

Enabling high performance digital manpower through higher education

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ABSTRACT: This research aimed to synthesise the required competence of high-performance digital manpower for students in higher education. The study began with stating the problem, followed by a literature review to find core, congruous elements for a digital competence qualifications framework for undergraduates and digital manpower competence. It has been established that the competencies in terms of high-performance digital manpower for students in higher education consist of eight aspects as follows: 1) information retrieval and usage; 2) creativity and innovation; 3) identity and quality of life; 4) teaching or learning; 5) tools and technology; 6) communication and coordination; 7) problem solving with digital tools; and 8) adaptive digital transformation. Guidelines for enabling high-performance digital manpower involve enhancing digital educational competencies for higher education qualifications and developing a curriculum that allows students to use digital technology to perform their duties appropriately and efficiently.

INTRODUCTION

The 20-Year National Strategy (2018-2037) of Thailand on Human Resources Development and Enhancement sets a goal to develop people in all dimensions and at all stages of their lives, so that they could become highly skilled, competent and virtuous individuals, with a love of learning and a desire for continuous self-improvement throughout life [1][2]. The Thai government, therefore, has a policy to lay the foundation for the country's human resource development in a systematic way to ensure that the population have competence and potential in accordance with the needs and goals of the country and the global situation. This is necessary because the world has entered a new economic era, with digital technology as an important engine to drive economies forward, create value, gain competitive advantages and prosper.

Digital competence is, therefore, an essential future skill for a knowledge-intensive economy [3]. This competence involves the ability of employees to apply their digital technology knowledge and skills, and demonstrate appropriate attributes in their work, both in terms of service patterns and work itself, to meet the future needs of the labour market. Thus, a conceptual framework for learning and skills for the digital era has been developed in many countries. For example, the European Commission has developed the Digital Competence Framework for Citizens: DigComp 2.1 [4]. This framework is being used as a tool for developing digital skills strategies [5]. In Thailand, the Digital Competency Framework for Thai Citizens to conform to the Thai context has been recently created [6]. In addition, the Office of the Higher Education Commission in Thailand has provided a document for higher education institutions titled Digital Competencies for Undergraduate Qualification to use as a guideline for setting learning outcomes standards [7], etc.

After the onset of the Covid-19 pandemic at the end of 2019, the adoption of digital technology for consumers and businesses has markedly accelerated. Empowering people in terms of their digital skills is challenging; however, if this challenge is not undertaken the lack of digital manpower would be a major barrier to the digital agility of organisations [8]. Assessing digital competence in higher education needs an increased amount of attention on the part of various educational institutions [3]. They need to adjust their teaching style to become also on-line providers of education, thus enabling their graduates to acquire the necessary skills [9-11]. However, there is still no adequate training to acquire those necessary skills.

The higher education sector is an important mechanism for developing and enhancing human resource capacity and building digital manpower. Graduates need to have the ability to apply existing knowledge, skills and attributes to high-level digital technology developments in their work in an appropriate manner [12]. Therefore, it is necessary to synthesise high-performance digital manpower for students in higher education in such a way as to determine the required characteristics that meet the demands of the labour market. This approach will enable graduates to become highly skilled in using digital technology in the workplace. Knowledgeable and skilled employees will help increase business and the country's productivity, leading to the development of new technology and fostering innovation in such a way as to help the industrial sector and the country's economy to grow sustainably.

LITERATURE REVIEW

Digital Competency

A *competency is a combination of an individual's strengths, skills and knowledge* [13]. Individuals use them at work, at school and in other environments that require the expertise that they already have. Competencies are observable, measurable, transferable, based on performance, linked to the workplace, to the academic environment and to other life experiences. *The McClelland model of performance in principle Freud's iceberg principle, compares competency to an iceberg and divides it into six specific competency elements: knowledge, skills, social role, self-concept, traits and motivation* [14].

Knowledge and skill are seen as the surface talent components that are readily available and easily understood. Social role, self-concept, characteristics and motivation are deeply ingrained talent elements that are hidden beneath the surface of the water in which the iceberg floats. These are not easy to detect and difficult to cultivate and improve. However, these characteristics determine the behaviour and performance of individuals [14]. Personality traits, motivations and values hidden in the *iceberg principle* model have a significant impact on performance [15].

A study of the competency of science teachers in terms of integrating higher thinking skills in teaching and learning, measured teacher competency levels, covering the three key components of knowledge, skills and attitudes [16]. Koch's theory of performance competence suggests that compliance with quality standards focuses on technical competence, social competence and learning methods [17]. The Future of Jobs Report 2020 is a unique resource that brings together insights from the world's largest companies on how careers will change through to 2024 in terms of trends affecting the labour market, changing work landscapes and changes related to skill requirements [18]. In this report performance has been categorised in terms of skills and knowledge, attitudes and cognitive abilities [18]. Competency can also be divided into three components; namely, the knowledge component, the skill component and attributes components.

The need for digital skills for every profession leads to the need for transformative learning and the utilisation of such skills, in terms of service patterns, work and future labour market needs. In the European framework for the digital competence of educators, is highlighted the confident, critical and constructive use of information and communication technologies to achieve goals related to work, employment, learning, leisure, inclusion and participation in society [19]. Digital performance is a core competence and future skill, essential for a highly knowledge-intensive economy which supports the digital transformation of society [3]. In conclusion, digital competency refers to the ability to apply existing knowledge, skills and attributes together, in order to use digital technology to perform any task appropriately and efficiently, until the desired success is achieved. The use of digital tools and media requires special skills, and positive attitudes towards using digital technology with critical understanding have to be developed, and creativity, responsibility and independence encouraged.

Digital Competencies for Undergraduate Qualifications

As mentioned above, the Office of the Higher Education Commission in Thailand has prepared guidelines for compliance with the National Framework for Higher Education Qualifications titled Digital Competencies for Undergraduate Qualifications [7] to use by higher education institutions to standardise learning outcomes in the area of numerical analysis skills, communication and use of information technology that include: 1) information retrieval and usage; 2) creativity and innovation; 3) identity and quality of life; 4) teaching or learning; 5) tools and technology; and 6) communication and coordination. Every aspect has the required level in reference to basic skills for all Bachelor's degree qualifications. The high-performance skills are more advanced, more intense skills for a Bachelor's degree including: 1) information retrieval and usage 2) creativity and innovation; 4) teaching or learning; and 5) tools and technology [7].

Digital Manpower

The key factor that will lead Thailand towards a digital economy and society is the development of manpower. Therefore, the government must prepare for the creation of skilled manpower in terms of digital aspects, as required by the targeted industrial sector of the country. The Digital Economy Promotion Agency in the Ministry of Digital Economy and Society in Thailand has referred to digital manpower as the capacity building in terms of old and new digital manpower, with the emphasis on meeting market demands in all sectors [20]. This includes activities covering education and training at all levels. The Thailand Development Research Institute has published its final report on the Digital Manpower Development Study project [20]. This was created to support the target industries (S-Curve) and the development of the Eastern Economic Corridor in Thailand. In the report it is pointed out that the closest definition of digital manpower would be the information and communications technology manpower (ICT) [20].

The ICT manpower in a broad sense includes ICT specialists who are superior ICT users that can apply advanced software tools. Basic users, on the other hand, can use common software tools, which are necessary for the information society, electronic government and working life. Employees directly engaged in digital technology in all occupational fields, have to have knowledge, abilities and expertise according to international standards. There is a need to create

high-value employment to support the development of the country in an economic and social era that uses digital technology as the main driving force. The 20-Year National Strategic Plan on Digital Development for Economy and Society (2018-2037), Strategy 5 is about: developing manpower to be ready for the digital economy and society; and focusing on developing digital manpower to support working in the digital economy [21-24].

It can be concluded that digital manpower refers to the development of manpower to be ready to enter the digital economy and society, developing people, creating jobs and building strength from within. The aim is to encourage all employees across all ages in all fields of economy to have the appropriate knowledge, skills and attributes for using digital technology.

In the study outlined in this article, digital manpower is defined as students in ICT at higher education institutions. Digital manpower competency consists of four dimensions: scope of competency involving the identification of each type of digital talent, competency descriptions, competency levels (categorised into required and high-performance levels), and the knowledge, skills and attributes required.

Digital Manpower Competency

Based on the literature review including research articles, government project report and private sector reports, the authors of this article found that the skills required in the 4th Industrial Revolution (4IR) era in almost every type and aspect of work are digital literacy skills. That era requires also that graduates analyse or synthesise data, which is a higher-order skill [5][6]. The increase in the use of technology in the workplace has created a demand for talent to use and develop technology [18][20]. Cognitive abilities also need to be enhanced for tasks that require problem solving and creativity, along with digital communication skills, teamwork, etc [5][18][21][25][26].

In research studies into modern apprenticeships, it was found that the part of the competence dimension that refers to personality traits, motivations and values has a significant impact on performance. Therefore, increased attention should be paid to cultivating multifaceted values, especially the importance of moral education should be stressed, as well as personality development related to the ability to learn. Adapting to digital transformation and accepting to learn new things throughout life are essential [15][17].

In this study, five essential components of digital manpower competency have been identified as shown in Table 1.

Table 1: Digital manpower competency - synthesis.

Order	Competency/Reference	[5]	[6]	[15]	[17]	[18]	[20]	[21]	[25]	[26]	Conclusion
1	Digital literacy	/	/	/	/	/	/	/	/	/	/
2	Technology use and development	/	/	/	/	/	/	/	/	/	/
3	Problem solving with digital tools	/	/		/	/	/	/	/	/	/
4	Adaptive digital transformation	/	/	/	/	/	/	/	/	/	/
5	Digital communication	/	/	/	/	/	/	/	/	/	/

The results of the synthesis of digital manpower competency clearly indicate the required manpower must be ready for knowledgeable work in the digital economy and in society. More specifically, the required competencies refer to:

- 1) digital literacy, including searching and accessing information, analysing or synthesising data, creating appropriate information and media content, being aware of legal implications and not infringing on the rights of others;
- 2) technology use and development, including technical skills to run operating systems, the ability to use programming to design a machine or a technology-based system suitable for the user's needs;
- 3) problem solving with digital tools, which includes using digital tools or technology creatively to solve problems, identifying the cause of operational errors and knowing how to fix them;
- 4) adaptive digital transformation, including the ability to survive in the present and future world that is likely to change fast, being agile to use technology to change lives for the better, developing an open attitude that ensures one is ready to learn, modifying and developing from the old era to meet new challenges in the new one; and
- 5) communication skills to include interpersonal communication skills in terms of listening, writing, speaking and electronic communication, developing presentation skills, being able to use technology to learn with confidence.

It can be seen that each form of digital manpower competency implies a high level of performance. For example, creating information and media content involves specialised skills in using digital technology, solving problems with digital tools, adapting to digital transformation, referring to others, so high expertise and performance is required in every aspect of this work.

High-Performance Digital Manpower

The digital manpower required by the labour market must perform at a high level in terms of using digital technologies. In order for higher education to develop the appropriate digital manpower to meet the needs of the labour market, students should increase their performance across all aspects of digital competencies. The digital competency qualifications framework for undergraduates consists of six competencies as shown in Figure 1 (the six competencies are on the left).

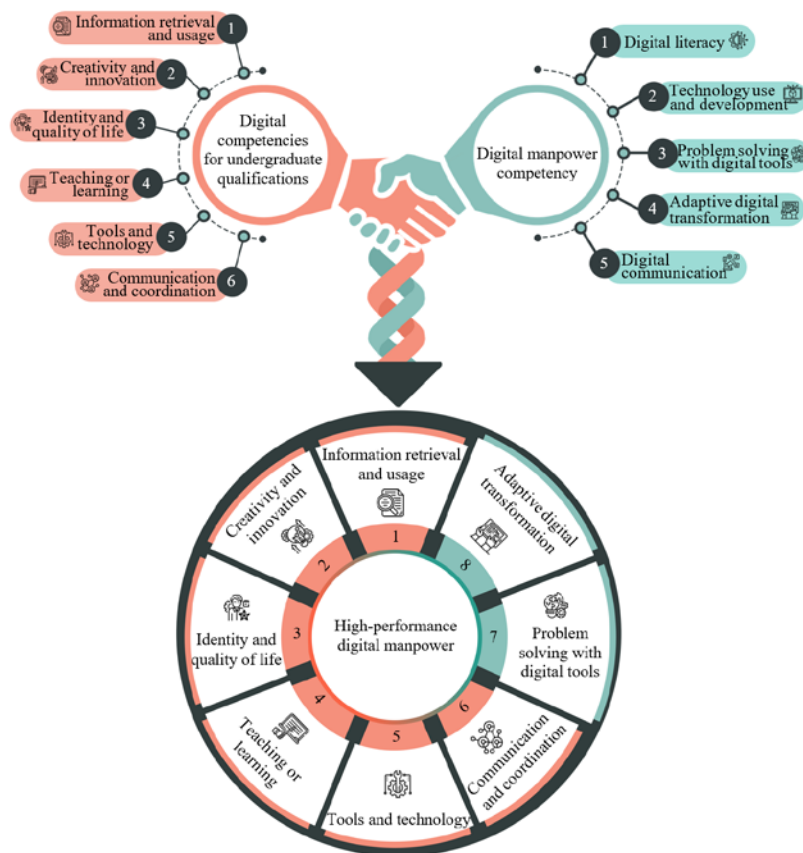


Figure 1: High-performance digital manpower.

The digital competencies needed to ensure high performance in terms of undergraduate qualifications are competencies number 1, 2, 4 and 5. Competencies 3 and 6 are basic skills, which should be enhanced to a high level to ensure that higher education institutions create a high-performance digital manpower that meets the needs of the labour market.

The digital manpower competency consists of five aspects as shown in Figure 1 (these five aspects are on the right). They are consistent with the digital competencies for undergraduate qualifications in the following areas: digital literacy corresponds to information retrieval and usage; technology use and development corresponds to tools and technology; and digital communication corresponds to communication and coordination. The digital manpower competency is inconsistent with the digital competency qualifications framework for undergraduates in the area of problem solving with digital tools and adapting to digital transformation. Therefore, a high-performance digital manpower requires the development of eight competencies as shown in Figure 1 (in the lower part of the figure).

The eight competencies in Figure 1 result from the linkage of digital competencies for undergraduate qualifications published by the Office of the Higher Education Commission [7], and the five digital manpower competencies identified through the literature review and its synthesis.

RESULTS AND DISCUSSION

The following points are an elaboration of the eight high-performance digital competencies for higher education students presented in Figure 1.

- 1) Information retrieval and usage: advanced searching and database analysis skills, using advanced browsing tools, data analysis and usage of publishing tools, sharing information on-line, assessing the credibility of information sources for decision making, applying appropriate methods/techniques to trace the information back to the relevant events, recognising various forms of rights.
- 2) Creativity and innovation: analysing content and creating digital media for a variety of purposes, finding ways to use creative tools and innovation as outlined in other studies [27][28], striving for digital competency associated with factors, such as creativity and innovation to form a high-performance group.

- 3) Identity and quality of life: analysing advanced cyber security methods, analysing the risks of personal data exposure on social media in line with other studies [29] - digital identity should be an element of the digital competencies for future professionals and current university students.
- 4) Teaching or learning: analysing how to use technology in learning and using learning technology with confidence, analysing methods for using technology to help test learning progress, analysing methods of studying and learning new things, developing skills to learn new things and to cope with change, developing a positive attitude to learning, modifying and progressing from the old era to meet new challenges.
- 5) Tools and technology: analysing how to use digital tools effectively, analysing how to use new technology operating systems, becoming familiar with/developing expertise in the methods and procedures of modern technology, applying cloud computing specialised skills to video creation and editing in marketing, creating a program to design a machine or technology system that is suitable for the needs of users, acknowledging the importance of using basic digital tools in work and life.
- 6) Communication and coordination: analysing how to properly use a variety of tools, implementing and deploying appropriate communication and interaction tools, forming an effective communication method in terms of listening, writing, speaking and presenting.
- 7) Problem solving with digital tools: analysing the problem and solving technical problems appropriately, finding creative solutions for connected problems using digital tools, becoming skilled in problem solving, using tools, equipment, applications, software or services to solve problems creatively, integrating knowledge and building it, solving problems and guiding others in the creative use of digital technology in line with best practices regarding problem solving, simultaneous learning and the use of information and communication technology for knowledge management [30].
- 8) Adaptive digital transformation: possessing knowledge of new media, building credibility through professional skills and IT knowledge in digital transformation, possessing relevant knowledge and understanding of lifelong learning, being able to propose new ideas and processes in operation, improving one's own knowledge appropriately, developing the ability to survive in today's and future worlds that are prone to change, becoming fast and fluent in digital technology (displaying digital agility), integrating prior and new knowledge in the use of technology to introduce change in work and life, possessing self-management skills, looking for opportunities to plan, create guidelines and develop oneself in practice (self-management), building credibility in terms of professional skills and IT knowledge in adapting to digital transformation, accepting new knowledge, developing a positive attitude towards adapting to a variety of new knowledge.

CONCLUSIONS

The higher education sector is an important mechanism for building a high-performance digital manpower involving groups of students and graduates having the ability to use appropriate knowledge, skills and attributes in the work context. According to the findings of the research, a high-performing digital manpower that meets the demands of the labour market, needs to be highly skilled in using digital technology in the workplace, and to be able to use digital tools to solve problems in a digital environment. There is also a need to develop the ability to survive in today's and tomorrow's rapidly-changing worlds through the development of digital agility and to use technology to transform work.

Guidelines for enabling a high-performance digital manpower involve enhancing digital educational competencies for higher education graduates. There is a need to develop a teaching curriculum that supports digital skills development to enable students to acquire the ability to apply existing knowledge, skills and qualifications in digital technology-based workplaces and to perform their duties appropriately and efficiently; it is also essential to create the correct tools and learning environment in order to support classroom learning. This will include the development of technology and educational innovations that support distance learning. This is necessary for education and training provision during the current crisis, and as preparation and readiness for new situations in the future.

Moreover, it is important that the higher education sector, research institutes and private sectors work together to advance knowledge, research, technology and innovation, with the private sector also taking part in the development of the teaching curriculum. The focus should be on developing professional and technical skills in such a way as to apply theoretical knowledge to practice. It will be necessary to develop a platform that connects skills development activities and career paths, such as training, post-training competency assessments, consultation, job placements for newly-qualified graduates, etc.

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