

An Empirical Investigation On The ICT Competency Readiness in ICT SME Sector Towards The Digital Economy In Thailand

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Abstract

This research addresses on the Thailand ICT competency readiness towards the Digital Economy in ICT SME sector which ICT HR competency is a key factor to drive the sector and the country towards the economic growth and social development. The in-depth interview and focus group with the experts from the ICT SME stakeholders from government, industry, business and academic sectors specify the required competencies which consist of not only knowledge and skills but also attitudes which are much more the important part. From the study, besides the current major concerns on the ICT readiness of ICT SME sector are presented, the ICT SMEs reveal that there is a big gap between the existing ICT competencies and the required ones while the ICT competencies which need to take as a priority to be developed are also identified. This research calls for serious attention from all stakeholders to take action to develop competencies of ICT workforce and improve the current Thailand's ICT Competency Readiness. The results of this ICT Competency Readiness research will help all stakeholders in ICT SME sectors be able to prepare ICT workforce with the right national policy to propel Thailand to be competitive in the Knowledge-based Economy and the ASEAN Community.

Keywords: ICT competency, Digital Economy, Knowledge-based Economy.

1. Introduction

1.1 SME in ASEAN and Thailand

ASEAN is entering a new phase in its cooperation as

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members move towards building an ASEAN Economic Community (AEC) by 2015. The single market will open up unprecedented opportunities for businesses and citizens of ASEAN member states, allowing goods to flow freely and seamlessly within a market that has a population of over 600 million people. It will emerge and present itself as a stronger community on the global stage, bringing a multitude of opportunities for ASEAN small and medium enterprises (SMEs). ASEAN's efforts to define a post-2015 ASEAN Economic Community (AEC) is an opportunity to address the competitiveness of its largest economic base – the small and medium enterprises (SMEs) sector – to achieve inclusive and sustainable economic growth for the region [1].

Accounting for more than 96 per cent of enterprises in ASEAN, SMEs are a significant engine of growth in the region and must seek to remain competitive. Within ASEAN, SMEs make up 92-99% of all commercial enterprises, employing 77-97% of the domestic work force in Indonesia, Thailand and Vietnam, and 58-62% in other ASEAN countries. It is expected by 2015, ASEAN SMEs will form a major part of regional and global supply chains. SMEs are also an important vehicle for gender empowerment with women-owned business constituting 38-47% of formal-sector SMEs in East and Southeast Asia [1]. It can be rather safely said that, in the ASEAN economies, SMEs including micro enterprises account for 97 to 99.9 % of all enterprises, and for 53% (Malaysia) to 97% (Indonesia) of employment, and contribute to 30% (Malaysia) to 58% (Indonesia) of GDP in each country [2].

At the regional level, the ASEAN leaders have recognized



SME development as a vital element for the AEC to be a competitive and equitable economic region. That is why ASEAN has formulated SME-specific policies. With this, the Action Plan for ASEAN SME Development (SAPASD) 2010-2015 has been devised to engage the businesses on issues of access to finance, technology development, and human resources development, among others, in order to enhance the resiliency and competitiveness of SMEs [3].

Regarding SMEs in Thailand, the country has established the Office of SME Promotion (OSMEP), a government agency under the governance of the Ministry of Industry, as the central agency responsible for coordinating and aligning the works of state agencies and private entities on SMEs. The SME sector development strategies are implemented under rolling five-year SME Promotion Master Plans. The Third SME Promotion Master Plan 2012-2016 has been adopted to promote Thai SMEs towards a global market. Four strategies are designed to strengthen Thai SMEs [3].

In 2010, there were 2,924,912 enterprises in Thailand which 99.6% were SMEs with contribution at 42.35% of GDP and 28.40% of national export value with nearly 12 Million employments [4]. Concerning this, in order to learn about the current potential and competitiveness of SMEs in each sector and to have the strategic plan to promote those SMEs in-line with the 11th National Economic and Social Development Plan and the Third SME Promotion Master Plan 2012-2016 above, OSMEP organized the project called “The Plan for Strategy and Operation to promote SMEs in ICT and Digital Content sectors” which will make the Third SME Promotion Master Plan 2012-2016 achieve its goals. On the study, the ICT and Digital TV/Broadcasting are among the fastest growing sectors at present with the growth rates at 89.2% and 88.2% accordingly. OSMEP classified the ICT and Digital Content sectors into two main business sectors which are 1. Computer Software: Enterprise Software, Mobile Application Software and others and 2. Computer Services: Software Maintenance Services, Service and Application Hosting, Software as a Service (SaaS), Software Services

Outsourcing, Software-related Training and Education and others. While the total IT and Telecommunication market in 2012 had value at 14.6 Billion USD, the Telecommunication has the largest market share at 76.9% and the Hardware and Software/Software services were at 17.6% and 5.5% consequently. Hence, in 2012, there were nearly 5,000 companies in the Software/Software services (Computer Software/Computer Services) sector and had market value at 1 Billion USD with growth rate at 17.2% in 2012. Besides the direct contribution to economy growth from the ICT and Digital Content sector, the ICT applications and services have been both direct and indirect enabler/contributor to the other SME sectors ranging from production, service and trading [4].

From the survey by Software Industry Promotion Agency in 2011, there were ICT related personnel who were ICT personnel at 17,254 persons (72% of the total employees in ICT areas) and non-ICT personnel at 6,868 persons (28%) with the ratios of Programmer at 36.0% and System Analyst at 11.4% accordingly. In 2013, the ICT positions which had the highest demand were the Programmer (38.5%), Tester (9.1%), Business/Software Analyst (4.3%), Software Engineer (6.3%) and Software/IT Project Manager (6.2%) accordingly [4].

With the information gathering from the focus group discussion and the research survey from the experts and stakeholders in the areas of ICT and Digital Contents, there have been some key factors which impact to the development of the SMEs and need to be taken care of urgently which are ability to access to financial resource, shortage of workforce, database for SMEs, rules and regulations and marketing. Particularly, on the human resource aspect, there have been issues on the required technical qualification and language skills which academic sector could not supply sufficient amount of graduates while their qualifications could not correspond to the ICT sector’s requirements due to the curriculum could not cover and align with the current business practice. The survey suggests that there should be the new way of teaching and learning and the short courses taught by

experienced instructors [4].

1.2 SME with Knowledge-based Economy and Digital Economy

At the 13th ASEAN Summit on 20 November 2007, the ASEAN countries aimed to increase the region's connectivity and competitiveness, strengthening on human resource cooperation, particularly on regional standardization of ICT human capital competencies to increase knowledgeable and versatile workforce in efforts to build an inclusive knowledge-based ASEAN Community in 2015 [5]. Kefela [6] noted that most ASEAN leaders and governments have embraced visions of developing a knowledge-based economy and a knowledge society as a way to achieve parity with western nations. These also include the countries like Malaysia, Singapore, Philippines and Thailand.

While many governments around the world have shown interest in a "Digital Economy" and are using this type of policy to boost economic growth, the Thai government announced its "Digital Thailand" plan that lays out development plans to transform Thailand into a "Digital Economy" which is one of the government's top priorities to foster the economic and social prosperity of the country. During the past year, this policy has progressed with the establishment of a Ministry of Digital Economy and Society earlier in 2017 and the drawing up of a "Digital Thailand" plan. Back in December 2016, the Thai government announced the Digital Economy and Society Development Plan (or Digital Thailand Plan). The Plan acts as a digital blueprint to revolutionize government operations, business practices and people's lifestyle. The ultimate goal is to bring about social stability as well as economic wealth in country. This plan is an extension of accumulative work that the MICT and partners in public, private, academic and civil society sectors have built for decades. The key objectives of the Digital Thailand plan are to set a government framework for allocating both human and financial resources required to drive the country towards a digital common goal, without investment redundancies while intending to raise capacity and competitiveness in all

economic sectors with digital technology including agriculture, manufacturing and services with a strong focus on SMEs and community business. In addition, the plan aims to build capacity and prepare both IT and non-IT workforce for the digital era [7]. This also corresponds to the Thailand ICT2020 Policy Framework aiming to lead Thailand towards a knowledge-based economy and society by using ICT as a driving force to create knowledge, creativity and innovation in goods and services. The important aim of the strategy is to allow Thailand to have sufficient high quality manpower that is capable of developing and using ICT efficiently in order to be prepared for national development in the era of the service economy and creative economy [8].

With the significant impact of SME sector, particularly in the ICT SME sector, on its major contribution to the economy in Thailand, the success of ICT SMEs will help promote the country's Digital Economy policy. Unfortunately, many SMEs in Thailand fail each year. According to the Thai Ministry of Commerce, the failure rate was more than 50% in 2010. This indicates that business failure is a huge problem among SMEs. Many studies have suggested that business failure is due largely to skill, knowledge and competency of entrepreneurs. As human capital and entrepreneurial competency can be improved through education and training, SMEs in Thailand still require an improvement in SME entrepreneurs' quantity and quality of life, for instance, consultants, educational-training program developers, academic researchers, and policy makers to improve their understanding of the effects of human capital and entrepreneurial competency on the career success of SME entrepreneurs in Thailand. In other words, there is a need to attain a better understanding of the effects of human capital and entrepreneurial competency on the career success of SME entrepreneurs in Thailand [9]. The ICT human resource development to build workforce in ICT SME sector with the right competencies to be capable enough to develop and use ICT efficiently is a key success factor to promote the country economy growth. Therefore, the understanding on the ICT

competency readiness including ICT competency gap, particularly in the ICT SME sector, to identify the requirement from the ICT SME sector on the ICT competency development will help bring Thailand successfully move towards the Digital Economy and the Knowledge-based Economy.

Research Objectives

In this research, the objectives of the study are the followings:

1. To identify the current gap between the existing ICT competency of workforce and the required ICT competencies by the ICT SMEs to drive the country towards the Knowledge-based Economy.
2. To verify the ICT competency readiness status of ICT SMEs.
3. To identify the requirement on the ICT competency development for ICT SME sector.
4. To propose the recommended ICT competency development for ICT SME sector.

While the hypotheses of the study are the followings:

1. The current gap between the existing ICT competency of workforce and the required ICT competencies by the ICT SMEs are significantly high.
2. The ICT competency readiness in ICT SME sector is significantly low.
3. The requirement from ICT SME sector on the ICT competency development is significantly high.

2. Theoretical background and related researches

2.1 Knowledge Based Economy and Digital Economy

The term Knowledge Based Economy (KBE) was first coined by OECD and defined as “economies which are directly based on the production, distribution and use of knowledge and information” [10]. Choudaha [11] used the terms such as knowledge economy, service economy, new economy, and knowledge-based service economy interchangeably. The term refers to the nature of economy that involves service interaction, complex problem-solving and technology or information based transactions. Turban [12]

defined “What is Digital Economy” is the information and entertainment products that are digitized including processes and services which are performed in this way as well. “Digital Economy” refers to a society that is enabled and supported in every aspect of modern life by digital technologies and markets connected via the internet. Put simply, the Digital Economy is the modern economy as it is naturally evolving and therefore does not represent an optional path for Thailand, or any economy for that matter, to remain regionally and globally competitive [13]. Other names of Digital Economy are Internet Economy, Knowledge-based Economy, Network Economy, Web-based Economy and New economy. Thus, this paper will refer the term Knowledge Based Economy to the terms “Service Economy”, “Knowledge Based Service Economy” and “Digital Economy.”

2.2 Competency

A competency is the capability of applying or using knowledge, skills, abilities, behaviors, and personal characteristics to successfully perform critical work tasks, specific functions, or operate in a given role or position [14]. The iceberg model for competencies [15] takes the help of an iceberg to explain the concept of competency. Similarly, a competency has some components which are visible like knowledge and skills but other behavioral components like attitude, traits, thinking styles, self-image, organizational fit etc. are hidden or beneath the surface as shown in Figure 1.

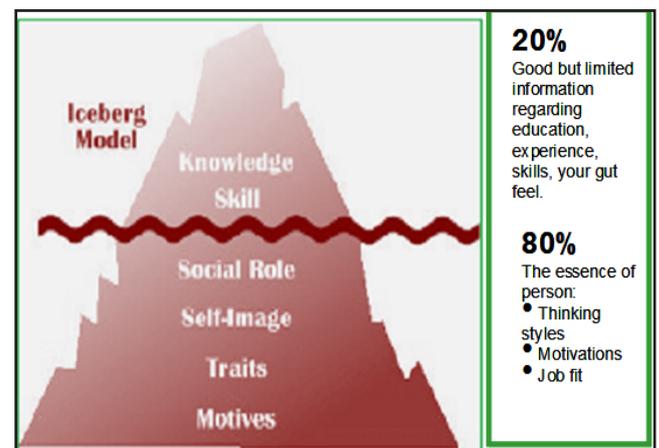


Figure 1. Competency Ice Berg Model [15].

2.3 Competency for Digital Economy and Skills in the 21st Century

In the knowledge economy, the notion of purposeful lifelong learning with the aim of improving knowledge, skill and competence has become widely accepted as pivotal to successful life/career management and business innovation in the 21st Century [16]. Within the lifelong learning framework, there is a growing need to provide all members of the workforce with a comprehensive set of so-called “meta-competencies” which a combination life/career management and employability skills [17]. These skills include ability to respond to change, the capability to identify life, career and learning opportunities that enable a satisfactory lifestyle, technology skills, problem solving, initiative and enterprise skills, teamwork, learning and self-management skills and communication skills, including competencies such as collaboration, interpersonal skills and interactive communication [18].

The growth of the digital economy and the information and communications technology (ICT) sector is affecting education and skills development needs and policies in both high- and low-income countries. From a recent research, it has shown that employers across many different regions and sectors, including in the digital economy, increasingly value non-cognitive skills as much as cognitive and technical ones. Thus, while skills such as basic computer skills, specialized capabilities, or programming knowledge are necessary for employment, these skills alone are insufficient for lasting quality employment, and broader non-cognitive, or soft skills, are also needed. Given this context, there are usually three acknowledged dimensions of skills development: (1) cognitive, (2) non-cognitive, and (3) technical. Cognitive skills are the basic mental abilities to think, study, and learn and are the tools with which technical and “life” skills are acquired. Non-cognitive skills refer to personality traits and behaviors. Also sometimes known as “21st-century skills,” these are particularly important for work in today’s global, 21st-century economy, as employers increasingly value skills such as

communication, teamwork, leadership, and entrepreneurialism. Finally, technical skills can include basic business skills, ICT skills, or other job-specific skills. Non-cognitive skills are also much more important for the informal sector than previously realized, as most informal workers are self-employed and thus need to be able to manage their entire value chain while running their own businesses. Skills required by employers in both the formal and informal sector likely include level of educational attainment, and critical thinking) and non-cognitive skills (attitudes, communication skills, flexibility, and adaptability). Employers seek employees not only with basic literacy skills but also with the ability to learn quickly on-the-job through well-developed life skills such as communication, leadership, and decision-making abilities. Employers are demanding technical and vocational skills, yet there is an inadequate supply of youth with those capabilities, and higher-order cognitive skills (for instance, flexibility, problem solving, and judgment), group work, and creative thinking are similarly not adequately fostered by the existing educational system [19].

While the process of identification of 21st century skills is still ongoing, researchers have developed broad classifications that can be partially linked to a task-based approach. In particular, the National Research Council in the United States has identified three broad domains: a cognitive domain, including cognitive processes, knowledge and creativity; an intrapersonal domain, including intellectual openness, work ethics and self-confidence; and an interpersonal domain, including teamwork, collaboration and leadership. Interestingly, this classification corresponds to another strand of work by the OECD aimed at identifying what skills are crucial for social progress and well-being [20]. According to this classification, next to cognitive skills children should be able to develop social and emotional skills, sometimes also referred to as “soft skills”. Social and emotional skills include working with others, managing emotions and achieving goals. Moreover, social and emotional skills should be developed alongside 21st century

skills as they contribute directly to their development [21].

2.4 ICT Competency Model for Knowledge-based Service Economy

In this research, the U.S. Department of Labor (DoL) IT Competency Model [22] in Figure 2 which includes 7 layers of required competencies from Layer 1 (Personal Effectiveness Competencies), Layer 2 (Academic Competencies), Layer 3 (Workplace Competencies), Layer 4 (Industry-Wide Technical Competencies), Layer 5 (Industry-Sector Technical Competencies), Layer 6 (Occupation-Specific Requirements) and Layer 7 (Management Competencies) which have been generally validated by DoL work across other industries. As such, the first three layers (Layer 1 – 3) consist of soft skills, academic and workplace ready competencies. Layer 1 which are the Personal Effectiveness Competencies consist of Interpersonal Skills & Teamwork, Integrity, Professionalism, Initiative, Adaptability & Flexibility, Dependability & Reliability and Lifelong Learning. Layer 2 which are the Academic Competencies consist of Reading, Writing, Mathematics Science, Communication, Critical & Analytical Thinking and Fundamental IT User Skills. Layer 3 which are the Workplace Competencies consist of Teamwork, Planning & Organizing, Innovative Thinking, Problem Solving & Decision Making, Working with Tools & Technology and Business Fundamental. In layer 4, the model represents the knowledge in ICT in 8 areas which are Principles of Information Technology, Databases and Applications, Networks (including Telecom., Wireless & Mobility), Software Development & Management, User & Customer Support, Digital Media and Visualization, Compliance and Risk Management (including Security & Information Assurance. Layer 5, layer 6 and layer 7 represent Industry-Sector Technical, Occupation Specific Requirements and Management Competencies accordingly.

As per the competencies proposed by Choudaha [11], with knowledge set in vertical part and skills and attitudes set in horizontal part, the Competency model for a service scientist/ T-shaped professional in Figure 3 should well correspond to the demands on competencies of knowledge-based service sector.

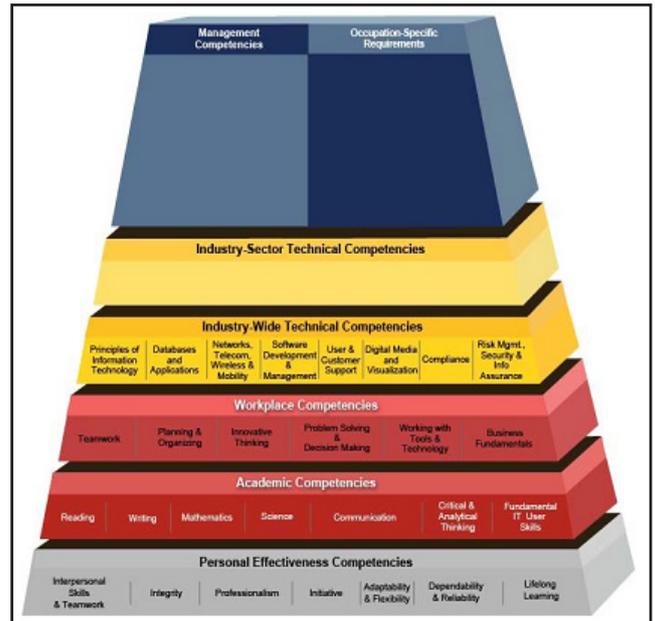


Figure 2. Competency Model of U.S. Department of Labor [22]

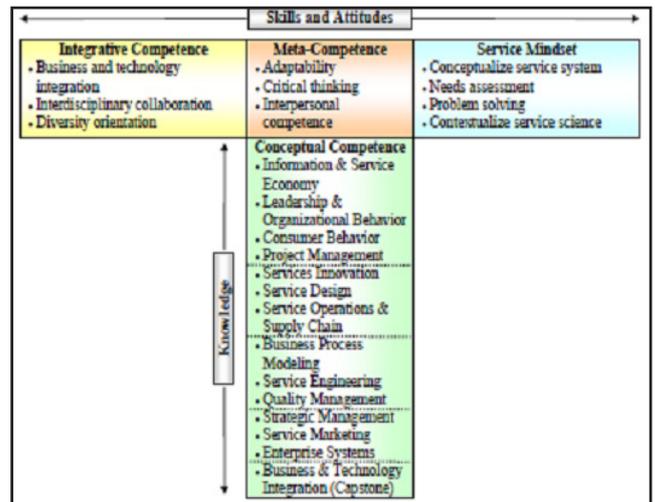


Figure 3. Service Scientist Competency Model [11].

In 2011, the Ministry of Education announced the Thailand Quality Framework (TQF) Computer standard as a foundation of education system in the country which covered in 5 majors including 1. Computer Science, 2. Computer Engineering, 3. Software Engineering, 4. IT (or ICT) and 5. Business Computing focusing in the areas of organization and ICT systems, technology for applications, technology and software process, ICT Infrastructure and Hardware and Computer Architect. The TQF Standard also defines competencies in 5 areas including Morals and Ethics, Knowledge, Cognitive Skills, Interpersonal Skills and Responsibilities and Numerical Analysis, Communications and Information

Technology Skills which also aligned well with the competencies in each layer of the U.S. Department of Labor (DoL) IT Competency Model. The TQF standard also complies with the Association for Computing Machinery (ACM) and the Association for information Systems (AIS) and the Institute of Electrical and Electronics Engineer Computer Society (IEEE-CS) [23]. In this research, the US DoL IT Competency Model will be used as a foundation ICT Competency Model while the TQF Competency Model which is the core ICT knowledge along with ICT competency for Knowledge-based Service Economy and the Service Scientist Competency Model will be incorporated to construct the ICT HR Competency Development Model for Thailand towards Knowledge-based Service Economy as shown below in Figure 4 [24].

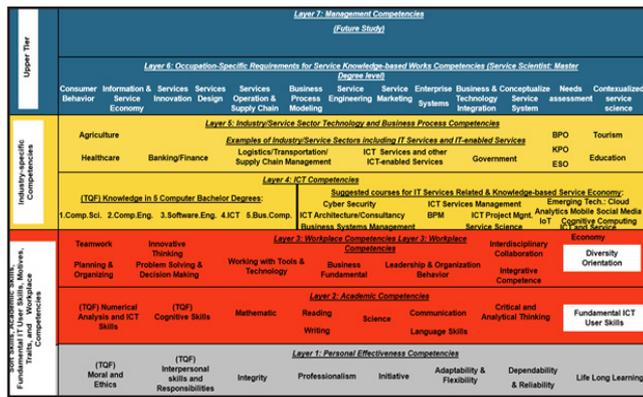


Figure 4. ICT HR Competency Development Model for Thailand Towards Knowledge-based Service Economy [24].

3. Research Methodology

In this research, from the layer 1 - 3 of the ICT HR Competency Development Model for Thailand Towards Knowledge-based Service Economy in Figure 4 above which are the layers of Personal Effectiveness, Academic and Workplace Competencies, the combination of research methodologies of both Qualitative Research and Quantitative Research with Documentary Research and Content Analysis were conducted thru research steps 1 – 12 in Figure 5 below to explore on the non-technical competencies required for ICT SME sector in Thailand. Particularly the Qualitative Research in step 4 by using In-depth Interview and step 10 using Focus Group and the Quantitative Research in step 7

was conducted with the experts and key stakeholders in the ICT SMEs sector.

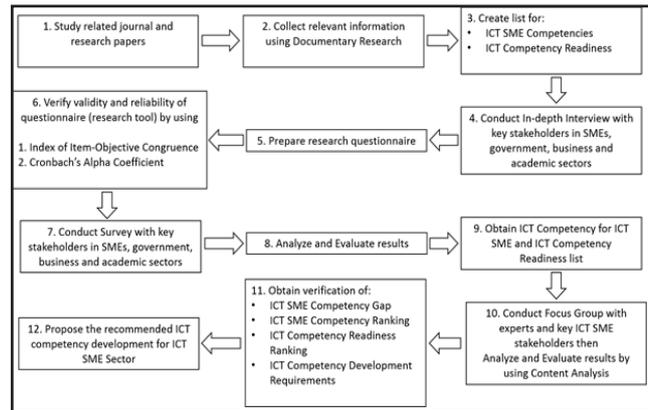


Figure 5. Research procedure on ICT Competency Readiness in ICT SME Sector towards the Digital Economy in Thailand.

Factor	1	2	3	4	5	6	7	8	9	10	Freq.
1. Analytical Thinking	/	/	/	/	/	/	/	/	/	/	10
2. Business Acumen	/	/	/	/	/	/	/	/	/	/	9
3. Client Service Orientation	/	/	/	/	/	/	/	/	/	/	4
4. Commitment to Learning	/	/	/	/	/	/	/	/	/	/	2
5. Communication	/	/	/	/	/	/	/	/	/	/	9
6. Conceptual Thinking	/	/	/	/	/	/	/	/	/	/	9
7. Order and Quality	/	/	/	/	/	/	/	/	/	/	4
8. Developing Others	/	/	/	/	/	/	/	/	/	/	4
9. Empathy	/	/	/	/	/	/	/	/	/	/	2
10. Expertise	/	/	/	/	/	/	/	/	/	/	9
11. Flexibility	/	/	/	/	/	/	/	/	/	/	3
12. Influence	/	/	/	/	/	/	/	/	/	/	4
13. Information Seeking	/	/	/	/	/	/	/	/	/	/	7
14. Initiative	/	/	/	/	/	/	/	/	/	/	3
15. Innovation	/	/	/	/	/	/	/	/	/	/	8
16. Organizational Awareness	/	/	/	/	/	/	/	/	/	/	6
17. Personal Motivation	/	/	/	/	/	/	/	/	/	/	7
18. Relationship Building	/	/	/	/	/	/	/	/	/	/	8
19. Results Orientation	/	/	/	/	/	/	/	/	/	/	6
20. Self-Confidence	/	/	/	/	/	/	/	/	/	/	10
21. Self-Control	/	/	/	/	/	/	/	/	/	/	10
22. Team Leadership	/	/	/	/	/	/	/	/	/	/	8
23. Verbal and Written Communication	/	/	/	/	/	/	/	/	/	/	6
24. Ambition	/	/	/	/	/	/	/	/	/	/	5
25. Ethical	/	/	/	/	/	/	/	/	/	/	2
26. Sale	/	/	/	/	/	/	/	/	/	/	7
27. Finance	/	/	/	/	/	/	/	/	/	/	7
28. Marketing	/	/	/	/	/	/	/	/	/	/	7
29. Tolerance for ambiguity and risk	/	/	/	/	/	/	/	/	/	/	6
30. Conscientiousness	/	/	/	/	/	/	/	/	/	/	4
31. Intellect	/	/	/	/	/	/	/	/	/	/	5
32. Creative	/	/	/	/	/	/	/	/	/	/	7
33. Passion	/	/	/	/	/	/	/	/	/	/	2

Figure 6. Collective ICT Competencies for ICT SME.

Rank	Competencis	Score
1	Analytical Thinking	10
2	Self-Confidence	10
3	Self-Control	10
4	Business Acumen	9
5	Conceptual Thinking	9
6	Expertise	9
7	Communication	8
8	Innovation	8
9	Team Leadership	8
10	Creativity	8
11	Information Seeking	7
12	Personal Motivation	7
13	Relationship Building	7
14	Sale	7
15	Finance	7
16	Market	7
17	Organizational Awareness	6
18	Results Orientation	6
19	Verbal and Written Communication	6
20	Tolerance for ambiguity and risk	6

Figure 7. Ranking of ICT SME Competencies with Documentary Analysis.

From the Documentary Research study [25], [26] on the research papers of [27-34], the competencies mainly in the non-skills and non-knowledge part (attitude/attribute part) for SMEs with frequency counting on each competency found in each paper could be constructed in the table below as in Figure 6.

With Documentary Research, the collective ICT SME competencies were analyzed and obtained from the table in Figure 6, the competencies with ranking with highest score on the importance could be shown in the table in Figure 7 with the highest-10-scores competency group which are Analytical Thinking, Self-Confidence and Self-Control while the lowest-6-scores competency group are Organization Awareness, Result Orientation, Verbal and Written Communication and Tolerance for Ambiguity and Risk accordingly. With the ranked ICT SME competencies from the table in Figure 7, based on the ICT HR Competency Development Model for Thailand Towards Knowledge-based Service Economy in Figure 4 [24], the ranked competencies, particularly on the Personal Effectiveness and Academic Competencies which originally are in Layer 1 and Layer 2 in Figure 4, now could be combined together in Layer 1 in the Proposed ICT Competency Development Model Figure 8 which is the combination of Personal Effectiveness and

Academic Competencies consisting of Analytical Thinking, Self-Confidence, Self-Control, Business Acumen, Conceptual Thinking, Expertise, Communication, Innovation, Team Leadership, Creative, Information Seeking, Personal Motivation, Relationship Building, Sale, Finance, Market, Organization Awareness, Result Orientation, Verbal and Written Communication, Tolerance for Ambiguity and Risk and Ethics while the competencies in Layer 2 in Figure 8 which is the Workplace Competencies consisting of Planning & Organizing, Teamwork, Innovative Thinking, Problem Solving & Decision Making, Working with Tools & Technology, Business Fundamental, Leadership & Organization Behavior, Interdisciplinary Collaboration, Integrative Competence and Diversity. These competencies in the Layer 1 and Layer 2 in the ICT SME Competency Development Model as proposed in Figure 8 will be further used as a foundation model in this research to analyze the ICT competency gap and the ICT competencies which are mostly required by the ICT SME sector in the next section.

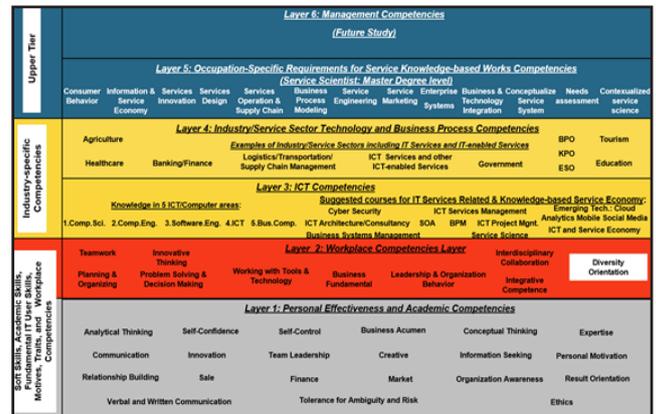


Figure 8. Proposed ICT SME Competency Development Model.

As noted, from the information gained from step 1 and from the Documentary Research in step 2, the lists of ICT SME Competencies and the ICT Competency Readiness were created thru the In-depth Interview in step 4 with 10 experts in ICT SME, government, academic and business sectors which the results were then used to prepare the research questionnaire in step 5. In step 6, the questionnaire for interview (the research tool) was verified its validity and reliability by using the Index of Item-Objective Congruence

(IOC) with the value ≥ 0.8 and the Cronbach Alpha Coefficient method with the confidence level at 0.93. Then, in step 7, the survey was conducted by using the questionnaire with 30 experts in ICT SME, government, academic and business sectors and the results were analyzed and evaluated in step 8 to obtain ICT Competency for ICT SME and ICT Competency Readiness list.

With the results from step 8 and the list of competencies in layer 1 on Personal Effectiveness and Academic Competencies ICT Competency Development Model for ICT SMEs as shown in Figure 8, the Focus Group with 10 – 12 key stakeholders such as the advisor to Minister of ICT, owners of leading ICT SME firms, executives of ICT associations, policy makers of Ministry of ICT, executives of Chamber of Commerce and SME associations and professors from academic sectors was conducted to identify current gap between the existing ICT competency of workforce and the required ICT competencies by the ICT SMEs to drive the country towards the Knowledge-based Economy, verify the ICT competency readiness status of ICT SMEs and identify the requirement from ICT SME sector on the ICT competency development by having them assign the five-points Likert scale in the box they see that it should reflect ranging from Totally Agreed (5), Strongly Agreed (4), Agreed (3), Somewhat Disagreed (2) and Totally Disagreed (1). Then, in step 11, the results were analyzed by using Content Analysis [35] to obtain verification of ICT SME Competency Gap, ICT SME Competency Ranking and ICT Competency Readiness Ranking. Finally, in step 12, the proposed recommendation to the requirements on ICT competency development for ICT SME sector was concluded.

4. Results

From the research, the result on the current ICT competency gap which is the difference between the current ICT competency of ICT workforce and the required ICT competency in the ICT SME organizations was indicated by the average Likert score at 4.5 which means that the current

gap between the existing ICT competency of workforce and the required ICT competencies by the ICT SMEs are significantly high as shown in Table 1 and this coincides with the hypothesis no. 1 made earlier. In addition, the study found out that, as per the result in Table 2, besides knowledge and skills on ICT for ICT HR competency Development, the high score of Likert scale at 4.5 showed that there should be a need to train workforce on Interpersonal Skills, Business Process of each industry, Services Knowledge, Attitudes and other related Soft Skills to correspond to the requirements from government, private and academic sectors. The result is relevant to this study which emphasizes on the ICT competencies in the non-ICT skills and non-ICT knowledge parts listed in the table in Figure 6 and Figure 7 which are necessary to help ICT workforce to be able to work in the real world business operation.

Table 1. Current ICT Competency Gap

Domain	Likert Score (1 – 5)	Meaning
There is a difference between the current ICT competency of ICT workforce and the required ICT competency in your organization. ($\bar{x} = 4.5, SD = 0.67$)	4.5	The majority of interviewees strongly agreed/totally agreed that, currently, there has been a big difference (Gap) between the ICT competency of existing ICT workforce in market and the competency required their firms.

Table 2. Current ICT Competency Readiness Situation

Domain	Likert Score (1 – 5)	Comments
Besides knowledge and skills on ICT for ICT HR competency Development, there should be a need to train workforce on Interpersonal Skills, Business Process of each industry, Services Knowledge, Attitudes and other related Soft Skills to correspond to the requirements from government, private and academic sectors. ($\bar{x} = 4.50, SD = 1.00$)	4.5	The interviewees strongly agreed to totally agreed that, currently, besides knowledge and skills on ICT for ICT HR competency Development, there should be a need to train workforce on Interpersonal Skills, Business Process of each industry, Services Knowledge, Attitudes and other related Soft Skills to correspond to the requirements from government, private and academic sectors.

From the Focus Group session, the list of ICT competencies in the table in Figure 7 was verified and modified from 20 to be 16 items and identified for the gap between the current ICT workforce competency and the required competency by ICT SMEs which the highest gap competency is Analytical Thinking while the lowest gap one is Market (vision and understanding about current market situation). The results are shown in Figure 9, Figure 10 and Figure 11 accordingly.

From the Focus Group session, the rank of ICT competencies from the most important to the lowest was identified while the top 5 most important ICT competencies for ICT SMEs were listed as shown in Figure 12 and Figure 13 consecutively, i.e. Analytical Thinking, Self-Confidence, Self-Control, Business Acumen and Personal Motivation.

	ICT Competency	Likert Scores Mean	S.D.	Level
1	Analytical Thinking	3.76	0.928	High
2	Relationship Building	3.75	0.938	High
3	Self-Control	3.67	0.79	High
4	Personal Motivation	3.58	0.957	High
5	Ethics and Morality	3.56	1.206	High
6	Team Leadership	3.51	0.971	High
7	Business Acumen	3.5	0.922	Medium
8	Verbal and Written Communication	3.5	0.985	Medium
9	Tolerance for Ambiguity and Risks	3.5	1.186	Medium
10	Result Orientation	3.49	0.995	Medium
11	Conceptual Thinking	3.48	0.998	Medium
12	Expertise	3.48	0.952	Medium
13	Creativity	3.47	0.863	Medium
14	Self-Confidence	3.47	1.078	Medium
15	Innovation	3.44	0.983	Medium
16	Market	3.44	0.967	Medium

Figure 9. ICT Competency Gap between the current ICT workforce competency and the required competency by ICT SMEs.

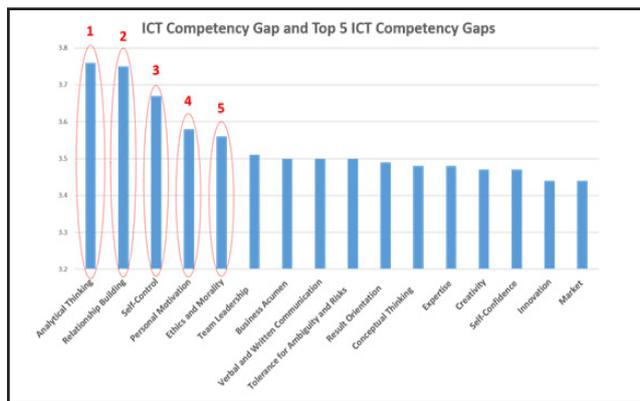


Figure 10. ICT Competency Gap between the current ICT workforce competency and the highest gap top 5 ICT competencies.

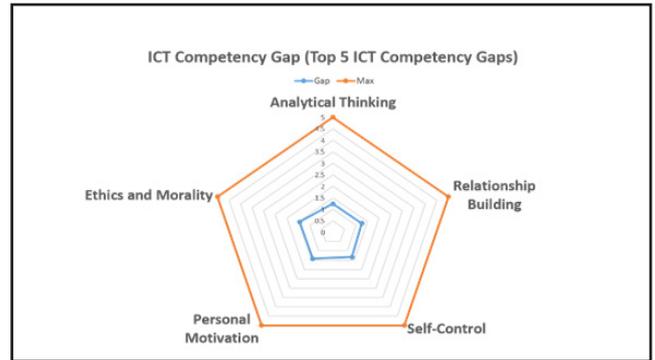


Figure 11. Top 5 ICT competencies which have highest gap between the current ICT workforce competency and the required competency by ICT SMEs.

	ICT Competency	Likert Scores Mean	S.D.	Level
1	Analytical Thinking	3.98	0.936	High
2	Self-Confidence	3.95	1.058	High
3	Self-Control	3.91	0.96	High
4	Business Acumen	3.85	0.958	High
5	Personal Motivation	3.82	0.89	High
6	Creativity	3.78	0.628	High
7	Conceptual Thinking	3.72	0.844	High
8	Expertise	3.7	0.84	High
9	Tolerance for Ambiguity and Risks	3.69	1.084	High
10	Market	3.65	1.101	High
11	Relationship Building	3.63	1.154	High
12	Verbal and Written Communication	3.63	0.807	High
13	Innovation	3.61	0.813	High
14	Ethics and Morality	3.59	1.302	High
15	Result Orientation	3.53	1.078	High
16	Team Leadership	3.52	1.122	High

Figure 12. ICT Competency Importance ranked by ICT SMEs.

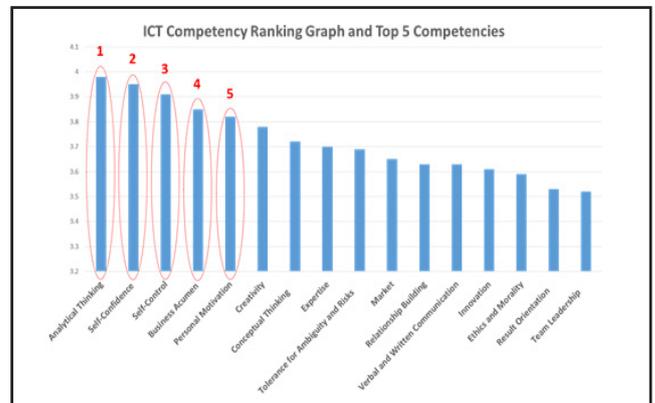


Figure 13. ICT Competency Importance ranked by ICT SMEs.

In the Table 3, the list of 15 ICT Competency Readiness situation in Thailand was verified and scored by the experts in the Focus Group. The results shows that 13 out of 15 items of ICT Competency Readiness have scores lower than 2.5 which means that the ICT competency readiness in ICT SME sector is significantly low as mentioned in the research

hypothesis no. 2 previously. In addition, the top 5 mostly concerned ICT Competency Readiness are Sufficient Numbers of ICT workforce, Education (TQF) for ICT Competency, R&D, National Strategy and Policy and Legal Implementation to support ICT Competency Development consecutively. The results are illustrated in Figure 14, Figure 15 and Figure 16 accordingly.

Table 3. Current ICT Competency Readiness Situation.

Domain	Likert Score (1 – 5)	Comments
1. There has been sufficient number of workforce with ICT competency for the demand in public, private and academic sectors. ($\bar{X} = 1.08, SD = 0.29$)	1.08	The interviewees somewhat disagreed to totally disagreed that there are sufficient ICT workforce with qualified ICT competency for their firms.
2. The current Thailand Quality Framework (TQF) education system has been implemented successfully on the ICT HR competency Development. ($\bar{X} = 1.33, SD = 0.65$)	1.33	The interviewees somewhat disagreed to totally disagreed that the current Thailand Quality Framework (TQF) education system has been implemented successfully.
3. The R&D on ICT HR competency Development has been promoted and given budget by all sectors, i.e. government, academic and private sectors. ($\bar{X} = 1.33, SD = 0.49$)	1.33	The interviewees somewhat disagreed to totally disagreed that there have been enough research on ICT HR competency development.
4. There has been national strategy and policy on ICT HR competency Development which clearly identify on the development on knowledge, skills and attributes. ($\bar{X} = 1.42, SD = 0.67$)	1.42	The interviewees somewhat disagreed to totally disagreed that, currently, there has been national strategy and policy on ICT HR competency Development which clearly identify on the development on knowledge, skills and attributes.
5. There has been the laws on ICT HR competency Development issued and implemented. ($\bar{X} = 1.67, SD = 0.49$)	1.67	The interviewees somewhat disagreed to totally disagreed that, currently, There has been the laws on ICT HR competency Development issued and implemented.

Table 3. Continued.

Domain	Likert Score (1 – 5)	Comments
6. There has been education on ICT HR competency developed by academic sector. ($\bar{X} = 1.75, SD = 0.97$)	1.75	The interviewees somewhat disagreed to totally disagreed that, currently, there has been education on ICT HR competency developed by academic sector.
7. There has been the development competency of teacher and instructor on the implementation of ICT HR competency Development. ($\bar{X} = 1.75, SD = 0.62$)	1.75	The interviewees somewhat disagreed to totally disagreed that, currently, there has been the development competency of teacher and instructor on the implementation of ICT HR competency Development.
8. The ICT human resource management has been taken by government, private and academic sectors seriously. ($\bar{X} = 1.83, SD = 0.72$)	1.83	The interviewees somewhat disagreed to totally disagreed that, currently, the ICT human resource management has been taken by government, private and academic sectors seriously.
9. The professional qualification rewarding system and carrier path planning have been implemented for the ICT carrier advancement. ($\bar{X} = 1.83, SD = 0.58$)	1.83	The interviewees somewhat disagreed to totally disagreed that, currently, the professional qualification rewarding system and carrier path planning have been implemented for the ICT carrier advancement.
10. There has been the laws issued and implemented to promote and facilitate the ICT HR competency Development. ($\bar{X} = 1.83, SD = 0.72$)	1.83	The interviewees somewhat disagreed to totally disagreed that, currently, there has been the laws issued and implemented to promote and facilitate the ICT HR competency Development.
11. The technology such as C (Cloud), A (Analytics and Big Data), M (Mobility), S (Social) S (Security), IoT (Internet of Things), Cognitive Computing has been used for the ICT HR competency Development. ($\bar{X} = 2.00, SD = 1.04$)	2	The interviewees somewhat disagreed that, currently, the technology such as C (Cloud), A (Analytics and Big Data), M (Mobility), S (Social) S (Security), IoT (Internet of Things), Cognitive Computing has been used for the ICT HR competency Development.

Table 3. Continued.

Domain	Likert Score (1 – 5)	Comments
12. The development of ICT Competency for human resource in Thailand has been taken seriously. ($\bar{X} = 2.17, SD = 0.39$)	2.17	The interviewees somewhat disagreed to agreed that, currently, the development of ICT Competency for human resource in Thailand has been taken seriously.
13. The academic has been collaborating closely with private and public sector on the ICT HR competency Development at the beginning stage of education program to prepare student for the working environment rather than rushing at the end of the program. ($\bar{X} = 2.33, SD = 0.49$)	2.33	The interviewees somewhat disagreed to agreed that, currently, the academic has been collaborating closely with private and public sector on the ICT HR competency Development at the beginning stage of education program to prepare student for the working environment rather than rushing at the end of the program.
14. The government, private and academic has currently given importance on the recruitment for ICT human workforce who has knowledge, skills and attributes. ($\bar{X} = 3.25, SD = 0.87$)	3.25	The interviewees agreed to strongly agreed that, currently, the government, private and academic has currently given importance on the recruitment for ICT human workforce who has knowledge, skills and attributes.
15. There have been teaching and training on C (Cloud), A (Analytics and Big Data), M (Mobility), S (Social) S (Security), IoT (Internet of Things), Cognitive Computing for the ICT HR competency Development. ($\bar{X} = 3.75, SD = 0.97$)	3.75	The interviewees agreed to strongly agreed that, currently, there have been teaching and training on C (Cloud), A (Analytics and Big Data), M (Mobility), S (Social) S (Security), IoT (Internet of Things), Cognitive Computing for the ICT HR competency Development.

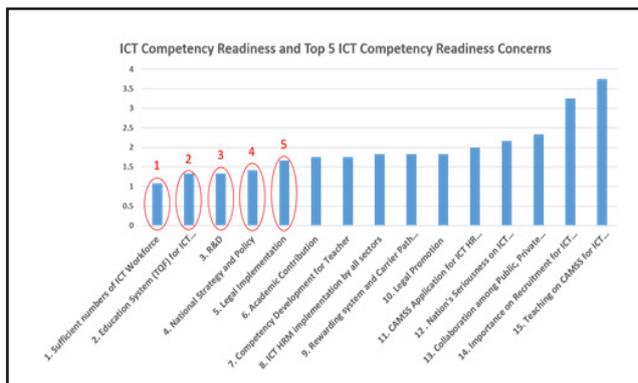


Figure 14. Graph shown the current ICT Competency Readiness and the Top 5 ICT Competency Readiness concerns.

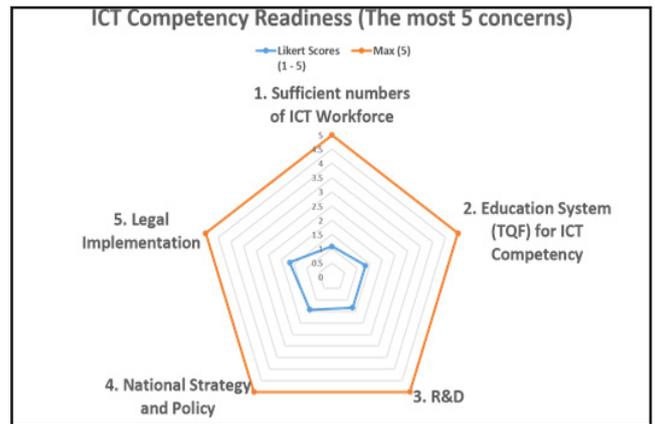


Figure 15. Top 5 ICT Competency Readiness concerns.

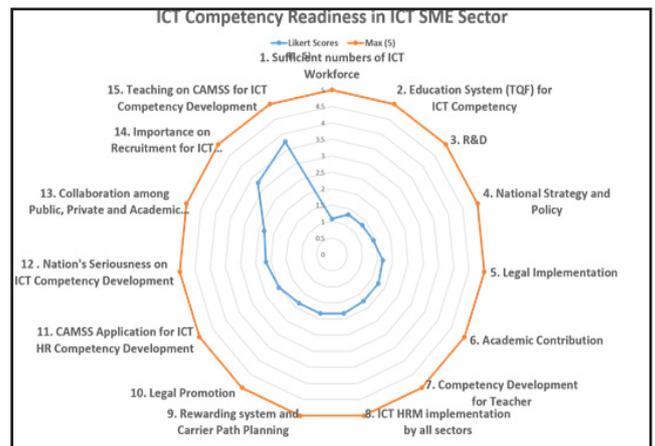


Figure 16. Current ICT Competency Readiness.

From the table3 and the graphs in Figure 14 - 16, there are quite a lot of issues showing the concerns of ICT SMEs on the development of the ICT competency for ICT workforce and the implementation measurement involving many aspects including government strategy and policy, education, professional qualification, laws and regulation, technology and the daily industry practices. Among those, there are quite some issues on the ICT competency development for human resource in the country which received Likert score less than 2 (Totally Disagreed to Somewhat Disagreed) which are the followings; sufficient numbers of ICT workforce with required ICT competency, current effectiveness of TQF education system, R&D on ICT competency development, national strategy, policy and plan, laws and regulations, competency development for teacher and instructor, strong intention to help promote ICT competency development, professional qualification rewarding system and use of technology for

teaching and learning for the workforce.

As noted, all of these which received the Likert scores lower than 2, especially the top 5 mostly concerned ICT Competency Readiness mentioned previously, i.e. Sufficient Numbers of ICT workforce, Education (TQF) for ICT Competency, R&D, National Strategy and Policy and Legal Issuance to support the development of ICT Competency, should be put as a nation's priority on how all stakeholders should consider and manage to drive the ICT competency development implemented successfully for the involved parties. In addition, although the rest 2 out of 15 ICT Competency Readiness show that ICT SME sees the importance of recruitment based on ICT Competency and, currently, there are teaching on CAMSS (Cloud, Analytic and Big Data, Mobility, Social and Security) to build up ICT competency for the ICT workforce, however the standard practice on the ICT competency-based recruitment will also need to further promoted while the teaching on the new trend of technology such as Internet of Things (IoTs), Cognitive Computing and relevant up-to-date technology also need to be taken to action to make sure ICT workforce be able to work in the fast-pacing technology world.

Table 4. Current ICT Competency Readiness Situation.

Domain	Awareness (Yes/No)
The ICT HR Competency Development has been put in the key national strategic Master Plan such as Nation ICT Master Plan, National ICT HR Development Plan, National HR Development Plan, 12th National Economy and Social Development Plan and etc.	YES = 17% NO = 83%
There has been organization such as TPQI (Thailand Professional Qualification Institute (Public Organization)) which has issued standard for profession qualification in 6 areas, i.e. Software and Applications, Telecommunications, Hardware, Network and Security, Animation and Project Management.	YES = 60% NO = 40%

From Table 4, another part of study also emphasizes the overall readiness of ICT Competency in terms of government strategy and policy. With the low level of awareness (Yes = 17%) on the nation plan supporting the ICT HR Competency Development, this means that the country and policy maker

should take this seriously on how to officially drive the implementation of ICT competency development with the clear action plan with supporting budget and measurement. This means that as the ICT Competency Development needs to be put as a national agenda i.e. to be officially written in the Nation ICT Master Plan, National ICT HR Development Plan, National HR Development Plan, 12th National Economy and Social Development Plan and related ones.

Nevertheless, regarding the ICT skills and knowledge standard, on the second case, more than a half (Yes = 60%) of the interviewees are aware on the roles of TPQI on giving the professional qualification standards to the industry. However, the TPQI professional qualification standards in the six areas which are Software and Applications, Telecommunication, Hardware, Network and Security, Animation and Project Management will need to be further verified if they well suit the industry requirements and are adopted widely by all of the involved sectors.

Last but not least, as the research finds that there is a big gap between the current ICT competencies of ICT workforce and the ones required by the ICT SME business owner which means that the current ICT competency of the workforce in the industry does not meet the requirement from the industry, the outcome from the study could further be applied to support ICT competency development to more relevant and effective for ICT SMEs by matching the highest gap ICT competencies in the ICT Competency Gap study and the required ICT competencies by the industry which will yield the benefit to the ICT industry to take the most important as priority to be trained to ICT workforce first which, in this case, are Analytic Thinking, Self-Control and Personal Motivation as shown in Figure 17.

5. Conclusion

As SME is the major contributor to economy both at the regional and national level, this research on the ICT competency readiness of ICT SMEs will be crucial for all concerned stakeholders to learn on how to take action on

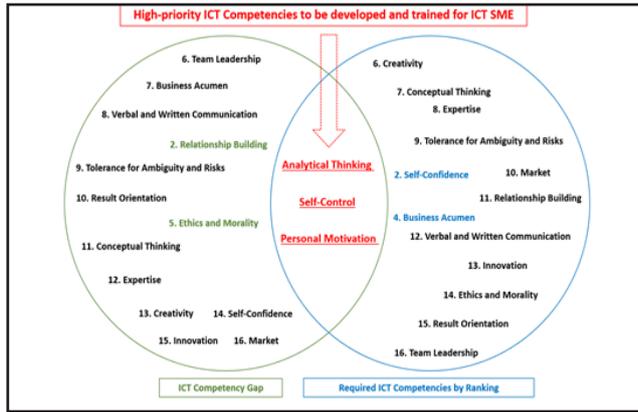


Figure 17. High-priority ICT competencies to be developed and trained for ICT SMEs.

capacity building for human resource which are the key strategy to promote the sustainable growth of SMEs. From the study, there has been a big difference between the ICT competency of the existing workforce in the market and the ICT competency expected and required by the ICT SMEs. In addition, beyond the technical knowledge and skills, other skills including soft skills and attitudes are also considered equivalently important. From the research, the current gap between the existing ICT competency of workforce and the required ICT competencies by the ICT SMEs are significantly high with top 5 highest gap competencies which are Analytical Thinking, Relationship Building, Self-Control, Personal Motivation, and Ethics/Morality consequently. Besides that, the top 5 key required competencies ranked from the experts in the research, are Analytical Thinking, Self-Confidence, Self-Control, Business Acumen and Personal Motivation accordingly.

Regarding the current ICT competency readiness, particularly on the supply of human resource which is one of the key driver of the ICT sector, with the low score on the sufficient number of workforce with ICT competency for the demand in public, private and academic sectors, it means that there is a shortage on the number of ICT graduates and the workforce in the market with ICT competency needed by the sectors. Furthermore, from the study, the ICT SMEs confirmed that the ICT competency readiness in ICT SME sector is significantly low and there is an urgent requirement

on the ICT competency development for the nation with the top 5 mostly concerned ICT competency readiness to be improved which are Sufficient Numbers of ICT workforce, Education (TQF) for ICT Competency, R&D, National Strategy and Policy and Legal Implementation.

From the research results, the actions from all stakeholders are needed to be taken place immediately. Hence there should be urgent measurements from all stakeholders ranging from ICT SME itself, SMEs, government and academic sectors and professional qualification standards authority such as TPQI (Thailand Professional Qualification Standards) to be implemented with all necessary measures to improve the ICT competency development of the country, particularly among the first five major concerns, which are providing enough supply of ICT workforce, redesigning of curriculum and professional qualification standards, allocating budget and promoting R&D on ICT human resource competency development, building up strategy, issuing policy, regulations and legal systems which could accommodate the ICT competency for the IT workforce and non-IT workforce to be able to effectively apply ICT to better the SMEs' operation efficiency, cost and time reduction and customer satisfaction for their organization while creating competitiveness at the level of regional and global arena.

In conclusion, this research addresses on the Thailand ICT competency readiness towards the Digital Economy in ICT SME sector which SME plays major roles in driving the economic growth and social development of the country. While the ICT HR competency is a key factor to propel the sector and the country towards the Digital Economy, from the study, besides the current major concerns on the ICT readiness of ICT SME sector are presented, the ICT SMEs reveal that there is a big gap between the existing ICT competencies and the required ones while the ICT competencies which need to take as a priority to be developed and trained for ICT workforce are also identified. This research calls for serious attention from all stakeholders to take action to develop competencies of ICT workforce and improve the

current Thailand's ICT Competency Readiness. The outcomes of this research could help all stakeholders in ICT SME sectors be able to prepare ICT workforce with the right national policy to move Thailand forward to be a competitive nation in the Knowledge-based Economy and the ASEAN Community.

Further study could be the use of software program to identify the mostly needed competencies to be trained for each ICT SME organization, the study on how to improve ICT competencies of ICT workforce and human resource required by key specific sectors in order to suit the requirements of each SME sector, and the requirements of ICT competencies in each specific sector for both IT and non-IT personnel. The study could also be further expanded to the regional level to help improve the ICT readiness in ICT SME sector in the neighbor countries for the sustainable growth of the ASEAN Economic Community and beyond.

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