VOL. 10, NO. 23, DECEMBER 2015 ISSN 1819-6608
ARPN Journal of Engineering and Applied Sciences

www.arpnjournals.com

# A PRELIMINARY STUDY ON LEARNING ORIENTATION, INFORMATION TECHNOLOGY INFRASTRUCTURE FLEXIBILITY AND AGILITY

Noor Hafizah Hassan, Noreen Izza Arshad and Emy Elyanee Mustapha
Department of Computer and Information Sciences, Universiti Teknologi Petronas, Tronoh, Malaysia
E-Mail: nhafizah_g02333@utp.edu.my

**ABSTRACT**

Of late, information technology (IT) is considered as a key component in every organisation. Improving IT competence to become agile and retain its competitive advantage is an important part of any organisation's strategy. Organisation Integration of IT and learning is very crucial. Continuous learning enables organisations to enhance their performance. Learning Orientation (LO) is a pillar of strength in every organisation. LO is also a vital part in organisational learning, which explains organisation's values of learning culture, shared goals and sharing knowledge. The research issue highlighted in prior studies emphasised on the link that relates organisational performance, competitive advantage, and agility. Agility refers to the response characteristic of the organisation, which implies organisations' quick response internally and externally and capability to gain an advantage in cost and time. Consequently, the aims of this research are to investigate the relationship of LO, IT Infrastructure Flexibility (ITIF) and organisational agility in the context of Malaysian organisations. Specifically, this paper discusses the pilot study procedures conducted and findings from surveys. Data collected from 50 participants were analysed statistically using SPSS 23.0 and SmartPLS 3.0. The results indicated that the research instruments are reliable and valid for a larger sample size. The descriptive statistics also show the existence of a learning culture and IT capability in Malaysia in enhancing organisational responsiveness.

**Keywords:** information technology capability, information technology infrastructure flexibility, learning orientation, organisational agility.

## INTRODUCTION

In studies related to information technology (IT), there are numerous uncertain issues, challenges and opportunities that involve a broad spectrum of technical, economic, sociological, strategic and organisational perspectives [1], [2]. One of the challenges is choosing the right IT infrastructure with the right implementation [3]. IT infrastructure exists in most of the organisations, regardless of their size and type. Therefore, factors that relate to the development of IT infrastructure must be well understood.

Organisational learning is a part of the organisation's development process and is equally important besides other factors. Although, studies on organisation learning are growing in number since last decade, however, most of the studies were mainly focused on organisations' innovativeness and performance [4]–[9]. This has constituted a question, whether learning will improve organisations' performance in term of responsiveness; and with the help of IT, learning will improve organisational agility. Literatures that investigate the link between IT, learning and agility is still lacking in number [10]-[12].

Studies have found that there is positive relationship between IT infrastructure and organisations' responsiveness [13]. Organisations' responsiveness refers to the ability of organisation to sense and respond towards changes in organisation's internal and external environment, this refers to "agility" [14]. According to Chen *et al*. [11], agility and flexibility are two different subjects. The author stated that the organisation needs to achieve both flexibility and agility. The author also added that agility is about the speed to sense or respond to opportunities and threats, while flexibility is a key antecedent of agility. Similarly, Bhatt *et al*. [15] found that Information Technology Infrastructure Flexibility (ITIF) is an enabler of organisational responsiveness. Therefore, flexibility and agility are crucial to an organisation's survival, the study that investigates the linking of flexibility and agility is essential [16].

The objective of a comprehensive research is to investigate the relationship of three components; LO, ITIF and organisational agility. Whereas, in this context, learning orientation consists of four dimensions, namely; commitment to learning, shared vision, open-mindedness, and intra organisational knowledge sharing. IT Infrastructure Flexibility includes three dimensions: IT compatibility, IT connectivity and IT personnel competency. Organisational agility dimensions include; market capitalising agility, and operational adjustment agility. The objective of this paper is to explain the conductance of a pilot study and elaboration on data analysis and its findings.

The remainder of this paper is organized as follows: the following section discussed on theoretical background. The third section explains on the pilot study methodology. The results analysis and discussion is present in fourth section and finally the last section concludes on the paper and highlights the future works of the research.


## THEORETICAL BACKGROUND

The ability to use knowledge in making business decisions are provided by the organisational learning process. In competitive environments, organisational learning plays a vital role in long-term stability of an organisation [17]. Learning oriented organisations create a culture, which is conducive to learning environment [18]. Therefore, empirical testing of four learning orientation components is the objective of this study. These learning orientation components are the composition of LO dimensions proposed by Sinkula *et al*. [19] and Calantone *et al*. [20]. These four dimensions include; commitment to learning, shared vision, open-mindedness, and intra-organisational knowledge sharing.

IT capability is defined as the organisation's ability to establish and utilise IT capitals in arrangements with other resources. IT capability involves information integration, managing knowledge, implement innovation, and in-time implementation of IT-enabled initiatives [14], [21]–[24]. The organisation of IT capability emanates in several components out of which infrastructure is one of the important components. IT infrastructures enable organisations to develop applications rapidly upon identification and to dissipate information across its products, services, and locations. IT infrastructure is also useful in applying mutual transaction processes and supply chain management, whereas, it can also categorise opportunities for synergy across business units [25].

One of the important characteristic of IT infrastructure is IT Infrastructure Flexibility (ITIF). ITIF is the issue of responsiveness: infrastructure is flexible when the organisation is able to respond rapidly and effectively to emergent needs or opportunities [26]. Referring to Jorfi *et al*. [27], IT flexibility is indicated as the quick employment of technology that is aided with the help of IT infrastructure. Specifically, IT infrastructure flexibility is contingent on the degree to which the IT is compatible, accessible, modular, and can handle multiple business applications [28]. In the context of this study, IT infrastructure, mainly concentrates on flexibility items, which include IT compatibility, IT connectivity, and IT personnel competency that were proposed by [28], [29].

- IT compatibility is defined as the ability to share any type of information across any technology component within the organisation and or to any party outside the organisation.
- IT connectivity is referring to the ability of any technology component to attach to any other component inside and outside of organisational environment.
- IT personnel competency is stated as the capability of IT personnel to deal with IT related technical problems and business demands [29], [30].

Bi et al. [31] mentioned that research which investigates the relationship between IT and organisational agility is increasingly encountered in the IS field. Organisational agility is defined as a way to cope with external and internal changes that are unpredictable or uncertain in which organisation need to be able to anticipate or respond to the changes with ease and in a timely manner [32]. Organizational agility is the ability to respond to change, uncertainty and unpredictability and creating a suitable reaction proficiently in a timely and lucrative manner [33], [34].

As allusion for this research, two information system (IS) theories were referred. These IS theories are resource-based view (RBV) theory and dynamic capability theory, which were initiated by Barney [35] and Teece *et al*. [36]. Based on RBV, industrious use of organisational capitals would permit the achievement of short-term competitive advantage. While, in the long term, organisations may withstand their competitive advantage based on imitability, substitutability and mobility [37]. In the context of this research, resources refer to knowledge and experiences that organisations obtain through time [38]. Moreover, the dynamic capability theory implies the capability of organisation to assimilate, shape and organise internal and external capability to counter the rapid dynamic environment [36]. ITIF is combinative capabilities that describe the integration of human and technologies that enhance organisational agility [38], [39].

## PILOT STUDY METHODOLOGY

A pilot study was conducted from May to June 2015, to gather preliminary data. It was a small-scale version while progressing towards the actual study to pre-test a research instrument. Although a pilot study did not guarantee success in the actual study, it greatly increased the probability. In other words, it is a small study to test research protocols, data collection instruments, sample recruitment strategies and other research techniques in preparation for a comprehensive study [40].

In this research, a set of questionnaire was structured into eleven sections consisting of: demographic, commitment to learning, shared vision, open-mindedness, Intra-organisational knowledge sharing, IT compatibility, IT connectivity, IT personnel competency, market capitalizing agility, and operational adjustment agility. The front page of the questionnaire contained the project title, project description, a researcher's name and contact details followed by the first section (Section A). This section was the demographic section, which consisted of six questions regarding the respondent's demographic profile. This was followed by ten more sections, Section B to Section J. The responses were recorded by a five point Likert scale with 'strongly disagree' 'disagree' 'neutral' 'agree' and 'strongly agree' options. These questions were presented in two languages that are English and Malay [41]. The questionnaire was evaluated for validation initially through the expert review method. Expert review is a process where a small group of people (three to eight) review the questionnaire from multiple perspectives [42].


This can be done either by having an individual to review the questionnaire alone or convening a group review, which is also known as an "expert panel" [43]. In this research, a face-to-face session of 1-hour with five reviewers was conducted. The reviewers and the researcher discussed each question until the completion of questionnaires. The reviewers were selected based on their expertise in Information Technology (IT) and Human Resource (HR) [41]. These reviewers had more than 10 years of experience in IT and HR.

The criteria for targeted respondents were any employees who use at least one system in their daily work. Questionnaires were distributed through both channels online and hand delivered. Surveymonkey.com was employed as a medium of distribution with 13 mail invitations, 5 Facebook posts, and 5 web links shared. Total of 28 respondents responded from surveymonkey.com and 24 respondents from hand delivered questionnaires. 52 responses were collected, whereby 2 of them were incomplete. The 50 samples later were analyzed with SPSS 23.0 and SmartPLS 3.0

## ANALYSIS AND DISCUSSIONS

Descriptive statistics are an eminent command available in SPSS, which allows researcher to report demographic information of respondents [44]. In this research, there were six questions in the demographic section of the questionnaire; five of them are reported in Table-1. Whereas, the sixth question, about the type of IT applications that respondents use in their daily work is presented in Table 2.

The demographic profile of the participants (Table-1) indicates that the majority of the respondents were from 'other' position, 40% of the respondents were either assistant managers, consultants, coordinators, vice presidents, lecturers or from clerical positions. Moreover, the majority of them were from IT department (28%), and employees who worked more than 10 years at the current organisation (42%). 36% of them were from education line and the majority were from large organisation (76%).

**Table-1.** Assessment of organisations.

| | Frequency | Percentage |
|---|---|---|
| Position | | |
| Senior Manager | 1 | 2.0 |
| Manager | 8 | 16.0 |
| Senior Executive | 15 | 30.0 |
| Executive | 6 | 12.0 |
| Other | 20 | 40.0 |
| Department | | |
| Information Technology | 14 | 28.0 |
| Human Resource | 2 | 4.0 |
| Marketing | 2 | 4.0 |
| Sales | 1 | 2.0 |
| Finance | 4 | 8.0 |
| Administration | 2 | 4.0 |
| Production | 3 | 6.0 |
| Operation | 7 | 14.0 |
| Logistic | 1 | 2.0 |
| Customer service | 2 | 4.0 |
| Other | 12 | 24.0 |
| Years in current organisation | | |
| Less than 5 years | 13 | 26.0 |
| 5 to 10 years | 16 | 32.0 |
| More than 10 years | 21 | 42.0 |
| Industry | | |
| Manufacturing and Production | 3 | 6.0 |
| Insurance | 2 | 4.0 |
| Oil & Gas | 2 | 4.0 |
| Banking | 9 | 18.0 |
| Telecommunication | 2 | 4.0 |
| Transportation | 1 | 2.0 |
| Computer/software | 6 | 12.0 |
| Education | 18 | 36.0 |
| Other | 7 | 14.0 |
| Size | | |
| Large | 38 | 76.0 |
| SME | 12 | 24.0 |

On the other hand, Table-2 presents the highest percentage of IT application usage, where the use of email was recorded at 100%, followed by use of internet at 84% and database system 62%, while the intranet 58%. Information systems play a vital role in any organisation; therefore, most of the respondents verified the usage of at least one information system in their daily work routines. This data was important in this research as IT capability of the organisation was examined in term of its flexibility. Also, if the flexibility enables organisations to respond to their stakeholders within time and with cost efficiency.


**Table-2.** IT applications used in daily work.

| IT application | Frequency | Percentage |
|---|---|---|
| Email | 50 | 100% |
| Management information system | 14 | 28% |
| Database system | 31 | 62% |
| Human resource system | 23 | 46% |
| Supply chain management system | 1 | 2% |
| Transaction processing system | 12 | 24% |
| Decision support system | 4 | 8% |
| Knowledge management system | 10 | 20% |
| Learning management system | 10 | 20% |
| Internet | 42 | 84% |
| Intranet | 29 | 58% |
| Extranet | 5 | 10% |
| Video conference | 7 | 14% |
| Other | 6 | 12% |

The questionnaire was checked for overall scale reliability and internal consistency of the items. Reliability analysis was assessed following Cronbach's Alpha (α) value and composite reliability. Cronbach's Alpha (α) value ranges between 0 and 1. Alpha value less than the threshold value of 0.7 was considered weak and 0.6 was deemed as poor reliability. Alpha value more than 0.7 was acceptable, more than 0.8 was good and more than 0.9 was considered as an excellent value [45].

Table-3 shows the Alpha value for each construct. All Alpha values for each subscale were reliable except for two constructs. These constructs were CTL and ITC, which refers to "commitment to learning" and "Information technology compatibility". All items in CTL appeared to be worthy of retention except item number 5 in this construct. The Alpha value would have increased to 0.717 if this item was deleted. In the meantime, none of the items in ITC would increase the Alpha value for ITC if any one of them was deleted [46]. Hair *et al*. [46] suggested that composite reliability value, which is 0.70 and above is acceptable. All the composite reliability values in Table-3 are above the threshold value except for 'CTL' construct. Therefore, CTL items need revision as it may influence the data analysis for research model measurement later on.

**Table-3.** Reliability analysis.

| Construct | No of items | Cronbach's Alpha value | Composite reliability |
|---|---|---|---|
| CTL | 5 | 0.674 | 0.437 |
| SV | 4 | 0.772 | 0.851 |
| OM | 5 | 0.814 | 0.870 |
| IKS | 4 | 0.853 | 0.902 |
| ITC | 5 | 0.664 | 0.766 |
| ITCO | 3 | 0.755 | 0.863 |
| ITPC | 3 | 0.920 | 0.941 |
| MCA | 3 | 0.734 | 0.851 |
| OAA | 3 | 0.866 | 0.919 |

Moreover, two types of construct validity were carried out in this research due to their importance [47]. Convergent validity is the one in which the measured item correlates sturdily with its assumed constructs. Whereas, in discriminant validity each measured item correlates feebly with every other construct, except for the theoretically associated one [47]. Partial Least Squares (PLS) were employed to conduct above analyses. PLS is an advanced statistical method that "facilitates testing of the psychometric properties of the scales used to measure a variable, as well as estimating the parameters of a structural model – that is the magnitude and direction of the relationships among the model variables" [48]. It is an effective multivariate technique, which is widely applied in MIS research [48]. The reason why this research opted PLS in the pilot study is that it has the advantage of working with small data sets as proposed by Ringle *et al*. [49].

In this research, convergent validity was examined in two ways (refer Table-4), First, the factor loading for each item, and second, the Average Variance Extracted (AVE) of the construct [50]. First, according to Fornell and Larcker [50], all the loading factors should not only be significant but should have values exceeding 0.70.


The loading value for each item was acceptable for every other item except for 'CTL1', 'CTL3', 'CTL4', 'CTL5', and 'ITC2' (colour shaded). However, two items from SV and OM needs revision, as the value is 0.635 for 'SV1' and 0.634 for 'OM1'. Second, the AVE of each construct should exceed 0.5. As shown in Table 4 all constructs meet the requirement except for 'CTL' construct. This construct AVE equals to 0.211(colour shaded) which indicated that these construct items need to be revised as they may influence the analysis of structural model in the next stage of the research.

On the other hand, discriminant validity was evaluated using the criteria suggested by Fornell and Larcker [50]. The authors suggested that discriminant validity is achieved when the square root of each construct's AVE is higher than the correlation of the construct to other latent variables. Table-5 shows the results of the discriminant validity test. All the diagonal values are the square root of AVE for each construct and are higher than their correlations with other constructs except for CTL. This implies that discriminant validity meets the criteria with a few adjustments on problematic construct like CTL and ITC.

**Table-4.** Factor loading and average variance extracted (AVE).

| Construct | Items | Loading | AVE |
|---|---|---|---|
| **CTL** | CTL1 | 0.425 | 0.211 |
| | CTL2 | 0.842 | |
| | CTL3 | 0.138 | |
| | CTL4 | -0.035 | |
| | CTL5 | 0.0378 | |
| **SV** | SV1 | 0.635 | 0.592 |
| | SV2 | 0.884 | |
| | SV3 | 0.733 | |
| | SV4 | 0.804 | |
| **OM** | OM1 | 0.634 | 0.575 |
| | OM2 | 0.799 | |
| | OM3 | 0.839 | |
| | OM4 | 0.696 | |
| | OM5 | 0.804 | |
| **IKS** | IKS1 | 0.836 | 0.697 |
| | IKS2 | 0.830 | |
| | IKS3 | 0.850 | |
| | IKS4 | 0.853 | |
| **ITC** | ITC1 | 0.849 | 0.536 |
| | ITC2 | 0.467 | |
| | ITC3 | 0.819 | |
| **ITCO** | ITCO1 | 0.860 | 0.679 |
| | ITCO2 | 0.708 | |
| | ITCO3 | 0.892 | |
| **ITPC** | ITPC1 | 0.855 | 0.761 |
| | ITPC2 | 0.858 | |
| | ITPC3 | 0.889 | |
| | ITPC4 | 0.915 | |
| | ITPC5 | 0.841 | |
| **MCA** | MCA1 | 0.826 | 0.655 |
| | MCA2 | 0.774 | |
| | MCA3 | 0.827 | |
| **OAA** | OAA1 | 0.880 | 0.791 |
| | OAA2 | 0.882 | |
| | OAA3 | 0.904 | |

## CONCLUSION AND FUTURE WORK

Pilot testing is often overlooked, but it is certainly an important fragment in any research. It aids in detecting possible glitches in the research design and instrumentation (i.e. if the inquired questions were clear to the targeted population or not). Furthermore, it certifies that the measurement instruments in the study are dependable and effectively measures the paradigms of interest. After a successful pilot testing, the researcher may then proceed with the larger data collection. Conducting a pilot study give researchers an advantage by


**Table-5.** Discriminant validity test.

| | CTL | SV | OM | IKS | ITC | ITCO | ITPC | MCA | OAA |
|---|---|---|---|---|---|---|---|---|---|
| Commitment to learning (CTL) | **0.459** | | | | | | | | |
| Share Vision (SV) | 0. 462 | **0.769** | | | | | | | |
| Open-mindedness (OM) | 0.338 | 0.544 | **0.758** | | | | | | |
| Intra-organisational knowledge sharing (IKS) | 0.370 | 0.429 | 0.679 | **0.835** | | | | | |
| Information Technology Compatibility (ITC) | 0.234 | 0.373 | 0.371 | 0.345 | **0.732** | | | | |
| Information Technology Connectivity (ITCO) | 0.307 | 0.306 | 0.423 | 0.504 | 0.532 | **0.824** | | | |
| Information Technology Personnel Competency (ITPC) | 0.205 | 0.284 | 0.434 | 0.446 | 0.402 | 0.514 | **0.872** | | |
| Market Capitalising Agility (MCA) | 0.256 | 0.537 | 0.436 | 0.580 | 0.139 | 0.396 | 0.473 | **0.809** | |
| Operational Adjustment Agility (OAA) | 0.177 | 0.385 | 0.532 | 0.493 | 0.172 | 0.326 | 0.493 | 0.591 | **0.889** |

providing awareness about the possible pitfalls in research, and areas where the research protocols were not followed or whether planned approaches or instruments are unsuitable or too complex. Nonetheless, the findings presented in this paper were preliminary data. The limitations of small dataset were presented and the actual study is required in realizing the main objectives and validating the proposed research model. In future, a valid and reliable research instrument will be deployed with a larger sample size for hypothesis testing.

This research aims to provide theoretical and practical contributions to academicians and practitioners. The finding of the larger study will provide a theoretical model that will help to build a new knowledge related to the learning orientation and IT infrastructure flexibility, which will further lead to organisational agility. Practitioners can also exploit the dimensions of the model to support their IT infrastructure flexibility, which permit organisations to rapidly respond to likely opportunities and threats. Moreover, practitioners may utilise the results to assess their learning orientation and IT infrastructure flexibility and consequently, develop effective learning, more flexible IT facilities and skilful IT personnel and successful organisational strategies.

## ACKNOWLEDGEMENTS

The author would like to thank everyone that is involved directly or indirectly with this project especially to Universiti Teknologi PETRONAS (UTP), and the Ministry of Higher Education (MOHE) for financial support throughout the research study.

## REFERENCES

[1] T. Ravichandran and C. Lertwongsatien, "Effect of information systems resources and capabilities on firm performance: a resource-based perspective," J. Manag. Inf. Syst., vol. 21, no. 4, pp. 237–276, 2005.

[2] V. Sambamurthy and M. Subramani, "Special issue on information technologies and knowledge management," MIS Q., vol. 29, no. 2, pp. 193–195, 2005.

[3] Y. Su and C. Yang, "Why are enterprise resource planning systems indispensable to supply chain management?," Eur. J. Oper. Res., vol. 203, no. 1, pp. 81–94, 2010.

[4] A. E. Akgün, H. Keskin, J. C. Byrne, and S. Aren, "Emotional and learning capability and their impact on product innovativeness and firm performance," Technovation, vol. 27, no. 9, pp. 501–513, 2007.

[5] G. D. Bhatt and V. Grover, "Types of information technology capabilities and their role in competitive advantage: an empirical study," J. Manag. Inf. Syst., vol. 22, no. 2, pp. 253–277, 2005.

[6] O. Çömlek, H. Kitapçı, V. Çelik, and M. Özşahin, "The effects of organizational learning capacity on firm innovative performance," Procedia-Social Behav. Sci., vol. 41, pp. 367–374, 2012.

[7] R. Hernández-Mogollon, G. Cepeda-Carrión, J. G. Cegarra-Navarro, and A. Leal-Millán, "The role of cultural barriers in the relationship between open-mindedness and organizational innovation," J. Organ. Chang. Manag., vol. 23, no. 4, pp. 360–376, 2010.

[8] Y. Malhotra, "Organizational learning and learning organizations: An overview, 1996." 2010.


[9] R. Preziosi, H. M. McLaughlin, and G. C. McLaughlin, "The Relationship Of Learning Orientation To Organizational Performance," J. Bus. Econ. Res., vol. 2, no. 4, 2011.

[10] T. A. Byrd and N. W. Davidson, "Examining possible antecedents of IT impact on the supply chain and its effect on firm performance," Inf. Manag., vol. 41, no. 2, pp. 243–255, 2003.

[11] J. Chen, F. Damanpour, and R. R. Reilly, "Understanding antecedents of new product development speed: A meta-analysis," J. Oper. Manag., vol. 28, no. 1, pp. 17–33, 2010.

[12] N. H. Hassan, N. I. Arshad, and E. E. Mustapha, "A literature review: Exploring organizational learning orientation as antecedent of Information Technology (IT) infrastructure capability to achieve organizational agility," in Research and Innovation in Information Systems (ICRIIS), 2013 International Conference on, 2013, pp. 204–209.

[13] Y. Lu and K. Ramamurthy, "Understanding the link between information technology capability and organizational agility: An empirical examination," MIS Quarterly-Management Inf. Syst., vol. 35, no. 4, p. 931, 2011.

[14] K. P. Gallagher and J. L. Worrell, "Organizing IT to promote agility," Inf. Technol. Manag., vol. 9, no. 1, pp. 71–88, 2008.

[15] G. Bhatt, A. Emdad, N. Roberts, and V. Grover, "Building and leveraging information in dynamic environments: The role of IT infrastructure flexibility as enabler of organizational responsiveness and competitive advantage," Inf. Manag., vol. 47, no. 7, pp. 341–349, 2010.

[16] R. A. Syler, "Exploring the fit of organizational culture traits and information technology infrastructure flexibility: A partial least squares latent variable modeling approach," Auburn University, 2003.

[17] H. Tohidi, "Organizational learning and learning organization," AWERProcedia Inf. Technol. Comput. Sci., vol. 1, 2012.

[18] E. Deniz Eris, T. Ozmen, and O. Neczan, "The effect of market orientation, learning orientation and innovativeness on firm performance: A research from Turkish logistics sector," Int. J. Econ. Sci. Appl. Res., vol. 5, no. 1, pp. 77–108, 2012.

[19] J. M. Sinkula, W. E. Baker, and T. Noordewier, "A framework for market-based organizational learning: linking values, knowledge, and behavior," J. Acad. Mark. Sci., vol. 25, no. 4, pp. 305–318, 1997.

[20] R. J. Calantone, S. T. Cavusgil, and Y. Zhao, "Learning orientation, firm innovation capability, and firm performance," Ind. Mark. Manag. vol. 31, no. 6, pp. 515–524, 2002.

[21] A. S. Bharadwaj, V. Sambamurthy, and R. W. Zmud, "IT capabilities: theoretical perspectives and empirical operationalization," in Proceedings of the 20th international conference on Information Systems, 1999, pp. 378–385.

[22] Y. Chen, Y. Wang, S. Nevo, J. Jin, L. Wang, and W. S. Chow, "IT capability and organizational performance: the roles of business process agility and environmental factors," Eur. J. Inf. Syst., 2013.

[23] P. Weill, M. Subramani, and M. Broadbent, "IT infrastructure for strategic agility," 2002.

[24] A. Zaheer and S. Zaheer, "Catching the wave: Alertness, responsiveness, and market influence in global electronic networks," Manage. Sci., vol. 43, no. 11, pp. 1493–1509, 1997.

[25] A. S. Bharadwaj, "A resource-based perspective on information technology capability and firm performance: an empirical investigation," MIS Q., pp. 169–196, 2000.

[26] N. B. Duncan, "Capturing flexibility of information technology infrastructure: A study of resource characteristics and their measure," J. Manag. Inf. Syst., pp. 37–57, 1995.

[27] S. Jorfi, K. M. Nor, and L. Najjar, "The relationships between IT flexibility, IT-business strategic alignment, and IT capability," Int. J. Manag. Inf. Technol., vol. 3, no. 1, pp. 16–31, 2011.

[28] T. A. Byrd and D. E. Turner, "An exploratory examination of the relationship between flexible IT infrastructure and competitive advantage," Inf. Manag., vol. 39, no. 1, pp. 41–52, 2001.

[29] J. Zhang, H. Li, and J. L. Ziegelmayer, "Resource or capability? a dissection of SMES'it infrastructure flexibility and its relationship with it responsiveness," J. Comput. Inf. Syst., vol. 50, no. 1, p. 46, 2009.

[30] A. Chanopas, D. Krairit, and D. Ba Khang, "Managing information technology infrastructure: a


new flexibility framework," Manag. Res. News, vol. 29, no. 10, pp. 632–651, 2006.

[31] R. Bi, B. Kam, and K. Smyrnios, "Building IT capability to increase organizational performance: A path-oriented process," Pacific Asia J. Assoc. Inf. Syst., vol. 3, no. 3, p. 3, 2011.

[32] M. van Oosterhout, E. Waarts, and J. van Hillegersberg, "Change factors requiring agility and implications for IT," Eur. J. Inf. Syst., vol. 15, no. 2, pp. 132–145, 2006.

[33] D. Seo and A. I. La Paz, "Exploring the dark side of IS in achieving organizational agility," Commun. ACM, vol. 51, no. 11, pp. 136–139, 2008.

[34] Y.-H. Tseng and C.-T. Lin, "Enhancing enterprise agility by deploying agile drivers, capabilities and providers," Inf. Sci. (Ny). vol. 181, no. 17, pp. 3693–3708, 2011.

[35] J. Barney, "Firm resources and sustained competitive advantage," J. Manage., vol. 17, no. 1, pp. 99–120, 1991.

[36] D. J. Teece, G. Pisano, and A. Shuen, "Dynamic capabilities and strategic management," Strateg. Manag. J., vol. 18, no. 7, pp. 509-533, 1997.

[37] M. Wade and J. Hulland, "Review: The resource-based view and information systems research: Review, extension, and suggestions for future research," MIS Q., vol. 28, no. 1, pp. 107–142, 2004.

[38] N. H. B. Hassan, N. I. B. Arshad, E. E. B. Mustapha, and J. Bin Jaafar, "Understanding the ways organizational learning drives information technology (IT) infrastructure," in Computer and Information Sciences (ICCOINS), 2014 International Conference on, 2014, pp. 1–5.

[39] K. M. Eisenhardt and J. A. Martin, "Dynamic capabilities: what are they?," Strateg. Manag. J. vol. 21, no. 10-11, pp. 1105-1121, 2000.

[40] Z. A. Hassan, P. Schattner, and D. Mazza, "Doing a pilot study: why is it essential?" Malaysian Fam. Physician, vol. 1, no. 2 and 3, 2006.

[41] N. Hassan, N. I. Arshad, and E. E. Mustapha, "Antecedent model of information technology infrastructure flexibility towards agility: questionnaire evaluation," in International Symposium on Mathematical Sciences and Computing Research (iSMSC) 2015, 2015.

[42] R. Czaja, "Questionnaire Pretesting Comes of Age," pp. 52-66, 1998.

[43] T. DeMaio and A. Landreth, "No Title," pp. 1-12, 1994.

[44] S. Hina and A. Oxley, "Participation/collaboration pattern: Perspectives of trust and security risks," in Computer and Information Sciences (ICCOINS), 2014 International Conference on, 2014, pp. 1-6.

[45] J. M. Cortina, "What is coefficient alpha? An examination of theory and applications," J. Appl. Psychol., vol. 78, no. 1, p. 98, 1993.

[46] J. F. Hair Jr, G. T. M. Hult, C. Ringle, and M. Sarstedt, A primer on partial least squares structural equation modeling (PLS-SEM). Sage Publications, 2013.

[47] D. Gefen and D. Straub, "A practical guide to factorial validity using PLS-Graph: Tutorial and annotated example," Commun. Assoc. Inf. Syst., vol. 16, no. 1, p. 5, 2005.

[48] X. Xu, W. Zhang, and R. Barkhi, "IT infrastructure capabilities and IT project success: a development team perspective," Inf. Technol. Manag., vol. 11, no. 3, pp. 123–142, 2010.

[49] C. M. Ringle, S. Wende, and A. Will, "SmartPLS 2.0 (beta)." Hamburg, 2005.

[50] C. Fornell and D. F. Larcker, "Evaluating structural equation models with unobservable variables and measurement error," J. Mark. Res., pp. 39–50, 1981.