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RESEARCH BRIEF

Exploring Antecedents to Thai Information and Communication Technology (ICT) Organizational Performance

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Thailand is quickly taking steps to embrace a sustainable, value-based economy under what has become known as *Thailand 4.0* (Tortermvasana, 2016). Building digital communities, creating digital innovative start-up networks, and establishing digital parks for small and medium-sized enterprises (SMEs) has become a Thai government priority (Jones & Pimdee, 2017). This is easy to understand knowing there are 2.7 million Thai SMEs, which account for 98% of all business units in Thailand, and 37% of Thailand gross domestic production (GDP), providing 10 million jobs in 2014 ("Digital economy," 2015). Information and communication technology (ICT) therefore, is one of key drivers of national development, particularly for achieving a transition to a knowledge-based, digital economy ("Thailand 4.0 mean opportunity Thailand," 2017; The Government Public Relations Department, 2016).

McKinsey & Company released a report in April 2017 discussing digital transformation and China's manufacturing productivity and indicated that an annual growth of 6.5% over the next 15 years is possible if executed correctly (Xuequan, 2017). Tan (2016) has also indicated that a 20% investment in ICT contributes 1% to gross domestic production (GDP), a 2.1% increase in competitiveness, a 2.2% increase in innovation, and a 2.3% in productivity. The effective use of ICT can also improve life quality, reduce educational gaps, and raise efficiency in industrial production and government service provisioning ("Thailand science technology and innovation profile," 2014).

However, shortages of industry-ready skilled workers present one of the biggest challenges for the five core member countries of the Association of Southeast Asian Nations, ASEAN-5, as they strive to realize their economic visions (Kraisuth & Panjakajornsak, 2017; Tan & Tang, 2016). Disruptive technologies also threaten to render jobs obsolete in many industries, including those in ICT.

To offset these problems and professionally staff the environments and educational institutions necessary for sustainable growth, and as part of the Thailand 4.0 initiative to support 10 key economic sectors, the Thai government has also announced plans to budget US$ 1 billion for 12,290 doctoral researchers to serve

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the country's industrial development and serve human resource development needs over the next 20 years (Kraisuth & Panjakajornsak, 2017). To put this goal in perspective, only 1,295 individuals were enrolled in science and technology PhD programs in 2013, as compared to 2,138 doctoral candidates in Thai university social sciences and humanities programs ("Thailand science technology and innovation profile," 2014).

The Thailand 4.0 PhD sponsorship campaign is part of the Royal Golden Jubilee PhD Programme, which since 1996 has been under the auspices of the Thailand Research Fund. In 2014, Thailand had 9.5 doctoral researchers per 10,000 people, which the present government wishes to increase to 80 researchers per 10,000 people by 2036 ("Govt designs 20-year plan," 2016). Also, according to a 50-nation digital economy study from Huawei Technologies, Thailand only has one information technology worker per capita, as compared to the study average of 3.18 workers (Tan, 2016). It seems both Thai academic and ICT professional human resource development needs serious improvement in the upcoming years.

In Thailand, the National Economic and Social Development Plan (NESDP) serves as the roadmap for economic development with the 12th Plan (2017−2021) aiming to transform, upgrade, and increase the research and development focus of key domestic industries, including automotive, agriculture, food manufacturing, tourism, and hospitality (Kumpa, 2016; Tan & Tang, 2016). The ICT and the education sectors will be instrumental in providing the physical and digital infrastructure, as well as the human capital needed to support the transformation. This is consistent with Numprasertchai and Igel (2005) which concluded that ICT communication, collaboration, and storage technologies are essential tools for collaboration within Thai university research environments.

Unfortunately, although ICT expenditure accounted for 7% of Thai GDP in 2015, of the projected annual requirement of 6,000–7,000 Thai ICT professionals, only 10% of the ICT graduates are considered employable according to interviews conducted with Association of Thai ICT Industry members (Tan & Tang, 2016). This is a major reason that the Thai government has singled out human capital development as a key focus of the 12th NESDP 2017–2022, and implemented other plans such as the STEM Masterplan 2015.

Literature Review

Knowledge Management

KPMG International (2014) has identified nine, interrelated, global megatrends, with the main reason for their interrelations coming from ICT. Knowledge management (KM) and ICT are thus transforming societies, with some developing nations "leap-frogging" technologically over older industrial nations. Digitalization is changing business models (Jones & Pimdee, 2017), customer relationships. and perceptions together with markets and competitive landscapes (Ernst & Young, 2015; KPMG International, 2014).

King (2009, p. 4) also discussed KM and organizational learning, and defined KM as the "planning, organizing, motivating, and controlling of people, processes and systems in the organization to ensure that its knowledge-related assets are improved and effectively employed." This was consistent with a meta-analysis study of hospitality organizations conducted by Hallin and Marnburg (2008), which also concluded the importance of KM in sustaining a competitive advantage (Ahmad & Schroeder, 2003; Buhalis, 2003; Hallin & Marnburg, 2008).

Hinton (2003) indicated from research in Australia and New Zealand that KM and data transfer is also critical to the competitiveness of the organization. Sheldon (1997) also confirmed the importance of information technology within the tourism industry, while Kahle (2002) also discussed the importance of ICT in achieving customer satisfaction.

King (2009) also stated that organizational learning is complementary to KM, and in reality, it is the goal of KM. Organizational learning therefore is the embedding of what has been learned into the fabric of the organization. This is consistent with Easterby-Smith and Lyles (2003), which indicated that the mission of organizational learning is to focus on the process, while the mission of KM is to focus on the content of the knowledge that an organization acquires, creates, processes, and eventually uses.

Sain and Wilde (2014) stated that a modern knowledge-based society needs to have employees which are competent with respect to their productivity, right knowledge use, and who focus on customer satisfaction. A key pillar of Thailand 4.0 and the new knowledge base economy requires skilled and innovative workers. An organization is therefore well-advised to match its current employee competencies with the organization's business strategy and goals.

From a review of the theory and research, the following hypotheses are proposed:

H1: Knowledge management directly affects organizational communications.
H4: Knowledge management directly affects employee competency.
H5: Knowledge management directly affects organizational performance.

Human Resource Management (HRM) Systems

From a 636-senior executive survey conducted by the Economist Intelligence Unit (2013) concerning present and future HR challenges, 50% indicated that people management was their greatest concern due to multi-generational workforces with growing cultural diversity. These same executives also voiced serious concern over the current disconnect between the skills fostered by education, and those actually needed by 21st century workers, and the considerable obstacle this significant problem presents in the coming years (Economist Intelligence Unit, 2013; Reeve, 2016).

Dechawatanapaisal (2005) investigated how HRM practices in 12 large Thai corporations affected ICT professionals learning capabilities. From the 524 questionnaires used, it was determined that staffing, training, and development as well as performance appraisal and pay are strong enabling drivers that enhance people's learning behaviour and promote a climate of organisational learning.

In Malaysia, it was also concluded that in ICT SMEs, human resource management practices had significant and positive impacts on innovation and internal process, as well as an ICT firm's employee learning and growth (Mansouri & Goher, 2016). Another study from the USA indicated that the most significant factor affecting retention rates was job advancement opportunities (Oladapo, 2014). In Greece, Katou (2012) studied 197 small firms and found that HRM policies, being contingent on business strategies (cost, innovation, quality), had a positive effect on organizational performance through employee attitudes and employee behaviors. From a review of the theory and research, the following hypotheses were proposed:

H2: Human resource management systems directly affects employee competency.
H3: Human resource management systems directly affects organizational communications.
H6: Human resource management systems directly affects organizational performance.

ICT Organization Performance

Salim and Sulaiman (2011) studied 115 Malaysian ICT SMEs and confirmed that organizational innovation has a significant influence on enterprise performance, with research from Taiwo and Edwin (2016) also confirming the significant positive relationship between ICT and organizational performance.

Organizational Communications

Wong, Ou, Davison, Zhu, and Zhang (2016) researched Web 2.0 applications, such as instant messengers and other social media platforms, in China and determined that they are fast becoming ubiquitous in organizations but their impact on work performance contributes significantly to individual and teamwork performance. These applications further enable employees to reach out to collaborators and business partners, thereby boosting individual productivity and team collaboration.

This is consistent with research by Parveen, Jaafar, and Ainin (2015) on Malaysian managers' use of social media at work, and stated that it is used for a multitude of purposes in organizations, including advertising and promotion, branding, information search, and building customer relations. Additionally, the results also showed that social media has a greater impact on the performance of organizations in terms of enhancement in customer relations and customer service activities, improvement in information accessibility, and cost reduction in terms of marketing and customer service.

After a review of the literature and development from the above concepts, the following hypothesis was created:

H7: Organizational communications directly affects organizational performance.

Employee Competency

Ismail and Abidin (2010) evaluated 1,136 Malaysian professionals involved in education, health, and ICT, with results showing the significant connection between workers' competence, human capital, and workers' characteristics on their performance.

In Thailand, however, many ICT firms are hesitant or unable to provide worker training due to the widespread practice of poaching by other companies. This in turn affects the employees' incentives to stay in the ICT SMEs, contributing to a vicious cycle of having high turnover rates and underqualified staff (Tan & Tang, 2016).

After a review of the literature and development from the above concepts, the following hypothesis was created:

H8: Employee competency directly affects ICT organizational performance.

Therefore, from the review of the literature and theory, Figure 1 presents the conceptual model for antecedents affecting ICT organizational performance.

Methods

Sample

The population of this study was ICT professionals who were members of Thailand's Association of Thai ICT Industry (ATCI), whose membership represents 80% of all computer hardware and software manufacturers, distributors, and ICT service providers. With such strong representation, ATCI plays a significant role in the development of National ICT policy and the Thai government's ICT Master Plan.

Sample collection commenced in February 2016 and continued through April 2016. Convenience sampling was used to target ICT professionals at ATCI related meetings, seminars, conventions, and association events, where individuals were asked to respond to the 68-item questionnaire.

The questionnaire

The questionnaire was divided into two parts, with Part 1 consisting of eight items concerning the respondent's general and personal information while Part 2 consisted of five parts and 60 items affecting ICT organization performance. The questionnaire items related to the constructs were measured by means of a 1 to 7-point Likert agreement scale ranging from Strongly disagree (1) to Strongly agree (7).

Furthermore, qualitative research was conducted by use of in-depth, semi-structured, guided interviews

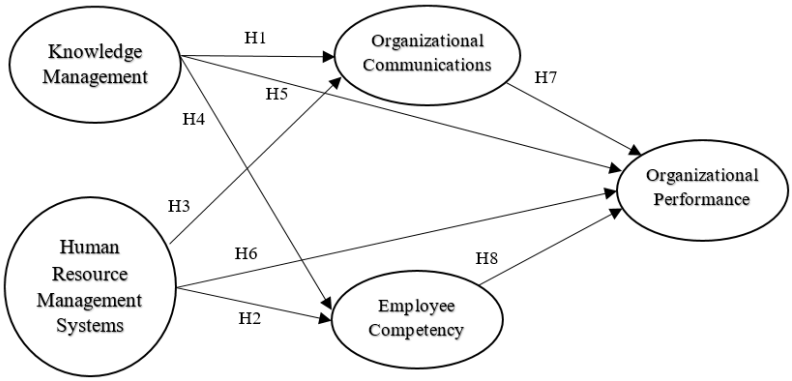

Figure 1. Conceptual model.

with five experts (two university ICT lecturers, two ATCI ICT members, and one executive from a Thai banking ICT support group) to determine the questionnaire's content validity which covered the four latent variables that were either revised or deleted based upon comments/feedback from each expert. Verification of the content validity was confirmed using the Index of Consistency. To evaluate the internal consistency of constructs, Cronbach's alpha was used to test the unidimensionality of the 7-level agreement scale questionnaire items and measure to which extent all the variables are related to each other (Tavakol & Dennick, 2011) from the initial 30 sample test survey. Various scholars have reported on different acceptable values of alpha, ranging from 0.70 to 0.95 (Hair, Hult, Ringle, & Sarstedt, 2016; Nunnally, 1978). The correlation coefficient results were within all recommended acceptable ranges and were between 0.796 to 0.958.

To further determine if the sample size of 280 ICT professionals selected by use of convenience sampling for the study was adequate, we further confirmed this to be the case from previous researchers (Hair et al., 2016) in which a ratio of 20 individuals for each observed variable is suggested. As the study had five latent variables, 280 questionnaires collected was deemed as sufficient and reliable. Analysis of ICT organization performance was conducted using descriptive statistics including frequency, percentage, mean, and standard deviation.

Confirmatory Factor Analysis (CFA)

Quantitative data analysis and confirmatory factor analysis (CFA) was also conducted by use of LISREL 9.10 to test manifest variables and latent variables and test the research hypotheses. In conducting a CFA, it is absolutely necessary to establish convergent and discriminant validity, as well as reliability which can be measured by both composite reliability (CR) and average variance extracted (AVE) (Chau, 1997).

Reflective model structures were created for this research and tested for convergent validity and discriminant validity. The criteria for convergent validity states that the loading value must be positive, and the indicator loading values must be over 0.707, having a statistical significance of ($| t | \geq 1.96$) for all values (Lauro & Venzi, 2004). Establishing discriminant validity also requires an appropriate AVE analysis (Gefen & Straub, 2005). Normally, the square root of the AVE of each construct should be significantly greater than the correlation of the specific construct with any of the other constructs in the model (Chin, 1998) and should be at least .50 (Fornell & Larcker, 1981; Lauro & Vinzi, 2004).

The root mean square error of approximation (RMSEA) is also an extremely informative criterion in evaluating model fit. The RMSEA index measures the discrepancy between the observed and estimated covariance matrices per degree of freedom (Steiger, 2007). It measures the discrepancy in terms of the population and not the sample. Thus, the value of this fit index is expected to better approximate or estimate the population and not be affected by sample size. Again, values run on a continuum from 0 to 1. Values less than 0.05 indicate good fit.

Results

Characteristics of the Respondents

From a potential survey population of 634,981 individuals involved in ICT in Thailand (Pinprayong, 2016), 280 respondents were eventually surveyed by use of convenience sampling conducted at ATCI sponsored ICT related conferences.

Of the 280 respondents for the study, most were male (72.0%) and under 30 years old (73.4%). "System Operators" were in the majority (30.2%), followed by "Programmers" (12.4%). The average salary for those surveyed was less than US$700 per month (24,000 Baht), while the majority (78%) had less than 10 years experience. Nearly all had a bachelors degree, with 18% having a graduate degree, but only 60% of this higher edcation were ICT related.

CFA Results

From the CFA analysis, RMSEA was determined to be < .05 (Figure 2 and Figure 3). Additionally, other goodness of fit statistics (GOF) indicated the following: $\chi 2$ was statistically insignificant ($p > .05$), $\chi 2$ / df < 2.00, goodness-of-fit index - GFI > .90, adjusted goodness of fir index - AGFI > .90, and the standardized root mean square residual - SRMR < .05.

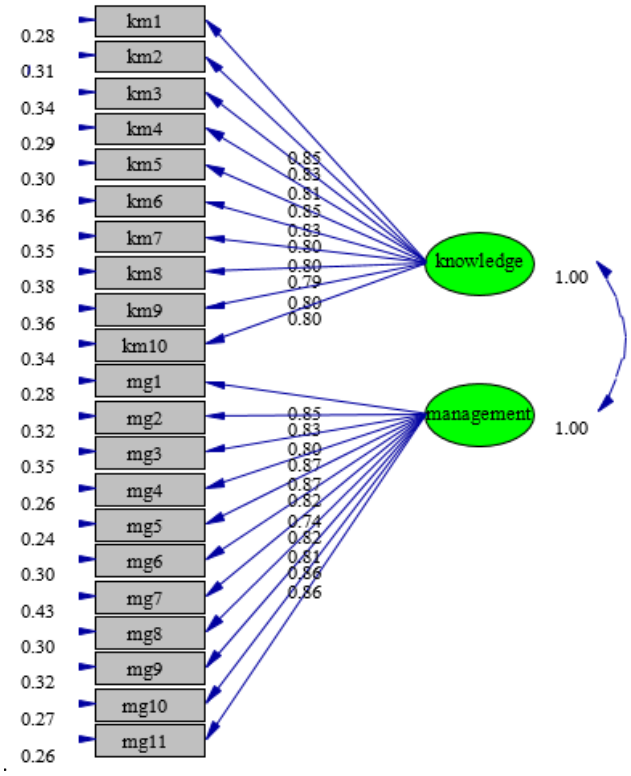

Figure 2. Confirmation of external latent variables.

Note: Chi-Square=101.48, df=128, *p*-value=0.95960, RMSEA=0.000

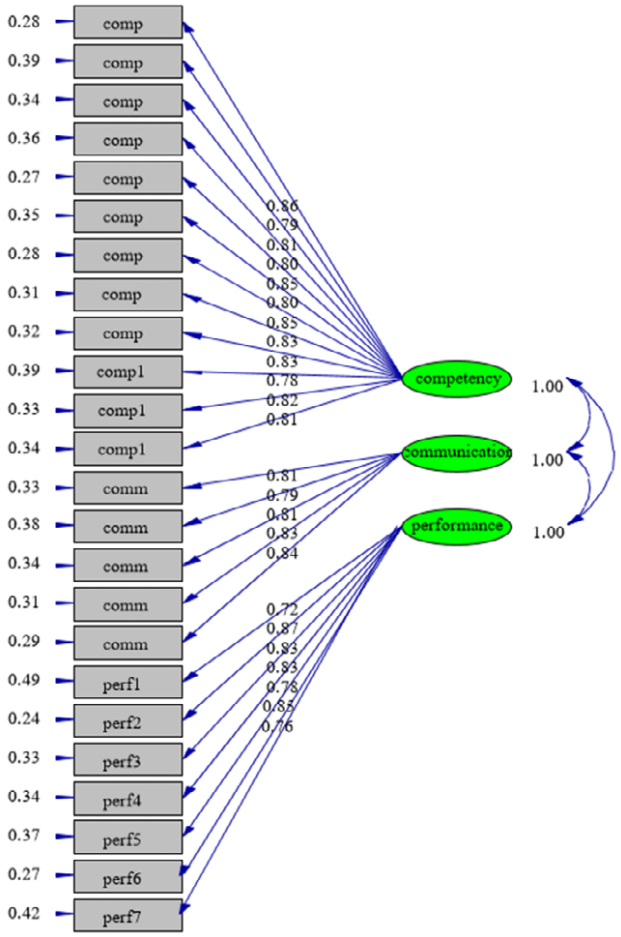

Figure 3. Confirmation of latent internal components.

Note: Chi-Square = 131.93, df = 178, *p*-value = 0.99604, RMSEA = 0.000

Construct Validity

Research construct validity testing used both convergent and discriminant validity in combination, to establish overall validity. Technically, convergent validity can be evaluated by three tests; item reliability, composite reliability and average variance extracted (AVE) (Chau, 1997) (Table 1). The first measure, item reliability is indicated if items have significant factor loadings of 0.50 or above. The second measure, composite reliability, is assessed based on the criteria that the indicator's estimated pattern coefficient is significant on its underlying factor, which should have a threshold value for construct reliability at 0.70 or higher (Nunnally, 1978). Table 1 shows that the CR was higher than 0.60, with all AVE values higher than 0.50, and all R^2 values classified as "substantial" (Hair et al., 2016).

SEM Hypotheses Testing Results

Results from the structural equation model (SEM) hypotheses testing are shown in Figure 4. The statistical significance level is at .05 ($p < .05$). Estimates close to the latent variables are their squared multiple correlations (R^2).

Table 1
Correlation Coefficients Between Latent Variables (Under the Diagonal), the Latency of the Latent Variable (pc) and the Average Variance Extracted (AVE)

Latent Variables	**competency**	**communications**	**performance**	**knowledge**	**management**
Employee competency (competency)	**1.00**				
Organizational communications (communications)	0.762	**1.00**			
Organizational performance (performance)	0.735	0.883	**1.00**		
Knowledge management (knowledge)	0.771	0.901	0.849	**1.00**	
Human resource management systems (management)	0.811	0.780	0.724	0.726	**1.00**
ρ_C (Construct Reliability)	0.958	0.910	0.934	0.952	0.956
ρ_V (AVE)	0.668	0.669	0.649	0.667	0.687
	0.817	0.819	0.806	0.817	0.829

Notes. Statistical significance level is at the 0.01 level and the numbers in the diagonal figures indicates $\sqrt{AVE}$. CR = composite reliability, AVE = average variance extracted, R^2 = square of the correlation.

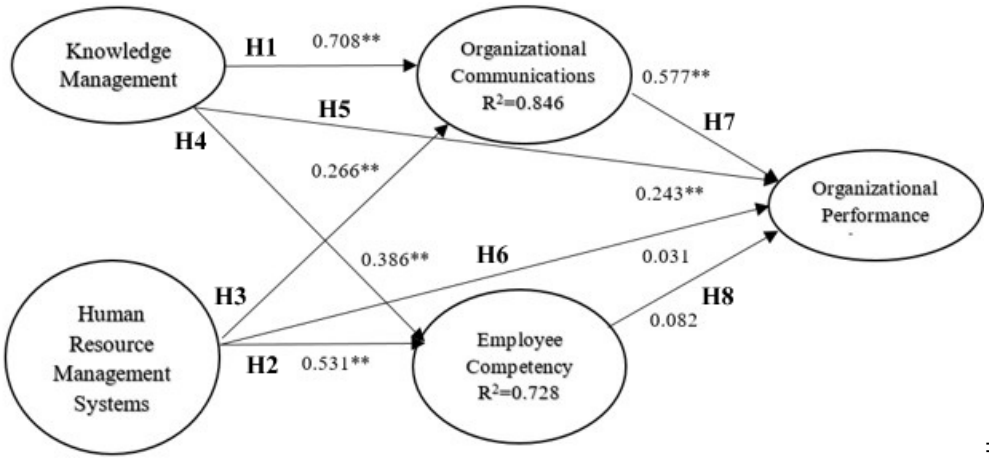

Figure 4. Final SEM of ICT organizational performance.

Note: Chi-Square = 745.11, df = 754, *p*-value = 0.58417, RMSEA = 0.000

Figure 4 and Table 2 show the results of the final hypotheses testing. The chi-square values were not statistically significant, $p = 0.58$, RMSEA = 0.00, GFI = 0.89, AGFI = 0.85 and SRMR = 0.03. All the causes of the model have a positive influence on the performance variables due to the 74.6% of the variance (R^2) can be described together. The four causal variables ranked in importance are knowledge management, organizational communications, human resource management systems, and employee competency, as reflected by their total effect (TE) scores of 0.683, 0.577, 0.228, and 0.082 in bold in Table 3, respectively.

Hypothesis Testing

Table 3 shows the direct effect (DE), indirect effect (IE), and total effect (TE) of each construct on the hypotheses testing. The *p* value is the "level of significance" with a $p < 0.05$ indicating that the probability that the result is observed due to chance being 5%, or a "false positive" result (McDonald, 2014). Furthermore, Hair et al. (2016) indicated that R^2 values of 0.75 are substantial, 0.50 are moderate, and 0.25 are weak.

Table 2
Research Hypotheses Test Results

Hypotheses	Coef.	t-test	results
H1: Knowledge management directly affects organizational communications.	0.708	10.628*	passed
H2: Human resource management systems directly affects employee competency.	0.531	8.617*	passed
H3: Human resource management systems directly affects organizational communication.	0.266	4.926*	passed
H4: Knowledge management directly affects employee competency.	0.386	6.687*	passed
H5: Knowledge management directly affects organizational performance.	0.243	2.113*	passed
H6: Human resource management systems directly affects organizational performance.	0.031	0.429	rejected
H7: Organizational communication directly affects organizational performance.	0.577	4.453*	passed
H8: Employee competency directly affects organizational performance.	0.082	1.176	rejected

Note: *Significance < 0.01

Discussion

Based on the results of this study, knowledge management in ICT was established as the most important enabler. This variable has been validated in previous studies by both Dechawatanapaisal (2005) and Tan and Nasurdin (2011), which indicated the importance of critical components such as employee training, employee involvement, and teamwork.

Organizational communications ranked second in importance in this study on Thai ICT organizational performance, which is consistent with other research from an Economist Intelligence Unit study in which it was concluded that social media has been by far the major technology focus of digital transformation initiatives, as stated by 72% of the EIU respondents (Pegasystems, 2016).

The boundaries between the private world and the work world are also no longer clear, with workers using personal social media at work, with chat programs blurring the lines between home and work, with concepts such as Work-Life Balance, Line-me, and Weisure Time (work/leisure time) becoming common. Learning through social networking is becoming very

important as well, with the "e"-decade (e.g., e-learning, e-book, e-commerce, etc.), morphing into the "s"-decade, or an era of social networking and social media (Mulgan, 2017). Organization communications through digital communications technologies such as Twitter, Line, Facebook, Messenger, and so forth in the workplace is no longer optional, as the applications have embedded themselves within the core of an organization's communications process.

In addition, the results showed that human resource management systems (0.531) has a direct and positive impact on employee competency, which corresponds to Tan and Nasurdin (2011), which indicated the importance of staff training systems. Hypothesis 6 however was rejected, which conjectured human resource management systems importance and direct relationship on Thai ICT organizational performance. Speculation for this rejection lies in the nature of Thai ICT organizations and the hiring culture surrounding it, as in Thailand, most ICT falls within the domain of the 2.7 million Thai SMEs, which account for 98% of all business units in Thailand ("Digital economy," 2015).

As these SMEs are small (less than 15 individuals), and rely mostly on word-of-mouth practices in their hiring process, support systems are relatively simple, and few go beyond simple email. Poaching is another contributing factor, as many ICT firms are hesitant to take on additional costs that human resource management systems entail (training, management skills, personnel skills, etc.), as many firms feel this will contribute to the future loss of their staff (Tan & Tang, 2016) to other organizations. Some have summarized this process with, "dumb workers are better than no workers."

This problem has also been recognized in various reports, one of which was from the American Chamber of Commerce (2016) study in Thailand, in which it was stated that Thai ICT has a unique HR challenge as there is a shortage of people with the required technical skills as well as the necessary English skills to implement and run regional and global ICT projects. The suggested solutions therefore are to allow easier work permits and minimum capital and staff ratio metrics, so that incentives are made which will encourage foreign ICT professionals to re-locate to Thailand.

The fortunate thing is that digital communications allows organizations to have access to a global talent pool that can connect across borders, languages, time zones, and generations (Cancialost, 2016). This can solve many problems associated with the reliance on a local, unskilled workforce, and a workforce not linguistically prepared for an international environment (Pinprayong, 2016). Some might use India's Bangalore IT outsourcing hub as an example of this process and its success (Hill, 2017).

Hypothesis 8 was also rejected in the study. The hypothesized relationship between employee competency and Thai ICT organizational performance was also rejected, and once again, most probably due to the uniqueness of Thai culture and the small size of most SME business units. Much of Thai business is based on "personal relationships," and ICT personnel and functions play secondary roles to these entrepreneurial management relationships. This however is not the case when the ICT role is in organizations which expands across international borders, which if not properly utilized can often times lead to a business's failure or demise (e.g. small regional airlines, travel agencies, and electronics and auto parts suppliers).

However, given the importance of Thailand 4.0 and Thailand's goal for a digital economy based on knowledge management, planning is paramount to success (Jones & Pimdee, 2017; Reeve, 2016; Tan & Tang, 2016; Tortermvasana, 2016). This includes online management, digital content, and understanding and implementing the "Internet of Things," as nearly everything in the future is linked to the Internet world. Mobile, smartphone technology has become the elephant in the room, with nearly every conceivable innovation such as the Thai National e-Payment, PromptPay, and Thailand 4.0 based around it.

ICT organization performance is also central to the Thai 20-year Digital Economy Master Plan which could contribute as much as 30% to Thailand's gross national product (GNP) by 2020. The Thai National Digital Economy Master Plan has six strategies focused on: (1) hard infrastructure, (2) digital economy acceleration, (3) digital society, (4) service infrastructure, (5) digital workforce, and (6) soft infrastructure, which represents US$ 4.01 billion by the end of 2019 to the IT services market (International Data Corporation, 2016). Within

ASEAN, implementation of a radical digital agenda could add $1 trillion to regional GDP over the next 10 years, up from $2.5 trillion now (A. T. Kearney, 2016).

Conclusion

A popular theme within recent literature is that the ability to learn and leverage knowledge of people is the primary source of sustainable competitive advantage for organisations (Dechawatanapaisal, 2005). This is supported by "Thailand 4.0 mean opportunity" (2017) report that ICT is one of key drivers of national development, particularly for achieving a transition to a knowledge-based, digital economy. Hard data supports these reports, as Thailand's Internet of Things (IoT) is forecast to have 400 million connected devices by 2020 (Oxford Business Group, 2017). Therefore, it is imperative that Thailand embrace policies to support ICT employee education and competency and the Thailand 4.0 initiatives (OECD/UNESCO, 2016). Managing disruptive technologies requires a paradigm shift in the thinking of policy makers, employers (particularly SMEs), and employees alike, who must find new ways to develop a skilled but flexible workforce, that accepts the need for continuous and lifelong learning (Tan & Tang, 2016). Specifically, this study agrees with other regional research that suggests that education and training institutions at all levels, have not been able to equip graduates adequately with skills that the growth industries need (American Chamber of Commerce, 2016). The low competency level in STEM education, and the shortage of workers with sufficient technical and engineering skills (Reeve, 2016), could threaten to derail the ambitious industrial development plans of Thailand (and its neighbours) and their move towards a more technology-and knowledge-intensive economy (Tan & Tang, 2016). The International Data Cooperation (2016) predicted that the Digital Economy Master Plan, if "done right", will be able to contribute to as much as 30% of Thailand's gross national product (GNP) by 2020. The main obstacle to this journey however, is the limited and qualified supply of ICT workers across all sectors and industries.

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