing is positively associated firm performance.

H3-IT Operation is positively associated firm performance

H4-Human capital moderates the relationship between IT operations and exchange of information.

This paper tries to study how IT operation may influence the firm performance, mediating effect of Exchange of information sharing. In the figure 1 we indicate the relationships among the constructs to be studied (see Figure 1).

4.3 Sample Size and Data collection

This chapter presents and explains the research design and methods used in this study and will answer the fundamental research question. Also, a detailed description of data collection instruments and methods used to address the research questions. Finally, a discussion on how issues of reliability, validity, and usability were addressed is included, followed by a summary section. China 2012 Enterprise Surveys Data Set World Bank, data collected in China between December 2011 and February 2013. A total of 2,700 privately-owned and 148 state-owned were successfully interviewed over this period. The structure of the database reflects the fact that three different versions of the questionnaire were used. We first assumed that all of the hypothesized relations were linear, and used the software package SmartPLS to test the model using standard linear PLS analysis. Using WarpPLS™ (Ned Kock, 2012), and the guidelines developed by Ned Kock and Mayfield (2015), the quality of the measures was assessed by inspecting item-to-total correlations. (Cochran, William G, 1977), (Levy, Paul S. and Stanley Lemeshow, 1999). (Scheaffer, Richard L.; Mendenhall, W.; Lyman, R, 1996).

4.4 Econometric Technique

Most of the scales adopted from Tippins and Sohi's (2003) paper. Previous strategy research has used similar indirect measures of firm performance when financial statement data are either unavailable or do not allow for

accurate comparisons among firms (Tippins and Sohi, 2003) .for human capital scales adopted from Angela Baron, (2011),"Measuring human capital",. (See APPENDIX) .

4.4.1 Partial Least Squares Structural Equation Modeling (PLS-SEM) Techniques Using SmartPLS

Joreskog (1973) and Bollen (1989).firstly applied the concept of structural equation modeling (SEM) in social sciences, serving as the academic advisor for (Herman,1973), who established the LISREL CB-SEM software package. Then, PLS-SEM had a better development due the efforts of (Ringle, Wende, and Will 2005).. It is argued by (Hair et. al.2010) that CB-SEM can be applied to assess the goodness of fit. It is focused on the minimizing of the differences or discrepancy between the estimated covariance matrix, and the observed covariance matrix. It is advised that its use is very suitable for the testing and determining the reason to do that. Nonetheless, scholars or managers need to set up the assumed concept in their conduction of CB-SEM. Firstly, it is the sample size for data needs to be large, more than 200. According to Hair et. al. (2010), the least sample size is decided by the complexity of models and the features of essential measurement models. It is pointed out by (Lewis, Goodhue, and Thompson ,2006), that sample size is not the main reason for the use of PLS-SEM as there are not enough statistical data about the small sample size. In addition, it is advised that PLS is an effective approach if the small sample size can be used in the comparison with CB-SEM. The package of statistical software for CB-SEM can be achieved in MPLUS, LISREL, AMOS, and EQS, when PLS-SEM is within PLS Graph and SMARTPLS. It is shown that all constructs should have more than three indicators for the purpose of avoiding the questions appearing in identification. There are three symbols left in the model, and could not be calculated, the model is just examined and all figures received from factor loadings have no meanings. Then, it is shown that only reliable and valid changes are appropriate in the testing of causal or direct relations. Therefore, this structure model cannot be conducted if validity and reliability are not obtained. Hence, partial least square SEM (PLS-SEM) is set up to deal with the problem. The use of SEM is to realize the maximum explained variance for dependent variables or endogenous latent constructs, while minimizing the changes that could not be explained.

At present, there are a lot of sharing approaches of knowledge, like training and development programs, and IT systems. They serve as the best examples for knowledge integration as knowledge is combined in a full scope for the purpose of improving the quality of products and services, adding more responses to customers' requirements, enhancing corporate performances, and strengthening innovation capabilities of enterprises (Wang and Wang, 2012).

4.4.2 Scales adopted from Tippins and Sohi's (2003)

4.4.2.1. IT Competency

IT operations (Cronbach's $\alpha = 0.891$)

Our firm is skilled at collecting and analyzing market information about our customers via computer-based Systems.

We routinely utilize computer-based systems to access market information from outside databases.

We have set procedures for collecting customer information from online sources.

We use computer-based systems to analyze customer and market information.

We utilize decision-support systems frequently when it comes to managing customer information.

We rely on computer-based systems to acquire, store, and process information about our customers.

4.4.2.2. Information sharing

Information acquisition (Cronbach's $\alpha = 0.807$)

We regularly meet with our customers in order to find out what their needs will be in the future.

We do a lot of in-house research that is directed at determining our customers' needs.

We view our customers as a source of market information.

We often ask our customers what they want or need.

We regularly collect information concerning our customers' objectives.

We often collect industry information from our customer

Information dissemination (Cronbach's $\alpha = 0.879$)

Within our firm sharing customer information is the norm.

Within our firm, information about our customers is readily available to those who need it most.

Representatives from different departments within our firm meet regularly to discuss our customers' needs.

Within our firm, customer information is rarely shared between functional departments'

When one agency obtains necessary information about our customers, it is circulated to other organizations.

4.4.2.3. Firm performance (Cronbach's $\alpha = 0.800$)

Customer retention

Sales growth

Profitability

Return on investment

4.4.2.4. Market power (Inter-item correlation = 0.816)

Market share

Firm size

4.4.3 .Survey measurement loading

(See the table 2 and the table 3)

Full collinearity VIFs should be less than 3.2

The best condition here should be more than 0.8/ although more than 0.7 is acceptable.

AVE should be more than .5 for measurement.

5. Results and Findings

The partial least squares path modeling method to structural equation modeling allows estimating complex cause-effect relationship models with latent variables. It is a component-based estimation approach that differs from the covariance-based structural equation modeling. It is more oriented towards maximizing the amount of variance explained (prediction) rather than statistical accuracy of the estimates. To a great samples like this research, the precision of estimates is well enough.

The structural model estimates the latent variables by means of simple or multiple linear regressions between the latent variables estimated by the measurement model. This algorithm repeats itself until convergence is achieved. Therefore, structural equation modeling (SEM) using the partial least squares (PLS) method was used to answer the research questions. In an external model, PLS analysis is used to estimate latent variables (LVs) based on the shared variance of observed variables, using t principal component weights of the observed variables. The shift in each indicator indicates the extent of its influence on a given LV, resulting in the best possible combination of weights for predicting the LV while accounting for observed variables (Tsethlikai, 2010). We first assumed that all of the hypothesized relations were linear, and used the software package SmartPLS to test the model using standard linear PLS analysis. Using WarpPLS™ (Ned Kock, 2012) and the guidelines developed by Ned Kock and Mayfield (2015), the quality of the measures was assessed by inspecting item-to-total correlations. We used the final LVs to calculate the pathways in the central model and identify significant paths. Due to the non-linear relationships between the variables addressed in this research, WarpPLS was used to explicitly identify nonlinear functions connecting pairs of latent variables in the SEM models and calculate multivariate coefficients of association accordingly.

5.1 Results

PLS analysis: The measurement model shows how each block of items relates to its construct or latent variable. The PLS results indicate that a satisfactory level of convergent validity was achieved, based on certain criteria. As shown in Table 2, all of the item loadings were greater than 0.60 (all significant, $p < 0.001$), except the question measuring IT operation, whose loading (0.588) was lower than the 0.60 thresholds. However, this item was retained for the following two reasons. (1) According to (Chin, 1998), a loading below the threshold is acceptable if the loadings of other items measuring the same construct are high. (2) The loading was still higher than the cutoff point of 0.4 recommended by some scholars (Hulland, 1999).. Discriminant validity is verified by measuring the difference between a construct's average variance extracted (AVE) value and its correlations with other constructs. To achieve a sufficiently high level of discriminant validity, the square root of the construct's AVE should be greater than its correlations with all other constructs (Ned Kock, 2012).. As shown in Table 2, the threshold for discriminant validity was also exceeded.

5.2 Structural Model

The hypotheses were assessed by examining the parameters of the PLS structural model. The R2 values obtained for dependent variables indicate the predictive power of a theoretical model, and standardized path coefficients indicate the strength of the relationship between the independent and dependent variables. The results are shown in Figure 1 and Table 3. The R2 value of 0.550 indicates that the theoretical model explained a substantial amount of the variance in ROA. Also, the model accounted for 52% of the difference in performance. As the R2 of a dependent variable must be at least 10% to ensure meaningful interpretation, the theoretical model demonstrated substantive explanatory power.

Figure 2 depicts the final structural model. The path coefficients can be taken as standardized beta weights, each of which was estimated after controlling for the effects of all of the other paths. To determine whether each path was significant, bootstrapping resembling (Efron & Gong, 1983) was performed. The PLS parameters of a series of random subsamples of the total sample were repeatedly tested until significance could be estimated from the convergent findings.

Our structural model can be generalized by noting the following significant direct effects of the LVs. IT operation predicted IT Sharing ($\beta = 0.37$, $p < 0.001$) and ROA ($\beta = 0.44$, $p < 0.001$). IT Sharing predicted ROA ($\beta = 0.38$, $p < 0.001$). IT Sharing mediated ROA ($\beta = 0.37$, $p < 0.001$) and ROA. Although Skill and

Education and training are predicting Human capital ($\beta = 0.69, p < 0.001$), but Human capital cannot moderate IT operation and IT Sharing ($\beta = -0.03, p = 0.4$).

In addition to direct effects, WarpPLS™ reports cumulative effects (i.e., direct and indirect effects). A shift from direct to cumulative effects can indicate the presence of important indirect effects (i.e., the contribution of one variable via its contribution to others). The information on cumulative effects obtained for our model demonstrated that the contribution made by several variables increased substantially. For each of these results, we calculated the indirect effects using the methods specified by (N. Kock and Gaskins, 2014). As already noted, we expected the contribution of IT operation to ROA to be mediated by applied IT Sharing (or by the contribution of endogenous IT Sharing). This expectation was confirmed (see Table 7). IT operation made indirect as well as direct contributions to variance in several other predictors via its contribution to IT Sharing. IT OPERA contributed indirectly and directly to ROA via its contribution to IT Sharing (0. 0.581, $p < 0.001$).

As shown in Figure 1 and Table 5, and 7, the results suggest that IT operation is the most significant predictor of ROA (58.1%) regarding both status and quality, compared with IT Sharing (38.3%) and Size (18%). Our results show that IT operation is positively related to ROA ($p < 0.001$), supporting H1. We also find support for H2 ($p < 0.001$), according to which IT operation is positively related to IT Sharing. H3 is also supported ($p < 0.001$), as our results demonstrate that an increase in IT sharing leads to an increase in ROA. H4 is upheld, as the relationship between Skill and Education and training with Human Capital ($p < 0.001$) is positive; and Human Capital could not moderate the IT operation and IT sharing, as stated in H5.

5.3 Analysis of Hypothesis

5.3.1 IT operation is positively associated information sharing.

IT operation predicted IT Sharing ($\beta = 0.37, p < 0.001$). As shown in Figure 1 and Table 7, the results suggest that IT operation is the most significant predictor of ROA (58.1%) regarding both status and quality, compared with IT Sharing (38.3%) and Size (18%). Our results show that IT operation is positively related to ROA ($p < 0.001$), supporting H1.

5.3.2 Information sharing is positively associated firm performance.

IT Sharing predicted ROA ($\beta = 0.38, p < 0.001$). IT Sharing mediated ROA ($\beta = 0.37, p < 0.001$) and ROA. We also find support for H2 ($p < 0.001$), according to which IT operation is positively related to IT Sharing. Many companies which defines information sharing as the vital and significant part of there organization and allocate budget to the training development of IT systems, improving the quality of products and services, and make friendly environment for employee and enhance the firm innovation capability, and finally improve firm performance (Wang and Wang, 2012).

5.3.3 IT operation is positively associated firm performance

IT operation predicted ROA ($\beta = 0.44, p < 0.001$). As we mentioned in the literature Human capital and information sharing play the significant role on firm performance. IT enables knowledge capabilities (Joshi et al., 2010).

5.3.4 The relationship between IT operations, information sharing, moderated by human capital

H4 is upheld, as the relationship between Skill and Education and training with Human Capital ($p < 0.001$) is positive; and Human Capital could not moderate the IT operation and IT sharing, as stated in H5. Although Skill and Education and training are predicting Human capital ($\beta = 0.69, p < 0.001$), but Human capital cannot moderate IT operation and IT Sharing ($\beta = -0.03, p = 0.4$). Firms which allocate money on IT they can have a good ROA if also consider the information sharing factor. due to the data analysis result of our study the role of human capital was not significant neither, accordingly the knowledge background of people was not measured by the information technology skills.

6. Conclusion and Future study Directions

The results represent a complexity of the relationships between IT operation tasks, information sharing capability, human capital role, and firm performance. This study provides additional Insights that some companies may not be realizing benefits from investing in IT, even with allocating time and money on the human capital if this human capital study is not related to the information technology based context. While managers decided to allocate more money IT operation, it may not just lead to productivity without concerning the related strategies to enhance their performance. This investment did not work well for all. The results clearly demonstrate that information sharing, increasing the Firm Productivity, Education and Training Affect versus the Education Increase knowledge & Skills, Moulds attitudes and enhance Motivation, into human capital which, causes the growth of budget by increasing their productivity. Accordingly, firms must focus their attention on intervening processes such as organizational learning and human capital studies to determine what benefits are being derived from IT-based information systems. This problem is widespread that IT can fix almost any problem .

REFERENCES:

- Suter, L. E., & Miller, H. P. (1973). Income differences between men and career women. *American Journal of Sociology*, 78(4), 962-974.
- Werts, C. E., Joreskog, K. G., & Linn, R. L. (1973). Identification and estimation in path analysis with unmeasured variables. *American Journal of Sociology*, 78(6), 1469-1484.
- Cochran, W. G. (1977). Sampling techniques-3.
- Boyatzis, R. E. (1982). *The competent manager: A model for efficient performance*: John Wiley & Sons.
- Granstrand, O. (1982). *Technology, management and markets: An investigation of R&D and innovation in industrial organizations*: External organization.
- Efron, B., & Gong, G. (1983). A free look at the bootstrap, the jackknife, and cross-validation. *The American Statistician*, 37(1), 36-48.
- Mitcham, C., & Mackey, R. (1983). *Philosophy and technology* (Vol. 80): Simon and Schuster.
- Ramanujam, V., Venkatraman, N., & Camillus, J. C. (1986). Multi-objective assessment of effectiveness of strategic planning: a discriminant analysis approach. *Academy of Management journal*, 29(2), 347-372.
- Itami, H. (1987). The firm and the market in Japan. *The Management Challenge: Japanese Views*, MIT Press, Cambridge.
- Bollen, K. A. (1989). A new incremental fit index for general structural equation models. *Sociological Methods & Research*, 17(3), 303-316.
- Davenport, T. H., & Short, J. E. (1990). The new industrial engineering: information technology and business process redesign.
- Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of management*, 17(1), 99-120.
- Glazer, R. (1991). Marketing in an information-intensive environment: strategic implications of knowledge as an asset. *The Journal of Marketing*, 1-19.
- Krcmar, H., & Lucas, H. C. (1991). Success factors for strategic information systems. *Information & Management*, 21(3), 137-145.
- Bemdt, E. R., Morrison, C. J., & Rosenblum, L. S. (1992). High-Tech Capital Formation and Labor Composition in US Manufacturing Industries: An Exploratory Analysis. *NBER Working Paper*(4010).
- Broderick, R., & Boudreau, J. W. (1992). Human resource management, information technology, and the competitive edge. *The Executive*, 6(2), 7-17.
- Becker, G. (1993). Human Capital: A theoretical and empirical approach with particular references to education. *Chicago: University of Chicago*.
- Thurbin, P. (1994). Implementing the learning organization. *Pitman, London*.
- Lau, C.-M., & Woodman, R. W. (1995). Understanding organizational change: A schematic perspective. *Academy of Management journal*, 38(2), 537-554.
- Mata, F. J., Fuerst, W. L., & Barney, J. B. (1995). Information technology and sustained competitive advantage: A resource-based analysis. *MIS quarterly*, 487-505.
- Nault, B. R., & Dexter, A. S. (1995). Added value and pricing with information technology. *MIS quarterly*, 449-464.
- Nonaka, I., & Takeuchi, H. (1995). The knowledge creation company: how Japanese companies create the dynamics of innovation. *New York*.
- Scheaffer, R. L., Mendenhall III, W., & Ott, L. (1996). Elementary Survey Sampling. 2 Duxbury Press. *Pacific Grove*.
- Liebowitz, J., & Wilcox, L. C. (1997). *Knowledge management and its integrative elements*: CRC Press.
- Sparrow, P. R., & Hiltrop, J.-M. (1997). Redefining the field of European human resource management: a battle between political mindsets and forces of business transition? *Human Resource Management (1986-1998)*, 36(2), 201.
- Chin, G. J. (1998). *Affirmative Action and the Constitution: Affirmative action before constitutional law, 1964-1977* (Vol. 1): Taylor & Francis.
- Sampler, J. L. (1998). Redefining industry structure for the information age. *Strategic management journal*, 343-355.
- Athey, T. R., & Orth, M. S. (1999). Emerging competency methods for the future. *Human resource management*, 38(3), 215-225.
- Dixon, F., & Whittaker, M. (1999). Valuing corporate environmental performance: Innovest's evaluation of the electric utilities industry. *Corporate Environmental Strategy*, 6(4), 343-354.
- Hulland, J. (1999). Use of partial least squares (PLS) in strategic management research: A review of four recent studies. *Strategic management journal*, 195-204.
- Lepak, D. P., & Snell, S. A. (1999). The human resource architecture: Toward a theory of human capital allocation and development. *Academy of management review*, 24(1), 31-48.
- Levy, P. S., & Lemeshow, S. (1999). Systematic sampling. *Sampling of Populations: Methods and Applications*,

- Fourth Edition*, 83-120.
- Phiri, M. (1999). *Information technology in construction design*: Thomas Telford.
- Bharadwaj, A. (2000). V. Sambamurthy Robert H. Smith School of Business University of Maryland College Park, MD 20742-1815. *Quest*.
- Hunt, S. D., & Lambe, C. J. (2000). Marketing's contribution to business strategy: market orientation, relationship marketing and resource - advantage theory. *International Journal of Management Reviews*, 2(1), 17-43.
- Barney, J., Wright, M., & Ketchen Jr, D. J. (2001). The resource-based view of the firm: Ten years after 1991. *Journal of management*, 27(6), 625-641.
- Delios, A., & Beamish, P. W. (2001). Survival and profitability: The roles of experience and intangible assets in foreign subsidiary performance. *Academy of Management journal*, 44(5), 1028-1038.
- Dewett, T., & Jones, G. R. (2001). The role of information technology in the organization: a review, model, and assessment. *Journal of management*, 27(3), 313-346.
- Saygılı, Ş., Cihan, C., & Yurtoğlu, H. (2001). Productivity and growth in OECD countries: an assessment of the determinants of productivity. *Yapı Kredi Economic Review*, 12(2), 49-66.
- Davidsson, P., & Honig, B. (2003). The role of social and human capital among nascent entrepreneurs. *Journal of business venturing*, 18(3), 301-331.
- Jackson, S., & Schuler, R. (2003). Managing HR through Strategic Partnership. *South-Western, Cincinnati, OH*.
- Tippins, M. J., & Sohi, R. S. (2003). IT competency and firm performance: is organizational learning a missing link? *Strategic management journal*, 24(8), 745-761.
- Yeo, R. (2003). The tangibles and intangibles of organisational performance. *Team performance management: an international journal*, 9(7/8), 199-204.
- Brush, C. G., & Manolova, T. S. (2004). Personal background. *Handbook of Entrepreneurial Dynamics: The Process of Business Creation*, 49-61.
- Moye, N. A., & Langfred, C. W. (2004). Information sharing and group conflict: Going beyond decision making to understand the effects of information sharing on group performance. *International Journal of Conflict Management*, 15(4), 381-410.
- Carbonara, N. (2005). Information and communication technology and geographical clusters: opportunities and spread. *Technovation*, 25(3), 213-222.
- Darroch, J. (2005). Knowledge management, innovation and firm performance. *Journal of knowledge management*, 9(3), 101-115.
- Perez Lopez, S., Montes Peon, J. M., & Vazquez Ordas, C. J. (2005). Human resource practices, organizational learning and business performance. *Human Resource Development International*, 8(2), 147-164.
- Tanriverdi, H. (2005). Information technology relatedness, knowledge management capability, and performance of multibusiness firms. *MIS quarterly*, 311-334.
- Boyer, M., & Robert, J. (2006). The Economics of Free and Open Source Software: Contributions to a Government Policy on Open Source Software. *Economics*, 03.
- Ucbasaran, D., Westhead, P., & Wright, M. (2008). Opportunity identification and pursuit: Does an entrepreneur's human capital matter? *Small Business Economics*, 30(2), 153-173.
- Bali, R. K., Wickramasinghe, N., & Lehaney, B. (2009). *Knowledge management primer*: Routledge.
- Nonaka, I., & Von Krogh, G. (2009). Perspective—Tacit knowledge and knowledge conversion: Controversy and advancement in organizational knowledge creation theory. *Organization Science*, 20(3), 635-652.
- Hair, J. F., Anderson, R. E., Babin, B. J., & Black, W. C. (2010). *Multivariate data analysis: A global perspective* (Vol. 7): Pearson Upper Saddle River, NJ.
- Joshi, A., & Hanssens, D. M. (2010). The direct and indirect effects of advertising spending on firm value. *Journal of marketing*, 74(1), 20-33.
- Tsethlikai, M. (2010). The influence of a friend's perspective on American Indian children's recall of previously misconstrued events. *Developmental psychology*, 46(6), 1481.
- Baron, A. (2011). Measuring human capital. *Strategic HR Review*, 10(2), 30-35.
- Cabello-Medina, C., López-Cabrales, A., & Valle-Cabrera, R. (2011). Leveraging the innovative performance of human capital through HRM and social capital in Spanish firms. *The International Journal of Human Resource Management*, 22(04), 807-828.
- Kock, N. (2012). WarpPLS 3.0 user manual. *Laredo, TX: ScriptWarp Systems*.
- Peet, M. (2012). Leadership transitions, tacit knowledge sharing and organizational generativity. *Journal of knowledge management*, 16(1), 45-60.
- Wang, Z., & Wang, N. (2012). Knowledge sharing, innovation and firm performance. *Expert systems with applications*, 39(10), 8899-8908.
- Wei, Y. S., Frankwick, G. L., & Nguyen, B. H. (2012). Should firms consider employee input in reward system design? The effect of participation on market orientation and new product performance. *Journal of*

Product Innovation Management, 29(4), 546-558.

- Bolshov, A. V. (2014). Improved Methods of Human Capital Valuation in the Modern Company. *Asian Social Science*, 10(20), 80.
- Kock, N., & Gaskins, L. (2014). The mediating role of voice and accountability in the relationship between Internet diffusion and government corruption in Latin America and Sub-Saharan Africa. *Information Technology for Development*, 20(1), 23-43.
- Lucey, B. M., Larkin, C., & O'Connor, F. (2014). Gold markets around the world—who spills over what, to whom, when? *Applied Economics Letters*, 21(13), 887-892.
- Kock, N. (2015). One-tailed or two-tailed P values in PLS-SEM? *International Journal of e-Collaboration (IJeC)*, 11(2), 1-7.
- Goodhue, D., Lewis, W., & Thompson, R. (2006). *PLS, small sample size, and statistical power in MIS research*. Paper presented at the System Sciences, 2006. HICSS'06. Proceedings of the 39th Annual Hawaii International Conference on.
- Ringle, C. M., Wende, S., & Will, A. (2005). SmartPLS 2.0 (beta): Hamburg.

Table 1 Summary of extant study's (Author & year Journal Focus Main arguments Results)

Writer and year	theory	keywords	finding
1, denise lustre 2007	organizational knowledge creation theory.	knowledge management, competences, legal profession	the experience showed that, more than developing supportive
2-seref saygili –2005	the convergence theory	humancapital productivity	growth supportive
3.maria de los dolores 2011	human capital theory	opportunity identification, humancapital, gender	supportive
4.sheila ghane 2014	human capital theory	relational capital, intellectual capital	supportive
5.chin-chun hsu2014	organizational learning	knowledge sharing, buyer-seller relationships, channel relationships, business performance	supportive
6.brent m. han2007	organizational learning	knowledge sharing, large enterprises	not supportive
7.yi-ming tai2014	organizational learning	information knowledge customers	services, sharing, supportive
8.dubravka cecez-kecmanovic2014	theory of communicative action	knowledge sharing computer-mediated communications	supportive
9.rob kling suzanne iacono,1989	institutionalization theory	institution information system	computer, supportive
11.ed mayo 2014	organizational learning	corporate responsibility, organizations, social co-operative social responsibility	supportive

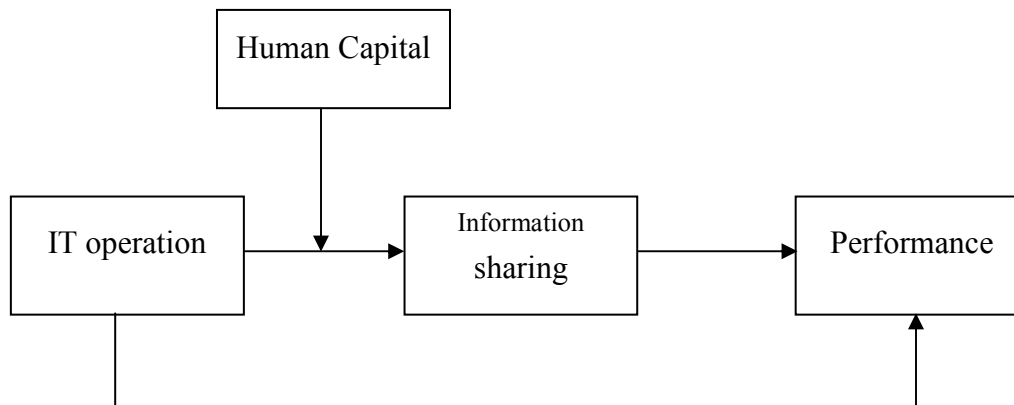


Figure.1 Conceptual model

Table 2 Measurement model (using combined loadings and cross-loadings)

	IT operation	IT Sharing	ROA	Skill	Size	Human capital	Education and Training	Human Cap*IT	Type (a)	SE	P value
new technology and equipment	0.862	0.007	-0.038	-0.034	0.024	0	-0.024	0.024	Reflect	0.023	<0.001
new quality control procedure	0.858	-0.022	-0.025	-0.024	0.017	0	0.005	0.015	Reflect	0.023	<0.001
new managerial/administrative processes	0.792	-0.017	-0.023	-0.011	0.01	0	-0.015	0.03	Reflect	0.023	<0.001
Provide technology training for staff	0.588	0.04	0.214	0.197	-0.045	0	0.013	-0.172	Reflect	0.023	<0.001
Introduce new product or new service	0.821	-0.001	0.065	0.074	-0.05	0	0.003	-0.07	Reflect	0.023	<0.001
Add new features to existing products	0.855	-0.037	-0.022	-0.018	0.024	0	0	0.017	Reflect	0.023	<0.001
Take measures to reduce production cost	0.837	-0.018	-0.019	-0.02	-0.015	0	0.023	0.026	Reflect	0.023	<0.001
Take actions to improve production flexibility	0.83	0.059	-0.087	-0.103	0.019	0	0	0.079	Reflect	0.023	<0.001
Partner relations (suppliers, contractors, etc.)	0.067	0.801	-0.087	-0.069	0.006	0	-0.065	0.07	Reflect	0.023	<0.001
Product and service enhancement	-0.026	0.859	-0.01	0.018	0.01	0	0.008	-0.006	Reflect	0.023	<0.001
Production and operations	0.027	0.843	0.064	0.048	-0.004	0	0.043	-0.035	Reflect	0.023	<0.001
Marketing and sales	-0.039	0.874	0.014	0.009	-0.013	0	0	-0.025	Reflect	0.023	<0.001
Customer relations	-0.022	0.889	0.014	-0.009	0.002	0	0.009	0.001	Reflect	0.023	<0.001
Total annual costs	0.243	0.058	-0.677	0.075	0.319	0	0.048	-0.113	Formati	0.023	<0.001
lv_ISBB	-0.169	0.248	0.799	0.06	0.296	0	0.002	-0.061	Formati	0.023	<0.001
lv_ITBB	0.239	-0.099	0.606	0.004	-0.034	0	0.05	-0.045	Formati	0.023	<0.001
Skilled production workers	-0.066	-0.026	0.069	0.883	-0.012	0	-0.001	0.131	Reflect	0.023	<0.001
Unskilled production workers	0.066	0.026	-0.069	0.883	0.012	0	0.001	-0.131	Reflect	0.023	<0.001
Sampling size	0.022	-0.018	-0.006	-0.001	0.919	0	-0.024	0.003	Reflect	0.023	<0.001
Screener Size	-0.022	0.018	0.006	0.001	0.919	0	0.024	-0.003	Reflect	0.023	<0.001
lv_Skil	0	0	0	0	0	0.719	0	0	Formati	0.023	<0.001
lv_Edu&	0	0	0	0	0	0.719	0	0	Formati	0.023	<0.001
Average number of years of education of typical production worker	0.024	0.042	-0.03	-0.034	-0.031	0	0.886	0.031	Reflect	0.023	<0.001
Average number of years of education of typical Female production worker	-0.024	-0.042	0.03	0.034	0.031	0	0.886	-0.031	Reflect	0.023	<0.001

Table 3 Latent Variable Coefficients

-Cronbach's alpha coefficients							
IT operation	IT Sharing	ROA	Skill	Size	Human capital	Education and Training	Human Cap*IT
0.923	0.907	-0.776	0.717	0.815	0.768	0.726	0.875
- Average variances extracted							
IT operation	IT Sharing	ROA	Skill	Size	Human capital	Education and Training	Human Cap*IT
0.656	0.729	0.688	0.779	0.844	0.518	0.785	0.665
- Full collinearity VIFs							
IT operation	IT Sharing	ROA	Skill	Size	Human capital	Education and Training	Human Cap*IT
1.61	1.62	2.711	1.12	1.278	1.08	1.22	1.524

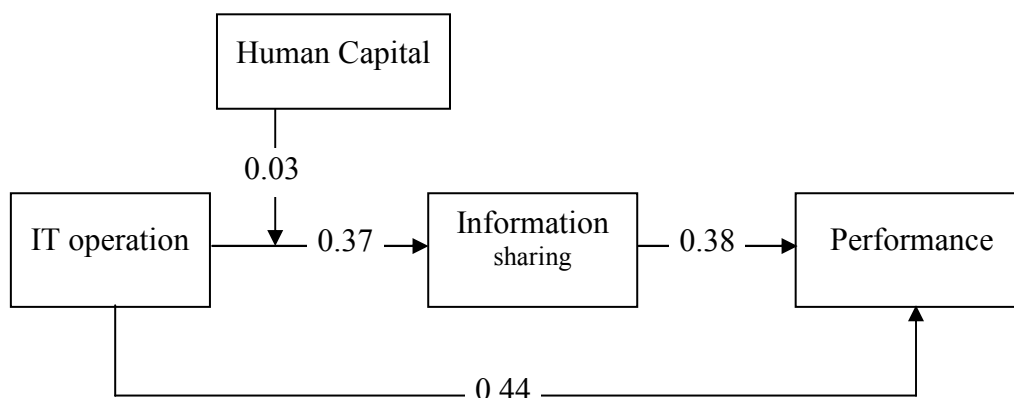


Figure 2 Structural Equation Modeling of Research Question

Table 4 Correlations among latent variables with square roots of AVEs, Latent variable coefficients window

	ITOPERA	IT Sharing	ROA	Skill	Size	Human Capital	Education and training	Human Cap*IT
ITOPERA	0.81	0.244	0.55	0.037	0.017	-0.008	-0.048	0.14
IT Sharing	0.244	0.854	0.555	0.062	0.162	0.138	0.137	0.028
ROA	0.55	0.555	0.699	-0.171	0.271	-0.068	0.074	0.101
Skill	0.037	0.062	-0.171	0.883	0.211	0.419	0.035	0.513
Size	0.017	0.162	0.271	0.211	0.919	0.199	0.076	0.033
Human Capital	-0.008	0.138	-0.068	0.419	0.199	0.719	0.519	0.365
Education and training	-0.048	0.137	0.074	0.035	0.076	0.519	0.886	0.013
Human Cap*IT	0.14	0.028	0.101	0.513	0.033	0.365	0.013	0.604

Table 5 Path coefficients

	IT Operation	IT sharing	ROA	Skill	Size	Human capital	Education and training	Human Cap*IT
IT Operation								
IT Sharing	0.368*							-0.027**
ROA	0.44*	0.383*			0.18*			
Skill								
Size								
Human capital				0.695*			0.694*	
Education and training								
Human Cap*IT								

* p < 0.001, ** p < 0.05.

Table 6 Effect sizes for path coefficients

	IT Operation	IT Sharing	ROA	Skill	Size	Human capital	Education and training	Human Cap*IT
IT Operation								
IT Sharing	0.136							0.001
ROA	0.253	0.214			0.049			
Skill								
Size								
Human capital				0.5			0.5	
Education and training								
Human Cap*IT								

Table 7 The sum of direct and indirect effect of LV on Performance

	ITOPERA	IT Sharing	ROA	Skill	Size	Human Capital	Education and training	Human Cap*IT
ITOPERA								
IT Sharing	(0.368*)							(-0.027)
ROA	(0.581*)	(0.383*)			(0.18*)			(-0.01)
Skill								
Size								
Hum Human Capital				(0.695)			(0.694*)	
Education and training								